

BUDGET The United States Department of the Interior **JUSTIFICATIONS**

and Performance Information
Fiscal Year 2010

U.S. GEOLOGICAL SURVEY

NOTICE: These budget justifications are prepared for the Interior, Environment and Related Agencies Appropriations Subcommittees.

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**U.S. GEOLOGICAL SURVEY
FY 2010 BUDGET JUSTIFICATION**

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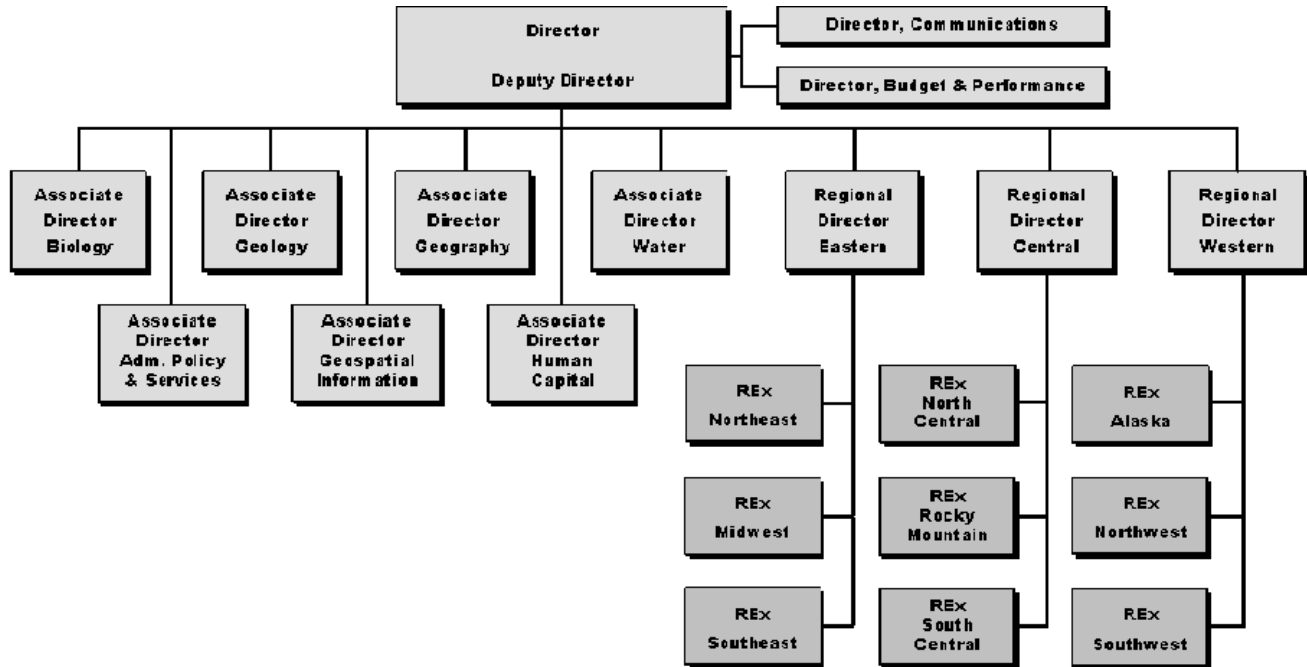
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U.S. Geological Survey



USGS Regional Structure



Acronyms

Alphabetical List of Acronyms

AAAS	American Association for the Advancement of Science
AAPG	American Association of Petroleum Geologists
ABC	Activity-Based Costing
ABC/M	Activity-Based Costing/Management
ABP	Asset Business Plan
ACI	American Competitive Initiative
ACP	Arctic Coastal Plain
ACWI	Advisory Committee on Water Information
ADA	Americans with Disabilities Act
AFWA	U.S. Air Force Weather Agency
AMP	Asset Management Plan
ANS	Alaska North Slope
ANS	Aquatic Nuisance Species
ANSS	Advanced National Seismic System
ANWR	Arctic National Wildlife Refuge
APHIS	Agricultures Animal and Plant Health Inspection Service
API	Asset Priority Index
APS	Administration and Policy Services
AR	Accounts Receivable
ARMI	Amphibian Research and Monitoring Initiative
ARRA	American Recovery and Reinvestment Act
ASC	Alaska Science Center
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
AVHRR	Advanced Very High Resolution Radiometer
AVO	Alaska Volcano Observatory
AWIFS	Advanced Wide Field Sensor
BASIS+	Budget and Science Information System
BBL	Bird Banding Laboratory
BBS	Bird Breeding Survey
BEN	Balkan Endemic Nephropathy
BF&E	Budget Formulation and Execution Team
BGN	Board of Geographic Names
BIA	Bureau of Indian Affairs
BIMD	Biological Information Management and Delivery
BIS	Commerce - Bureau of Industry and Security
BLM	Bureau of Land Management
BLT	Business Leaders Team
BMPs	Best Management Practices
BNP	Biscayne National Park
BOR	Bureau of Reclamation
BPC	Bureau Program Council
BPXA	BP Exploration (Alaska)
BRD	Biological Resources Discipline
BRM	Biological Research and Monitoring
BSR	Business Strategy Review
CA	Condition Assessment
CAC	Civil Applications Committee
CALFED	California Federal (Bay-Delta Authority program)
CAP	Cooperative Agreements Program

CARA	Circum-Arctic Resource Appraisal
C&A	Certification and Accreditation
CC	Cost Center
CBLCM	Chesapeake Bay Land Cover Management
CBM	Coal bed Methane
CBP	Chesapeake Bay Program
CCOAT	Coast Chesapeake Online Assessment Tool
CCSP	U.S. Climate Change Science Program
CDC	Centers for Disease Control and Prevention
CDR	Critical Design Review
CEN	Climate Effects Network
CENR	Committee on Environment and Natural Resources
CEAP	Conservation Effects Assessment Project
CEGIS	Center of Excellence for Geographic Information Science
CEOS	Committee on Earth Observation Satellites
CEQ/NSTC	Council on Environmental Quality/National Science and Technology Council
CERC	Columbia Environmental Research Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	Comprehensive Everglades Restoration Plan
CFO	Chief Financial Officer
CISN	California Integrated Seismic Network
CMGP	Coastal and Marine Geology Program
CNMI	Commonwealth of the Northern Mariana Islands
CNS	Central portion of the North Slope
CO ₂	Carbon Dioxide
COAST	Chesapeake Online Adaptive Support Toolkit
CORE	Committee on Resource Evaluation
CPIC	Capital Planning and Investment Control
CR	Central Region
CRADA	Cooperative Research and Development Agreement
CRSSP	Commercial Remote Sensing Space Policy
CRTF	Coral Reef Task Force
CRU	Cooperative Research Units
CRUISE	Columbia River USGS Integrated Science Explorer
CRWA	Charles River Watershed Association
CSIRC	Computer Security Incident Response Capability
CSRS	Civil Service Retirement System
CTBTO	Comprehensive Test Ban Treaty Organization
CTM	Cooperative Topographic Mapping
CUES	Comprehensive Urban Ecosystems Studies
CUSEC	Central United States Earthquake Consortium
CVO	Cascades Volcano Observatory
CWD	Chronic Wasting Disease
CWP	Cooperative Water Program
CWS	Canadian Wildlife Service
DCIA	Debt Collection Improvement Act
DEM	Digital Elevation Model
DEP	[State] Department of Environmental Protection
DEQ	[State] Department of Environmental Quality
DFRs	Departmental Functional Reviews

Acronyms

DGH	Indian Directorate General of Hydrocarbons
DHS	Department of Homeland Security
DiGIR	Distributed Generic Information Retrieval
DMC	Data Management Center
DMCI	Deferred Maintenance and Capital Improvements
DNR	Department of Natural Resources
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DPAS	Data Processing and Archiving
DRAGON	Delta Research and Global Observation Network
DSS	Decision Support System
EA	Enterprise Architecture
EAL	Energy Analytical Laboratory
ECM	Energy Conservation Measures
ECO	Energy Conserving Opportunities
ECS	[U.S.] Extended Continental Shelf
EDEN	Everglades Depth Estimation Network
EDMAP	Education Mapping Program (in National Cooperative Geologic Mapping Program)
EDRR	Early Detection, Rapid Assessment and Response
EEOC	Equal Employment Opportunity Commission
EFT	Electronic Funds Transfer
EGIM	Enterprise Geographic Information Management
EGS	Enhanced Geothermal Systems
EHP	Earthquake Hazards Program
EHP	Enterprise Hosting Platform
EI	Enterprise Information
EIR	Enterprise Information Resources
EISA	Energy Independence and Security Act of 2007
EIS&T	Enterprise Information Security and Technology
ELA	Enterprise License Agreement
ELT	Executive Leadership Team
EMS	Environmental Management System
EO	Executive Order
EOL	Encyclopedia of Life
EOP	Executive Office of the President
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act of 2000
EPM	Ecosystem Portfolio Model
EPN	Enterprise Publishing Network
ER	Eastern Region
ERA	E-Risk Assessment
ERAS	eRemote Access Services
EROS	Earth Resources Observation and Science
ERP	Energy Resources Program
ESD	Earth Surface Dynamics
ESN	Enterprise Services Network
ESRI	Environmental Systems Research Institute
ETM+	Enhanced Thematic Mapper Plus
EVMS	Earned Value Management System

FAA	Federal Aviation Administration
FAC	Federal Advisory Committee
FACA	Federal Advisory Committee Act
FAER	Fisheries Aquatic and Endangered Resources
FASAB	Federal Accounting Standards Advisory Board
FBAT	Facilities Budget Allocation Team
FBMS	Financial Business Management System
FBWT	Fund Balance with Treasury
FCI	Facilities Condition Index
FEA	Federal Enterprise Architecture
FECA	Federal Employee Compensation Act
FEDMAP	Federal lands Mapping Program (in National Cooperative Geologic Mapping Program)
FEGLI	Federal Employees Group Life Insurance
FEHB	Federal Employees Health Benefit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FERS	Federal Employees Retirement System
FFMIA	Federal Financial Management Improvement Act of 1996
FFS	Fire and Fire Surrogate
FGDC	Federal Geographic Data Committee
FICA	Federal Insurance Contributions Act
FICMNEW	Federal Interagency Committee for the Management of Noxious and Exotic Weeds
FISC	Florida Integrated Science Center
FISMA	Federal Information Security Management Act
FMT	Field Managers Team
FMFIA	Federal Managers' Financial Integrity Act of 1982
FMMS	Facilities Maintenance Management System
FOS	Flight Operations Segment
FOT	Flight Operations Team
FRAMES	Fire Research and Management Exchange System
FRB	Federal Reserve Board
FRPC	Federal Real Property Council
FRPP	Federal Real Property Profile
FSA	Farm Service Agency
FSAM	Federal Segment Architecture Methodology
FTE	Full-Time Equivalent
FWS	U.S. Fish and Wildlife Service
GAAP	Generally Accepted Accounting Principles
GAM	Geographic Analysis and Monitoring Program
GAP	Gap Analysis Program
GAO	Government Accountability Office
GBIP	Great Basin Information Project
GBIS	Global Biodiversity Information Facility
GCDAMP	Glen Canyon Dam Adaptive Management Program
GC-IMS	Global Change-Information Management System
GCP	Global Change Program
GCMRC	Grand Canyon Monitoring and Research Center
GEO	Group on Earth Observations
GEODE	GEO-Data Explorer
GeoMAC	Geospatial Multi-Agency Coordination Group

Acronyms

GEOSS	Global Earth Observation System of Systems
GFDL	Geophysical Fluid Dynamics Laboratory
GIO	Geographic Information Office
GIS	Geographic Information System
GLSC	Great Lakes Science Center
GNIS	Geographic Names Information System
GOES	Geostationary Operational Environmental Satellites
GOS	Geospatial One-Stop
GPRA	Government Performance and Results Act
GRB	Green River Basin
GPS	Global Positioning System
GPSC	Geospatial Products and Services Contract
GSA	General Services Administration
GS-FLOW	Groundwater and Surface-water flow model
GSN	Global Seismographic Network
GWRP	Ground-Water Resources Program
HAZUS	Federal Emergency Management Agency's Earthquake Loss Estimation Program
HBN	USGS Hydrologic Benchmark Network
HDOA	Hawaii Department of Agriculture
HEDDS	Highly Pathogenic Avian Influenza Early Detection Data System
HHS	Department of Health and Human Services
HIF	Hydrologic Instrumentation Facility
HLI	Healthy Lands Initiative
HNA	Hydrologic Networks and Analysis Program
HPO	High Performing Organization
HR	Human Resources
HR&D	Hydrologic Research and Development Program
HSPD -12	Homeland Security Presidential Directive 12
HUD	US Department of Housing and Urban Development
HVO	Hawaii Volcano Observatory
HWATT	Hemlock Woolly Adelgid Action Team
I&M	Inventory and Monitoring – NPS
IAGA	International Association of Geomagnetism and Aeronomy
ICAO	International Civil Aviation Organization
ICL	International Consortium on Landslides
ICRP	Internal Control Review Plan
ICWP	Interstate Council on Water Policy
IEAM	Integrated Environmental Assessment and Management
IGPP	Institute for Geophysics and Planetary Physics
IIE	Integrated Information Environment
ILM	Integrated Landscape Monitoring
IOOS	Integrated Ocean and coastal Observing System
IP	Investment Plan
IPDS	Information Product Data System
IRB	Investment Review Board
IRIS	Incorporated Research Institutions for Seismology
InSAR	Interferometric Synthetic Aperture Radar
ISO	International Organization for Standardization
IT	Information Technology
ITAP	Invasive Terrestrial Animals and Plants

ITILOB	Information Technology Infrastructure Line of Business
IT IS	Integrated Taxonomic Information System
ITSOT	IT Security Operations Team
ITSSC	IT Security Steering Committee
JFA	Joint Funding Agreement
JV	Joint Venture Partnerships
KSF	Thousand Square Feet
LAS	Local Action Strategy
LCAT	Land Cover Analysis Tool
LDCM	Landsat Data Continuity Mission
LDGST	Landsat Data GAP Study Team
LEAG	Long-term Estuary Assessment Group
LHP	Landslide Hazards Program
LiDAR	Light Detecting and Ranging
LIMA	Landsat Image Mosaic of Antarctica
LMV	Lower Mississippi Valley
LMVJV	Lower Mississippi Valley Joint Venture Office
LOA	Level of Authentication
LRS	Land Remote Sensing
LTRMP	Long-Term Resource Monitoring Program
LTWG	Landsat Technical Working Group
LVO	Long Valley Volcano Observatory
Mbtu	Million British thermal units
MD	Management Directive
MEO	Most Effective Organization
MHDP	Multi-Hazards Demonstration Project
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MOC	Mission Operations Center
MODIS	Moderate Resolution Imaging Spectroradiometer
MODFLOW	Modular Ground-Water Flow Model
MOU	Memorandum of Understanding
MRDS	Mineral Resources Data System
MRERP	Mineral Resources External Research Program
MRLC	Multi-Resolution Land Characteristics Consortium
MRP	Mineral Resources Program
MSCP	Multi-Species Conservation Program
MSH	Mount St. Helens
MSS	Multi Spectral Scanner
MTBE	methyl tert-butyl ether
MUSIC	MIT-USGS Science Impact Collaborative
MW	Megawatt
MWe	Megawatt electric
NABCI	North American Bird Conservation Initiative
NACO	National Association of Counties
NADP	National Atmospheric Deposition Program
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NARA	National Archives and Records Administration
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration

Acronyms

NASQAN	National Stream Quality Accounting Network
NAWQA	National Water-Quality Assessment
NBC	Department of Interior – National Business Center
NBII	National Biological Information Infrastructure
NCAR	National Center for Atmospheric Research
NCAP	National Civil Applications Program
NCCWSC	National Climate Change and Wildlife Science Center
NCDE	Northern Continental Divide Ecosystem
NCEP/NOAA	National Centers for Environmental Prediction
NCGMP	National Cooperative Geologic Mapping Program
NCIA	National Competitiveness Investment Act
NCPP	USGS National Coastal Program Plan
NCRDS	National Coal Resources Data System
NDOP	National Digital Orthoimagery Program
NED	National Elevation Dataset
NEHRP	National Earthquake Hazards Reduction Program
NEIC	National Earthquake Information Center
NEON	National Ecological Observatory Network
NEPA	National Environmental Policy Act
NEST	National Environmental Status and Trends
NETL	National Energy Technology Laboratory
NFHAP	National Fish Habitat Action Plan
NGA	National Geospatial-Intelligence Agency
NGAC	National Geospatial Advisory Committee
NGGDPP	National Geological and Geophysical Data Preservation Program
NGIC	National Geomagnetic Information Center
NGMDP	National Geologic Map Database Project
NGO	Nongovernmental organization
NGP	National Geospatial Program
NGTOC	National Geospatial Technical Operations Center
NHD	National Hydrology Dataset
NHWC	National Hydrologic Warning Council
NIEHS	National Institute of Environmental Health Sciences
NIFC	National Interagency Fire Center
NIH	National Institute of Health
NISC	National Invasive Species Council
NISS	National Institute for Invasive Species Science
NIST	National Institute of Standards and Technology
NIWR	National Institutes for Water Resources
NLC	National League of Cities
NLCD	National Land Cover Database
NLIC	National Landslide Information Center
NLIP	National Land Imaging Program
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NORTHCOM	U.S. Northern Command
NOSC	National Operations and Security Center
NPN	National Phenology Network
NPRA	National Petroleum Reserve Alaska
NPS	National Park Service

NRDA	Natural Resource Damage Assessment
NRIS	Natural Resource Information System
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRMP	National Resource Monitoring Partnership
NRP	National Research Program (research organization in USGS Water discipline)
NRPP	National Resource Preservation Program
NSDI	National Spatial Data Infrastructure
NSF	National Science Foundation
NSGIC	National States Geographic Information Council
NSIP	National Streamflow Information Program
NSLRSDA	National Satellite Land Remote Sensing Data Archive
NSMP	National Strong Motion Program
NSPD	National Space Policy
NSTC	National Science and Technology Council
NSVRC	Northern Shenandoah Valley Regional Commission
NTN	National Trends Network
NVEWS	National Volcano Early Warning System
NWHC	National Wildlife Health Center
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
NWQMN	National Water Quality Monitoring Network
NWS	National Weather Service
O&M	Operations and Maintenance
OAFM	USGS Office of Accounting and Financial Management
OAG	USGS Office of Acquisition and Grants
OAP	Ocean Action Plan
OBIS	Ocean Biogeographic Information System
OBIS	USGS Office of Business Information Systems
OBP	USGS Office of Budget and Performance
OC	USGS Office of Communications
OEPC	Office of Environmental Policy and Compliance
OES	Office of Emergency Services
OFDA	Office of Foreign Disaster Assistance
OFEE	Office of the Federal Environmental Executive
OFR	Open-File Report
OGC	Open Geospatial Consortium
OHC	USGS Office of Human Capital
OIA	Office of Insular Affairs
OICR	USGS Office of Internal Control and Reporting
OIG	Office of the Inspector General
OGDB	Organic Geochemistry Database
OLI	Operational Land Imager
OMB	Office of Management and Budget
OMS	USGS Office of Management Services
OPA	USGS Office of Policy and Analysis
OPM	Office of Personnel Management
ORPP	Ocean Research Priority Plan
ORPPIS	Ocean Research and Priorities Plan and Implementation Strategy
OSHA	Occupational Safety and Health Administration

Acronyms

OSM	Office of Surface Mining
OSTP	Office of Science and Technology Policy
OWRS	Office of Western Regional Services
PAGER	Prompt Assessment of Global Earthquakes for Response
PAR	Performance and Accountability Report
PART	Program Assessment Rating Tool
PBX	Private Branch eXchange
PDA	Personal Digital Assistant
PDR	Preliminary Design Review
PES	Priority Ecosystem Science
PFM	(Department) Office of Financial Management
PI	Principal Investigator
PII	Personally Identifiable Information
PIP	Performance Improvement Plan
PIP	Program Improvement Plan
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
PP&E	Property, Plant, and Equipment
PPM	Planning Performance Management
P&PM	Planning and Performance Management Team
PRB	Powder River Basin
PSNER	Puget Sound Near Shore Ecosystem Restoration
PSS	Perimeter Security Standard
PTWC	Pacific Tsunami Warning Center
PWRC	Patuxent Wildlife Research Center
QOL	Quality of Life
R&D	Research and Development
RASA	Regional Aquifer-System Analysis
RCM	Regional Climate Models
RCOOS	Regional Coastal Ocean Observing Systems
REMS	River Ecosystem and Modeling Science
RFP	Request for Proposal
RGIO	Regional Geospatial Information Office®
RIF	Reduction in Force
RISA	Regional Integrated Science and Assessments – NOAA
RPM	Real Property Management System
RSSI	Required Supplementary Stewardship Information
RTS	Reports Tracking System (Water Resources)
RWRPC	Regional Water Resources Policy Committee
SAFOD	San Andreas Fault Observatory at Depth
SAIN	Southern Appalachian Information Node
SAPs	Synthesis and Assessment Products
SAR	Synthetic Aperture Radar
SAUs	Storage Assessment Units
SBFD	San Francisco Bay and freshwater delta
SBSP	South Bay Salt Pond Restoration Project
SCEC	Southern California Earthquake Center
SCR	System Concept Review
SDR	Subcommittee for Disaster Reductions
SDRT	Supervisory Development Review Team
SES	Senior Executive Service

SETAC	Society of Environmental Toxicology and Chemistry
SFBD	San Francisco Bay Delta
SFWMD	South Florida Water Management District
SHC	Strategic Habitat Conservation
SLC	Scan Line Corrector
SGL	Standard General Ledger
SIR	Surveys, Investigations, and Research
SOW	Statement of Work
SPARROW	SPAtially Referenced Regressions on Watershed Attributes
SPOC	Security Point of Contact
SPRESO	South Pole Remote Earth Science Observatory
SRR	Systems Requirement Review
SRTM	Shuttle Radar Topographic Mission
SSRIs	Selective Serotonin Reuptake Inhibitors
STATEMAP	State Mapping Program (in Cooperative Geologic Mapping Program)
STIG	Security Technical Implementation Guides
SWAQ	Subcommittee on Water Availability and Quality
SWPC	Space Weather Prediction Center
TAA	Technical Assistance Agreements
TANC	Transport of Anthropogenic and Natural Contaminants
TCOM	Tahoe Constrained Optimization Model
TIRS	Thermal Infrared Sensor
TM	Thematic Mapper
TMDL	Total Maximum Daily Loads (Clean Water Act requirement)
TRIGRS	Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis
TRIP	The Road Indicator Project
TROR	Treasury Report on Receivables
TRPA	Tahoe Regional Planning Agency
TSP	Thrift Savings Plan
UAS	Unmanned Aircraft Systems
UIC	Underground Injection Control
URISA	Urban and Regional Information System Association
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USFS	U.S. Forest Service
USGCRP	U.S. Global Change Research Program
USGEO	U.S. Group on Earth Observations
USGS	U.S. Geological Survey
USNG	United States Nation Grid
VANS	Volcano Activity Notices
VDAP	Volcano Disaster Assistance Program
VHP	Volcano Hazards Program
VHSV	Viral Hemorrhagic Septicemia Virus
VOIP	Voice over IP Systems
VONA	Volcano Observatory Notifications for Aviation
V&V	Validation and Verification

Acronyms

VSIP/VERA	Voluntary Separation Incentive Payment/Voluntary Early Retirement Authority
WAN	Wide Area Network
WCF	Working Capital Fund
WFRC	Western Fisheries Research Center
WLCI	Wyoming Landscape Conservation Initiative
WNS	White-Nose Syndrome
WNV	West Nile Virus
WPA	World Petroleum Assessment 2000
WR	Western Region
WRD	Water Resources Discipline
WRIR	Water Resources Investigation Report
WRRR	Water Resources Research Act
WRRIs	[State] Water Resources Research Institutes
WSC	[USGS State] Water Science Center
WSWC	Western States Water Council
WUI	Wildland-Urban Interface
YMP	Yucca Mountain Program
YVO	Yellowstone Volcano Observatory

A. General Statement

General Statement
Total 2010 Budget Request
(Dollars in Thousands)

Budget Authority	2008 Actual	2009 Enacted	2010 Budget Request	Change 2010 from 2009
Discretionary	1,006,480	1,043,803	1,097,844	54,041
Mandatory	2,698	2,557	1,688	-869
Total	1,009,178	1,046,360	1,099,532	53,172
<i>FTEs</i>	<i>8,355</i>	<i>8,370</i>	<i>8,419</i>	<i>49</i>

FTEs	2008 Actual	2009 Enacted	2010 Budget Request	Change 2010 from 2009
Direct/Appropriated	5,416	5,354	5,418	64
Reimbursable	2,752	2,672	2,672	0
Working Capital Fund	157	312	307	-5
Contributed Funds	19	21	11	-10
Allocation Accounts	11	11	11	0
Total	8,355	8,370	8,419	49

2010 Budget Request by Interior Goal
(Dollars in Thousands)

Improve Understanding	2008 Actual	2009 Enacted	2010 Budget Request	Change 2010 from 2009
National Ecosystems and Resources	801,099	830,731	879,957	49,226
Energy and Mineral Resources	97,367	99,378	102,681	3,303
Natural Hazards	108,014	113,694	115,206	1,512
Total	1,006,480	1,043,803	1,097,844	54,041

Overview

The 2010 request for the U.S. Geological Survey (USGS) is \$1.1 billion in current appropriations, an increase of \$54 million from the 2009 enacted appropriation. The 2010 budget advances Administration priorities of:

- A New Energy Frontier
 - Energy independence for America with a focus on renewables,
 - Responsible production of oil and natural gas,
- A 21st Century Youth Conservation Corps, and
- Climate Impacts

In making funding and priority decisions, the USGS considered the following criteria in weighing the value of the science: interdisciplinary conduct and application, collaboration and partnerships, results of program evaluations, demonstration of progress toward advancing the USGS Science Strategy, and the research and development investment criteria—performance, quality, and relevance.

The USGS is a valuable source of research and information for the American public. Under the proposed budget, the USGS will continue to:

- Work closely with Interior bureaus to ensure that their science and information needs are an integral part of USGS science plans;
- Carry out large-scale, regional and national, investigations that build the base of knowledge about the Earth;
- Apply multi-disciplinary scientific expertise in the fields of biology, geography, geology, hydrology, and geospatial information;
- Sustain long-term monitoring and assessment of natural resources;
- Collect, monitor, and analyze data and provide scientific understanding about natural resource conditions, issues, and problems; and
- Provide relevant, timely, impartial, and peer-reviewed natural resource information products.

These combined efforts, coupled with a mission independent of regulatory or land management activities, position the USGS as a leader in understanding complex natural science questions of the day; performing objective analysis; and providing scientific products that lead to solutions. For more than a century, natural resource managers, emergency response organizations, land use planners, decisionmakers at all levels of government, and citizens in all walks of life have come to depend on the USGS for reliable unbiased information to use as tools to address societal issues related to public safety and health, natural resource management, and environmental protection.

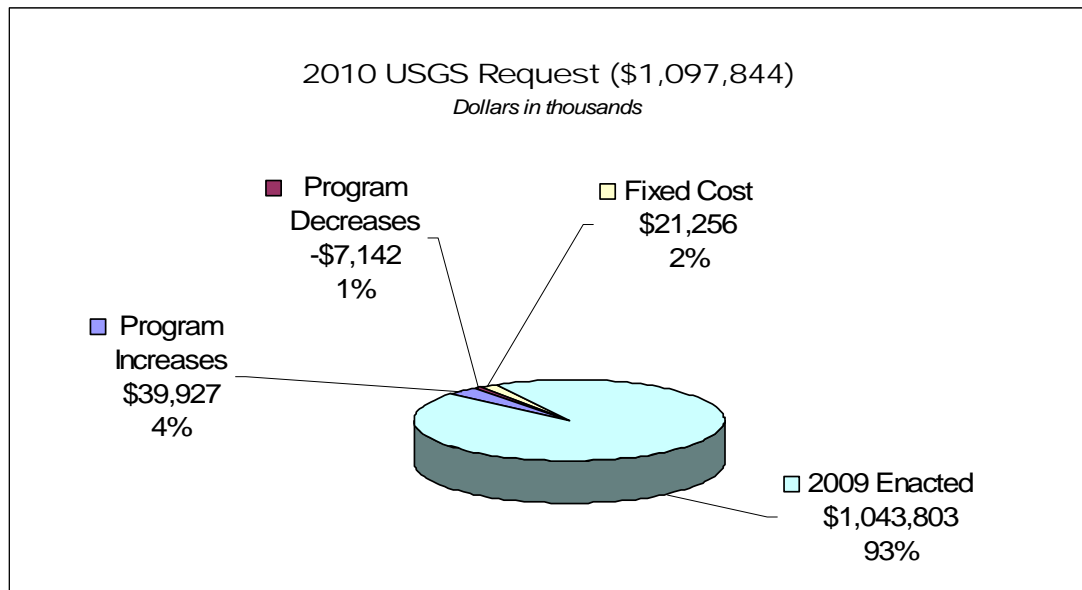
USGS funding provided through the American Recovery and Reinvestment Act of 2009 is described in a separate tab section found at the back of the budget justification. This section contains the bureau's program plan for investments to be funded through the Recovery Act,

including identification of the bureau activities to be funded by the Act, criteria for selection of projects, and plans for performance monitoring.

However, a subactivity or program that anticipates receiving Recovery Act funding may need to reference the Recovery Act and the potential impact of that funding in explaining particular program performance for beyond 2010. Where ARRA-related performance is included in a table, the situation is clearly explained in the performance measure comment row and in the program performance narrative.

2010 Major Focus

The 2010 budget request is based on the 2009 Omnibus Appropriations Act. It includes fixed costs totaling \$21,256,000. Secretarial Initiatives are funded at \$27,000,000. Other increases include \$1,000,000 for extended continental shelf efforts, \$5,000,000 to enhance the National stream gage network, \$727,000 to study impact of energy development on the landscape, \$4,200,000 for arctic ecosystem studies, and \$2,000,000 to fund staffing for the Biology Cooperative Research Units. Decreases total \$7,142,000. Decreases proposed include all unrequested Congressional increases in the 2009 Omnibus Appropriations Bill. The focus of the 2010 budget request is Secretarial Initiatives in New Energy Frontier, Climate Change, and 21st Century Youth Corps. See Section C. Key Increases for details on these initiatives.



Technical Adjustments

In the 2010 President's Budget Request, the USGS proposed a technical adjustment to move the National Geospatial Program (NGP) subactivity in Enterprise Information to Geographic Research, Investigations, and Remote Sensing. The technical adjustment will align the USGS' geographic-based programs to better integrate NGP activities into a single organization; better integrate geographic data from *in situ*, aerial, and space-based remote sensing platforms; and enhance the capability to leverage existing state-of-the-art data management, archive and dissemination capabilities at Earth Resources Observation and Science Center (EROS). It is applied in both the budget and performance tables for the 2009 Enacted and the 2010 President's Budget. Details on the technical adjustment can be found in Section F.

Department Crosscuts

For most departmental crosscutting activities, USGS funding levels for science are preserved or increased in this budget. These crosscutting activities range from environmental issues such as the Everglades restoration and coral reef protection in the Pacific Islands to environmental and climactic change issues being studied under the Global Change activity. The following are some of the crosscutting activities in which the USGS plays a prominent role: Great Lakes Restoration, Columbia River Basin Salmon Recovery, Coral Reef Protection, Global Change, Restoring the Nation's Greater Everglades and Coastal Ecosystems, Invasive Species, and Klamath River Basin. For more on the associated crosscuts, see Section G, Science on the Landscape.

Strategic Plan

In accordance with the Government Performance and Results Act of 1993 and with OMB policy and direction, the DOI Strategic Plan is currently undergoing the required triennial review and update. The Department is reviewing the organization and construct of the Strategic Plan in light of the Administration's priorities, goals, and objectives. Although the majority of end outcome goals and measures are expected to remain intact, the organizing principles for those goals and measures may change during this review. Therefore, this budget request does not directly reference the existing DOI Strategic Plan, but does continue to report on performance goals and accomplishments associated with the current slate of end outcome goals and related performance measures.

Science lies at the foundation of Interior programs. USGS programmatic outcomes directly contribute to the goals of understanding

- National Ecosystems and Resources
- Energy and Mineral Resources and
- Natural Hazards

to inform decisions on land and resource management and planning, managing and mitigating the effects of natural hazards by Federal, State and local governments and private citizens..

The intermediate outcomes or strategies to achieve those ends are to:

- Ensure availability and
- Ensure the quality and relevance

of science information and data to support decision making

These strategies are both the criteria on which investment decisions are made for Research and Development (R&D) and the accountability premise on which performance is measured for each goal. The Strategic Plan is legislatively mandated to be revised in 2009 which is currently in progress. USGS has been conducting a review of our performance measures to ensure they produce useful information about USGS program performance.

Science Strategy

The USGS Science Strategy, "*Facing Tomorrow's Challenges—U.S. Geological Survey Science in the Decade 2007–2017*," is helping us to better target our science toward some of the Nation's most pressing natural-science issues. Under the guidance of this report, we are focusing on six strategic science directions:

- understanding ecosystems and predicting ecosystem change;
- climate variability and change;
- energy and minerals for America's future;
- a national hazards risk and resilience assessment program;
- the role of environment and wildlife in human health; and
- a water census in the United States.

Section B contains information on the implementation of the USGS Science Strategy.

Science Planning

A key aspect of implementing the USGS Science Strategy is creating and sustaining a work environment and culture that is conducive to collaborative, interdisciplinary scientific research. *This is critical to the Bureau's ability to deliver science addressing complex natural systems that informs natural resource and land management challenges that clients and partners face.* A component in achieving the goals of our USGS Science Strategy is to implement a common bureau science planning process. The Regional Executives and the discipline Chief Scientists have been charged with developing and refining a bureau science planning and implementation model that will build stronger interactions among the disciplines and regions. The result will define components for planning science work that implement the USGS Science Strategy across programs and across regions. Three of the USGS Science Strategy Directions are in various stages of model testing. Global Change, Ecosystems, and Multi-Hazards are reviewing current work and looking for opportunities to build integrated projects in the future.

Data Validation and Verification (V&V)

USGS has complied with requirements for performance data credibility with the USGS GPRA coordinators completing and certifying a checklist comprised of criteria in the Department V&V Assessment Matrix for all performance measures in the performance budget. Verification includes assessing data accuracy, completeness, consistency, availability, and internal control practices that serve to determine the overall reliability of the data collected. GPRA coordinators document any inconsistencies, inaccuracies or anomalies in performance data to ensure their integrity. Validation criteria include scrutiny to determine that goals are realistic and measurable, understandable to users, and ultimately used in decisionmaking. The USGS demonstrated accountability by establishing a clear connection among mission, work activities, and what work accomplishes for the funds that have been authorized and appropriated..

Peer review is a Fundamental Science Practice at the USGS, substantiating the quality investment criterion, and servicing as a performance measure for all programs. In 2008, the USGS began using the A-123 Internal Control Review process to validate the peer review process. In the first year of implementation, the USGS tested peer review for four programs:

- Geographic Analysis and Monitoring
- Geologic Hazard Assessments
- Cooperative Water Program
- Biological Information Management and Delivery

Peer review addresses:

- Scientific Excellence, Integrity and Objectivity
- Conflict of Interest

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- Impartiality and Nonadvocacy
- Methodology and Documentation
- Public Benefit and Access
- Natural Hazards and Public or Wildlife Health
- Accessibility and Corporate Identify

Roles and responsibilities of those in the review and approval process were tested and were generally found to be working as intended. In addition to validating the process, the control testing identified areas that could be further improved and these recommendations were provided to the Fundamental Science Practice Advisory Council for consideration.

In 2009 USGS is testing

- Land Remote Sensing
- Geologic Resource Assessments
- Water Resources Research Act Program
- Cooperative Research Units

Performance Improvement

The USGS uses performance management to make agency program practices more efficient and effective. An integrated science planning process ensures that the management of programs and funding is handled appropriately and uniformly at local, regional, and national levels. Internal control reviews of programs, financial practices, information security and human resources, as well as administrative reviews, external program evaluations, peer review of science; program performance improvement plans, GPRA performance measures, managerial cost accounting, and employee performance appraisals tied to program performance are all tools that contribute to USGS success.

The USGS strives to make our performance data transparent and accessible to both employees and the public. Through our internal and external budget and performance websites as well as OMB's websites, managerial cost accounting, performance improvement plans, and GPRA performance are made available to all stakeholders. By providing the data to the public, USGS encourages optimum performance and accountability to the taxpayer for our use of Federal funds.

Through Activity-Based Costing (ABC) and performance measurement, USGS has collected vast amounts of performance information. Since 2004, USGS has developed Performance Improvement Plans, setting and working toward achievement of 120 actions with 382 milestones to continuously improve program performance. USGS has an on-time completion rate of 97 percent of milestones. In addition, periodic external program reviews are conducted. Having used this information to hold managers accountable for their programs, the USGS is poised to build on these practices to implement innovative techniques in support of continuous program improvement.

2010 Performance Summary

To improve the understanding of National Ecosystems and Resources, USGS is requesting \$879,857,000, 81 percent of the total USGS budget and a net total increase of \$49,226,000 from the 2009 Enacted level. This request includes net programmatic change of \$32,441,000 from the 2009 Enacted level, including program increases totaling \$1,900,000 for A New Energy

Frontier, \$22,000,000 for Climate Impacts, \$5,000,000 to Enhance the National Streamgauge Network \$727,000 for Sustainable Energy Development, \$1,000,000 for Extended Continental Shelf, \$4,200,000 for Biological Research and Monitoring, \$2,000,000 for Cooperative Research Unit vacancies, and \$1,606,000 for a portion of A 21st Century Youth Conservation Corps. This request includes program decrease totaling \$5,992,000 for California sea floor mapping, San Diego, California aquifer mapping, Hood Canal, San Pedro Partnership, Long-term Estuary Group, US-Mexico trans-boundary aquifer study, Lake Champlain, and Hawaii, Molecular biology at Leetown Science Center, San Francisco salt pond studies and NatureServe. The goal represents over 96 percent of the proposed USGS program increases and 84 percent of proposed program decreases. Fixed costs and related charges account for the remaining increase of \$16,785,000. Performance for these initiatives include: (1) increasing the number of systematic analyses completed, (2) increasing the number of workshops or training provided to customers, and (3) increasing the percent of surface area with temporal and spatial research and modeling and assessment/data coverage. In 2008, all programs supporting this goal have met or exceeded their GPRA performance measures, and continue to meet milestones documented, monitored and tracked in their Performance Improvement Plans. Of 85 follow-up actions that have been created for these programs since 2004, 65 have been completed and 20 are currently in progress. Of a total of 252 milestones for these programs 97 percent are completed on time. There are 57 milestones in 2009 of which 35 remain to be completed.

To improve understanding of Energy and Mineral Resources, USGS is requesting \$102,681,000, 9 percent of the total USGS budget and a net total increase of \$3,303,000 from the 2009 Enacted level. This request includes net programmatic change of \$636,000 from the 2009 Enacted level, including program increasing totaling \$1,100,000 for New Energy Frontier, and \$186,000 for a portion of A 21st Century Youth Conservation Corps. This request includes program decrease totaling \$650,000 for mineral assessment in Nye County, Nevada. The goal represents nearly 3 percent of the proposed USGS program increases and 9 percent of proposed program decreases. Fixed costs and related charges account for the remaining increase of \$2,667,000. Performance for these initiatives include: increasing the number of systematic analyses completed, and increasing the number of workshops or training provided to customers. In 2008, all programs supporting this goal have met or exceeded their GPRA performance measures, and continue to meet milestones documented, monitored and tracked in their Performance Improvement Plans. Of 20 follow-up actions that have been created for these programs since 2004, 16 have been completed and 4 are currently in progress. Of a total of 75 milestones for these programs, 97 percent are completed on time. There are 11 milestones in 2009 of which 6 remain to be completed.

To improve the understanding of Natural Hazards, USGS is requesting \$115,206,000, 10 percent of the total USGS budget and a net total increase of \$1,512,000 from the 2009 Enacted level. This request includes net programmatic decrease of \$292,000 from the 2009 Enacted level, including program increases totaling \$208,000 for a portion of A 21st Century Youth Conservation Corps. This request includes net programmatic decrease totaling \$500,000 for the Arkansas Seismological Observatory. The goal represents approximately 1 percent of the proposed USGS program increases and 7 percent of proposed program decreases. Fixed costs and related charges account for the remaining increase of \$1,804,000. In 2008, all programs supporting this goal have met or exceeded their GPRA performance measures, and continue to meet milestones documented, monitored and tracked in their Performance Improvement Plans. Of 15 follow-up actions that have been created for these programs since 2004, 13 have been completed and 2 are currently in progress. Of a total of 55 milestones for these programs, 92 percent are completed on time. There are 7 milestones in 2009 of which 4 remain to be completed.

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The USGS vision, mission, and strategic direction focus on responsiveness and customer service, underscoring the application of science to customer, partner, and other stakeholder needs. They direct the combined expertise of the bureau's scientific disciplines and define its commitment to pursuing a multidisciplinary approach to providing science for a changing world.

Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment

Interior's land management mandate has grown dramatically, both in terms of the numbers and types of resources involved and in the complexity of the associated management issues. Interior administers programs on thousands of upland, wetland, and aquatic parcels within the Department's direct jurisdiction and provides resources for conservation activities on non-Federal lands. Extreme changes in the environment are less costly if their likely effects can be mapped, quantified, and anticipated. Resources can be more efficiently used if the impacts of their development and extraction can be predicted and mitigated. Damaged or endangered ecosystems can be repaired more effectively if the natural processes that form and maintain them are accounted for in remediation and restoration plans. Strategies for conserving and using the Nation's lands and resources are improved when natural processes are incorporated into predictive models and management plans in an adaptive manner. USGS science programs collaborate with many organizations across the country to provide critical information that assists land and resource management agencies, partners, stakeholders, customers, and the general public with timely information to inform their decisions.

To improve understanding, the USGS produces scientific assessments and information on the quality and quantity of our Nation's water resources; collects, processes, integrates, archives, and provides access to geographic, geospatial and natural resource data; generates and distributes information needed in the conservation and management of the Nation's biological resources; and conducts multi-purpose natural science research to promote understanding of earth processes. USGS's multiple scientific disciplines

National Research Council (NRC) Evaluation of River Science

The report released August 2007 recommended that USGS river science activities be driven by the compelling national need for an integrative multidisciplinary science, structured and conducted to develop a process-based predictive understanding of the functions of the nation's river systems and their responses to natural variability and the growing, pervasive, and cumulative effects of human activities. The highest priority river science issues identified in the report are environmental flows and river restoration, sediment transport and geomorphology, and groundwater surface-water interactions.

The USGS realignment implemented in 2008 will help to facilitate more integrated science addressing rivers by helping USGS scientists draw upon whatever capabilities they need from the USGS portfolio, regardless of geographic location or organizational structure, in order to meet the needs of our customers. To address the identified highest priority river science issues, the USGS is developing an integrated surface-water / ground-water coupled model and an integrated river-flow / aquatic-habitat coupled model. In addition, the USGS continues to pursue the development and implementation of new technologies, such as hydroacoustics, lasers, and radar, to better measure sediment transport and document geomorphic changes in rivers.

combine their diverse expertise in interagency ecosystem initiatives across the United States. The development of new methods and techniques allows USGS scientists to work more efficiently and cost effectively.

Improve the understanding of energy and mineral resources to promote responsible use and sustain the Nation's dynamic economy

Managing the vast resources of America's public lands has been a core Interior responsibility since the Department's establishment in 1849. The lands and offshore areas that fall under Interior's sphere of influence today supply roughly 30 percent of the Nation's domestic energy production, including 35 percent of the natural gas, 35 percent of the oil, 44 percent of the coal, 17 percent of the hydropower, and 50 percent of the geothermal energy. Managing resources has become increasingly more complex. Today, the Department is often called upon to determine where, when, and to what extent renewable and non-renewable economic resources on public lands should be made available. That task demands that the Department balance the economy's call for resource use with its resource protection and recreation responsibilities. USGS research on and assessments of undiscovered energy and nonfuel mineral resources assist the Department's land management agencies in their goal of providing responsible management of resources on Federal lands.

NRC Evaluation of Minerals, Critical Minerals, and the U.S. Economy

In response to Administration questions about the importance to the U.S. economy of information on production and consumption of nonfuel mineral commodities, USGS asked the National Research Council to undertake a study of the importance of minerals and minerals information. Their report, released in October 2007, concludes that minerals are indeed critical to the U.S. economy and suggests a new methodology for determining the extent to which any particular mineral is critical at any time, called a criticality matrix.

Immediately on receiving the report, USGS convened a panel of senior mineral resources scientists to determine how best to use the criticality matrix in updating the National Mineral Resource assessment, scheduled to begin in 2012. Following a brief period of internal analysis, USGS began working with members of the NRC panel to improve our understanding of their proposed method and seek advice on specifics of application of their findings to the planned revision of the National Mineral Resource assessment. The primary use of this tool is expected to be in identifying priority commodities for both minerals information and research and assessment studies. This prioritization process will maximize the likelihood that the updated National Mineral Resource assessment is an unbiased, efficient, and cost-effective source for information required by decision-makers to ensure supply of critical mineral materials to meet the Nation's civilian and defense needs.

Each Interior bureau has a role in implementing the Energy Policy Act of 2005 addressing more than 100 actions dealing with the development of renewable and alternative energy sources such as solar, geothermal, wind, gas hydrates, and oil shale. The USGS is the primary provider of earth science energy resource information and assessments for a variety of stakeholders in addition to Interior, including Federal agencies such as the U.S. Department of Agriculture (USDA) Forest Service, and Department of Energy, local and State agencies and electric power producers, the environmental community, academia, and the general public. The USGS Energy Resources Program conducts national and global energy research on and assessments of oil, natural gas, coalbed methane, gas hydrates, coal, geothermal resources, oil shale, and uranium; evaluates environmental and human health impacts associated with production, use, and occurrence of energy resources; and provides information for the Nation to make sound decisions regarding increases or changes in domestic energy production or mix with an understanding of potential impacts on the environment.

The United States is the world's largest user of mineral commodities. Nonfuel mineral materials underpin significant portions of the U.S. economy and influence decisions related to national

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security. Processed materials of mineral origin accounted for an estimated \$575.0 billion in the United States economy in 2007, an increase of 6 percent over the estimated 2006 value. In 2007, U.S. manufacturers and consumers of mineral products depended on other countries for 100 percent of 17 mineral commodities and for more than 50 percent of 45 mineral commodities that are critical to the U.S. economy. Current and reliable information about both domestic and international mineral resources and the consequences of their development informs decisions about supply and development of mineral commodities.

The USGS Mineral Resources Program is the sole Federal provider of scientific information for objective resource assessments and unbiased research results on mineral potential, production, consumption, and environmental effects. Life cycle analysis of nonfuel mineral systems demonstrates the connections between various natural and anthropogenic processes through which minerals are made available to sustain developed societies. Land managers and policymakers use this information to support resource use decisions to enhance public benefit, promote responsible use, and ensure optimal value. Among the tools and technologies developed and employed in these functions are assessments for as-yet undiscovered mineral deposits in the United States and around the world, and Web-based data delivery tools that serve 128 years of mineral resource, geochemical and geophysical data to land managers, Federal agencies responsible for national security and economic policy, the public, and other research scientists.

Improve the understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property

Under the Stafford Act (P.L. 93–288), Interior is responsible for issuing timely warnings of potential geologic disasters—earthquakes, volcanoes, and landslides—to the affected U.S. populace and civil authorities. The Secretary of the Interior has delegated this responsibility to the USGS. In addition, the National Oceanic and Atmospheric Administration (NOAA) uses USGS seismic data to support its delegated Stafford Act responsibility for tsunami warnings; NOAA and the U.S. Air Force use data from USGS geomagnetic observatories for solar-storm warnings; and the USGS and NOAA are collaborating on a pilot debris-flow and flash flood warning system in southern California. For foreign disasters, the USGS works with the Agency for International Development's Office of Foreign Disaster Assistance in responding to appeals for technical assistance from affected countries.

Using USGS Earthquake Science to Inform Mitigation Efforts

On July 8, 2008, almost 19 years after the 1989 Loma Prieta earthquake, San Francisco's current Mayor announced legislation to speed up the retrofitting of soft-story construction which was especially vulnerable to the earthquake and resulted in substantial damage and loss of life. The legislation would expedite the review and waive associated fees for permits to retrofit soft-story buildings which have more windows and doors than solid wall on the first floor.

The USGS conducted major public awareness campaign, focused on the 140th anniversary of the 1868 Hayward Fault earthquake in October, 2008. The occurrence of the past five earthquakes on the Hayward Fault averaging 140 years apart is providing motivation to retrofit buildings throughout the San Francisco Bay area.

Natural hazards can result in considerable human suffering and billions of dollars in property and business losses. The occurrence of these hazardous events is inevitable and largely uncontrollable. However, the extent of damage and loss of life can be reduced through

preventative planning; social, economic, and engineering adaptations; real-time warning capabilities; and more effective post-event emergency response.

Central to this preplanning is the availability of accurate, scientifically based geologic hazards assessments and real-time warning systems that define the nature and degree of risk or potential damage. The more precisely risks can be defined the greater the likelihood that appropriate mitigation strategies will be adopted (e.g., building codes for new construction and retrofitting; land-use plans; and design and location and routing of critical infrastructure such as highways, bridges, subways, water, sewer, gas, electric, local zoning regulations, and petroleum-distribution networks).

The more quickly information reaches emergency response centers the faster teams can be dispatched to resolve time-sensitive medical, utility, or other infrastructure problems.

Volcano Hazards Program Evaluation and Response

In 2007 an external program review panel was convened by the American Association for the Advancement of Science (AAAS) to review the Volcano Hazards Program's (VHP).

The AAAS panel issued its final report on September 30, 2007 and in 2008, VHP has taken the following steps based on the review:

- Shifted coordination of monitoring activities for volcanoes in the Mariana Islands from the Hawaiian Volcano Observatory (HVO) to the Alaska Volcano Observatory (AVO)
- Adopted the 2009 Science Plan to develop scientific and hazard mitigation lessons learned from Volcano Disaster Assistance Program (VDAP) foreign-volcano responses that can be applied to US volcanoes, including new monitoring techniques.
- Developed a new VHP home page with real-time map representation of current hazard status of active volcanoes.
- Volcano Activity Notices (VANs) and Volcano Observatory Notifications for Aviation (VONAs) became automated and web-generated.
- Held meetings with the Wyoming State Geological Survey and University of Hawaii to discuss partnerships in volcano monitoring at Yellowstone Volcano Observatory (YVO) and Hawaii Volcano Observatory, respectively.

Earthquake Scenario for Southern San Andreas Fault Released

This past November, over 5.4 million people in southern California took part in the *Great Southern California Shakeout*, the largest earthquake preparedness exercise in US history. Using a USGS-led scenario that spelled out the likely consequences of a major earthquake on the San Andreas Fault, this event and the accompanying statewide Golden Guardian emergency response exercise demonstrated the value of the many rapid information products that the USGS and its state and university partners can generate in the immediate aftermath of a damaging earthquake. For instance, Los Angeles Unified School District learned how to use *ShakeCast* to feed earthquake shaking information into their facilities management software so, that within 2-5 minutes of a big earthquake, they will have a priority list showing which of their 13,000 buildings are most likely to be unsafe for students. These types of products provide "situation awareness" that emergency managers want and need, and that will empower communities to improve their earthquake resiliency.

USGS geologic hazards programs conduct targeted research, gather long-term data, operate monitoring networks, perform assessments and modeling, and disseminate findings to the public, enabling the Nation's emergency management capabilities to warn of impending disasters, better define risk, encourage appropriate response, and mitigate damage and loss. These programs are designed to produce information and understanding that will lead to a reduced impact of natural hazards and disasters on human life and the economy.

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Manage the Department to be highly skilled, accountable, modern, functionally integrated, citizen-centered, and result-oriented

Successful management requires improvement in accountability for results, more effective means of leveraging available resources, and the continuous introduction and evaluation of process, structural, and technology improvements.

Science Support funds the executive and managerial direction of the bureau, as well as bureau sustaining support services. Science Support has four components: 1) leadership (including the directorate, the Office of Budget and Performance, and the Office of Communications), 2) the Office of Administrative Policy and Services, 3) the Office of Human Capital, and 4) bureau-wide costs. Funding for facilities provide safe and functional workspace and facilities for accomplishing the bureau's scientific mission. Appropriated funds cover approximately 73 percent of recurring USGS rental and operations and maintenance facilities costs. Customers, through reimbursable funding provide approximately 25 percent, and USGS science programs provide the remaining funds. The Facilities Activity comprises rental payments, operations and maintenance, and deferred maintenance and capital improvement.

The Enterprise Information (EI) Activity serves as the focal point for the bureau's information-related resources and activities: information technology security and infrastructures (networks, hardware and software); information management policies and standards; national geospatial data acquisition and archive, and information services (such as libraries, information centers, publications, and the USGS presence on the Internet). Through a telephone survey in 2006, the Pew Internet and American Life Project found that about 23 percent of all Internet users have visited the main website of the USGS, at http://www.pewinternet.org/PPF/r/191/report_display.asp. EI strengthens scientific inquiry both within the USGS and the broader natural science community by ensuring a reliable and streamlined path to relevant USGS data, information, and enhanced access to science information that can easily be understood, shared, and applied.

Standard Management Control Surveys

To ensure quality and relevance of internal USGS products and services to USGS employees, the Office of Budget and Performance (OBP) conducts a variety of standard management control surveys.

- Administrative Support Service Surveys are conducted prior to administrative reviews at USGS science centers. Since 2002, 65 surveys have been conducted.
- Information Technology Support Service Surveys are conducted prior to IT reviews at USGS science centers. Since 2002, 16 surveys have been conducted.
- Meeting Evaluations are conducted after the conclusion of USGS conferences/workshops. Since 2003, 11 surveys have been conducted.
- Hiring Assistance Surveys provide employee input to the selection process for USGS management positions. Since 2008, 6 surveys have been conducted.
- Employee Satisfaction Surveys are conducted on specific internal products, services, and websites. Since 2001, 30 surveys have been conducted.
- Organizational Assessment Surveys provide a broad review of operations and conditions at a science center or office. Since 2002, 17 surveys have been conducted.

In response to the expressed needs of employees, the USGS has made many enhancements to its internal products and services. Each type of survey follows a standard format, although each is modified to meet a specific science center's or office's customer information needs. As a result, the final outcome of each survey is immediately useful to science center or office management, and can be aggregated to support Bureau level performance reporting. OBP follows up with the managers to ascertain how survey results were applied.

Emergency management agencies rely on USGS data in assessing hazards, determining impacts, and creating and implementing response plans. Such data sources include National Water Information System, the Climate Effects Network, the National Biological Information Infrastructure, Geo-Data Explorer, the Seamless Data Distribution System, and Landsat satellite imagery.

Although the mission of the USGS is science, the business behind the science is equally important for keeping our research relevant and responsive. Leaders must stay on top of ever-changing expectations and maintain appropriate internal controls of management and administrative processes while supporting employees, customers, and the science. Reviews and management assessments, such as quarterly Status of Funds and Performance reviews with the Executive Leadership Team and Quarterly Investment Review Board (IRB) meetings maintain a focus on accountability and ensure that investments in the infrastructure supporting science and expenditure of funds yield desired results. Employees, in both science and administrative functions, are kept aware of requirements and held accountable to ensure conformance to strategic directions through the use of cascading performance measures.

Workforce planning and strategic management of human capital are crucial to achieving science goals and are an integral part of USGS planning processes. Workforce plans focus on building and maintaining internal capacity and using creative solutions to address rapid changes in technology. Workforce flexibility is achieved through the use of position management allowing for the appropriate use of various employment and contract options, such as permanent and non-permanent employees, contractors, student appointments, and partnerships. USGS organizations continue to implement various workforce management strategies such as utilization of Voluntary Separation Incentive Payment/Voluntary Early Retirement Authority (VSIP/VERA) authorities; restructuring programmatic activities, organizations, and positions; training and development; and targeted recruitment to achieve workforce goals. The USGS uses a systematic workforce planning approach as the foundation for the development of more detailed workforce plans at the science center/office level. Additionally, the USGS developed a succession planning strategy to complement the workforce planning model to take a more holistic, strategic approach to human capital management and planning.

The USGS systematically monitors the health of the workforce and the organization through structured analyses and surveys, internal surveys coupled with the results of the annual Federal Human Capital Survey, provide very useful information to assess organizational excellence and employee satisfaction. Using these results, USGS leadership develops strategies to address the findings and take actions that benefit our science and our employees and that advance the mission of both the USGS and the Interior. Some of these actions include the formation of a Science Advisory Team, enhanced use of multi-media technologies for improving internal communications, and changes to bureau program planning methods that are more inclusive of field-level involvement.

Partnerships

Our ongoing efforts to develop partnerships that promote scientific advancement in support of our mission are critical to achieving Interior's Strategic Plan. The USGS values collaborative relationships and actively seeks opportunities to build mutually productive partnerships that keep science relevant and allow for leveraging of scarce resources. The value of partnerships has been demonstrated throughout the description of achieving mission goals. A variety of partnership vehicles employed by USGS programs are described at

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http://www.usgs.gov/aboutusgs/working_with_us/partnerships.asp to encourage and facilitate collaborative endeavors.

The USGS National Climate Change and Wildlife Science Center (NCCWSC) partnership approach is designed in collaboration with key federal agencies including the FWS, the NPS, NOAA, the USFS, the BLM, the EPA, the Bureau of Reclamation (BOR), NASA, the Department of Defense (DOD) and the States through the Association of Fish and Wildlife Agencies (AFWA). The NCCWSC's role is to provide coordination for the national assessment and synthesis of physical, biological and ecological information to track, quantify and forecast climate change effects on the flora and fauna of the Nation. The national efforts in new climate science for fish and wildlife adaptation will share existing capabilities and infrastructure for national syntheses, development of standardized approaches, and innovation with NASA, NOAA – Regional Integrated Science and Assessments (RISAs), the National Ecological Observatory Network (NEON), the National Phenology Network, and the Climate Effects Network among others

The USGS plans to build on the successes of its two previous Modeling Conferences, which were held in 2006 and 2008, with another conference in 2010. Following the examples from the two previous conferences, we will have participants from other DOI Bureau's and science agencies that we work closely with including U.S. Environmental Protection Agency (EPA), National Aeronautics and Space Administration (NASA), and NOAA. The framework for the 2010 conference will encompass the main priorities of the new Administration of energy and climate, as well as the science directions in the USGS Science Strategy (USGS Circular 1309, 2007). These directions include energy and the environment; global climate change; ecosystems; hazards; wildlife and human health; water; and data integration. The conference will provide an opportunity for modelers to meet, exchange ideas, and discuss specific opportunities for collaboration to continue to develop integrated models that address complex science questions.

More than a decade ago, the NPS and the USGS initiated the NPS/USGS Water Quality Partnership Program. This partnership built upon a foundation established when the NPS and the USGS NAWQA program implemented a pilot water-quality monitoring program in national parks. To date, 145 partnership projects have been implemented in 104 national park units. The program supports a range of science activities focused on providing park resource managers information necessary to make scientifically defensible management and policy decisions. Partnership activities range in scope from basic technical assistance to fixed station monitoring to intensive projects. One important benefit of the partnership is the interaction among park staff and USGS scientists. In many cases, our scientists and park staff had not worked together prior to coordinating on partnership projects. The partnership program promotes these new relationships and will likely to lead to future opportunities for collaboration.

USGS scientists are engaged with other agencies to provide scientific information needed to manage many aspects of wildland fires, including fire history, ecosystem fire regime, short- and long-term effects of fire, and wildland fuels. In collaboration with the Forest Service (USFS) and academic researchers, the USGS conducted a large Fire and Fire Surrogate (FFS) study to understand effects of fuel treatments on landscapes and climate change. The project is assessing tradeoffs between carbon sequestration opportunity costs and effectiveness of fuel treatments. This work was used by the USFS in their decision to focus more on treatments near wildland-urban interface (WUI) areas instead of lands away from WUI. In partnership with the BLM, the USGS has developed an operational resource monitoring protocol, including a digital library for land treatment records, field sampling schemes, and a comprehensive monitoring

procedure for post-fire landscape rehabilitation and restoration. The research, supported in part by BLM, developed a comprehensive method for monitoring sources of seeds for post-fire re-seeding, invasive species, and rate of success for post-fire rehabilitation. The BLM is adopting the USGS methodology as part of their national resource monitoring strategy. The USGS is an active member of the Joint Fire Science Program. The program receives annual funding of \$12.0 million from Interior and USFS to fund fire research efforts. The USGS collaborates with USFS and all major Interior bureaus (e.g. BLM, BIA, FWS, NPS) on the Governing Board of the program to set fire research priorities and funding decisions. USGS fire researchers are well represented in projects funded by the interagency program.

The USGS is part of a large partnership focused on protecting, restoring and enhancing fish habitat across the nation. The National Fish Habitat Action Plan coordinates fish habitat restoration activities through a series of regional and local partnerships. This partnership includes Federal, State, and Tribal resource management agencies and non-governmental organizations such as Trout Unlimited, The Nature Conservancy and American Sportfishing Association. A strength of the National Fish Habitat Action Plan is that decisions are based on science. The USGS has provided science and data leadership throughout the development of the action plan and continues to lead by providing science leadership on the first national assessment of fish habitat in the United States.

Another important USGS partnership effort for the coming year is the development of the National Climate Effects Network. Through collaboration with other Federal, State, and international data collection programs, this integrated monitoring and research program will provide the nation with an early detection system for addressing changes before they become chronic or catastrophic conditions. This data will be used as a science information source for creating decision-support tools, thus providing scientifically-based management strategies that both accelerate and improve our responsiveness to resource management and policy needs. As the pilot of this effort, the USGS, USFS, the Department resource management agencies, the University of Alaska, the Yukon River Inter-Tribal Watershed Council, and several other partners are implementing a prototype climate effects network in the Yukon River Basin. The collaboration will integrate air, water, soil, and forest information across the Yukon River Basin to track and understand regional changes in carbon flux and storage.

Examples of the depth and breadth of partnerships are documented throughout the budget document. The following is a representative listing of USGS cross-cutting relationships with Federal, State, local, and non-government, and international organizations.

Federal
National/Governmentwide: National Geospatial Program Office, The National Map, National Spatial Data Infrastructure, National Biological Information Infrastructure, National Earthquake Hazards Reduction Program, U.S. Global Change Research Program, National Atlas, Geographic Names, Imagery, elevation and hydrography data collection programs, Civil Applications Committee
Agriculture/Forest Service: Endangered Species, Conservation genetics, Habitat management, Forest planning, Wildlife, Invasive species, Fire science, National Forest maps, Drought/Fire fuel monitoring and management, Energy and mineral resources, Natural hazards, Mine lands, Land cover characteristics, Hydrologic data collection/studies. Topographic maps, digital orthophoto and elevation data, <i>The National Map</i> , National Hydrography Dataset, and geographic names
Commerce/NOAA: Endangered Species, Salmonid restoration, Coral reefs, Hazards monitoring and research, Geomagnetism, Vegetation change, Coastal erosion, Fish habitat, Marine sanctuaries, Geographic Information System, Commerce/ National Institute of Standards and Technology: Earthquake Hazards, coastal and bathymetric mapping

General Statement

Defense: Geospatial Coordination with States: Endangered Species, Salmonid restoration, Coral reefs, Coastal erosion, mapping support during conflict, Natural hazards, Test ban monitoring, Strategic minerals and energy resources, Geomagnetism, Terrain visualization, Hydrologic data collection/studies. Environmental contamination and remediation studies on military bases, NORTHCOMM, High-resolution imagery over urban areas
Defense/Army Corp of Engineers: Endangered Species, Habitat assessment, Fish behavior, Fish physiology, Dam impacts, Wetlands restoration, Seafloor mapping, Shoreline stability, Floodplain morphology, Mine lands, Energy resources, Natural Hazards, Hydrologic data collection/studies
Energy: Endangered Species, Bio-resource monitoring, Contaminant cause and effects, Gas Hydrates, Mining technology, Energy resources, Geologic hazards, Groundwater framework, Coalbed methane, Hydrologic data collection/studies, Geologic Sequestration
EPA: Endangered Species, Endocrine disruption, Contaminant effects, Status/Trends, Mine lands and drainage, Emissions modeling/clean air, Water quality, Seafloor mapping, Geochemical analyses, Coal resources and mining, Urban dynamics/land characterization, Hydrologic data collection/studies Remote sensing, Mineral baselines, GAP Analysis, National Hydrography Dataset
Federal Energy Regulatory Commission Permittees/Licensees: Hydrologic data collection/studies, Restoration of Threatened and Endangered migratory fish
Homeland Security/FEMA: Hazards monitoring and mitigation, Hydrologic data collection/studies, Floodplain mapping, providing emergency maps, elevation data
Health and Human Services: Chemical Analyses
Intelligence Community: Information coordination, Environmental/ resource studies, Hazards Support, Geospatial data coordination.
Interior/BLM: Rangeland Health, Wild Horse Management, Invasive Species, Abandoned Mine Lands, Air Quality, Threatened and Endangered species, Water Quality, Mineral Resource Assessments, Prescribed Fire, mapping of National Petroleum Reserve/Alaska (NPR/A), mapping and geospatial data and analysis, National Hydrography Dataset
Interior/BOR: Water quality, Ecological models, Decision Support Systems, Seismic Monitoring.
Interior/FWS: Inventory and Monitoring, Aquatics and Contaminants, Biological resources, Threatened and Endangered species, Water Quantity/Quality, Gap Analysis Program, Geospatial data
Interior/MMS: Gas hydrates
Interior/NPS: Water quantity/quality, Geologic mapping, Biological resources, Volcano hazard assessment, mapping and geospatial data, National Hydrography Dataset
Interior/Office of Surface Mining: Acid mine drainage
Justice: GIS
Labor: Energy resources
National Academy of Science: Hazards studies, Geographic research, Evaluating licensing of geospatial data, K-12 geography curricula
National Aeronautics and Space Administration (NASA): Planetary research, Landsats 5 and 7 operations, design of Landsat Data Continuity Mission. Natural hazards, Earth Science research, Data management, Land Processes Distributed Active Archive Center, GIS, United Nations Environment Program clearinghouse, Remote sensing, Spaceflight support; Shuttle Radar Topography Mission
National Institutes of Health: Human health and environment, West Nile virus mapping with CDC
Interior: FWS, NPS; USDA: Animal and Plant Health Inspection Service, the Centers for Disease Control and Prevention: Highly Pathogenic Avian Influenza
National Science Foundation: Hazards studies, Antarctic research and mapping, Global seismology
Smithsonian Institution: North American vertebrate collections, Volcanic hazards
State: Natural hazards, Energy resources, Global seismology, Hydrologic data collection/studies, Famine Early Warning System, Pan American Institute of Geography and History, Geospatial Support.
Tennessee Valley Authority: Hydrologic data collection/studies
Transportation/Federal Highway Administration: Hazards studies, Hydrologic data collection/studies
Transportation/Federal Aviation Administration: Volcanic hazards
U.S. Agency for International Development: Geologic hazards, Hydrologic data collection/studies, Energy resources, Atmospheric moisture index
State and Local Government
Airports: Volcanic hazards
American Indians/Alaska Natives: K-12 educational resources, Streamgaging, Water quality/ quantity, Technical training and capability upgrade, Environmental hazards, Fisheries research, Invasive species, NativeView for American Indian colleges and universities, and Geospatial Support
Civil Defense: Hazards mitigation

Departments of Natural Resources/Geographic Information Councils: Volcanic hazards, Map data integration, Hydrologic data collection/studies , Orthoimagery
Departments of Environmental Protection/Quality/Health: Hydrologic data collection/studies, Mapping data
Departments of Fish and Game/Conservation Commission/Wildlife and Parks: Endangered species, Population dynamics, Habitat requirements, Fire management, Fisheries, Wildlife disease, Invasive species, Waterfowl surveys, Bird banding, Aquaculture, GAP Analysis, Geospatial Support
Offices of Emergency Management: Hazards monitoring and mitigation, Providing emergency maps
Planning Commissions/Transportation/Engineering/Municipalities: Conservation plans, Hydrologic data collection/studies, Topographic mapping, Hazards monitoring/assessment, Creating decision support systems for local decisionmaking
State Geological Surveys: Geologic and topographic mapping, Hazards assessment
Higher Education: University participation in AmericaView
Water Resources Authorities/Public Works/Sanitation: Contaminant Transport, Hydrologic data collection/studies
Non-government Organizations
American Farm Bureau/American Society of Civil Engineers/Chemical Manufacturers Association/etc.: Coordination of hydrologic programs
American Red Cross: Hazards monitoring and mitigation
Electric Power Research Institute: Coal quality
Industry: Spatial data modeling, Spatial data browsing and retrieval, Product development, registration, and production, Environmental monitoring, Acid rain deposition program, Hazard monitoring, research and assessments
The Nature Conservancy: Endangered species, Species at Risk, Ecological research, Biological Status/Trends, Coordination of hydrologic programs, GAP Analysis, Decision Support System
National Geographic: Geospatial information coordination
Universities/Cooperative Fish and Wildlife Research Units/State Water Resources Research Institutes: Planetary research, Space-based instrumentation, Natural science information delivery, Natural science research and applications, Hazards research and monitoring networks, Training/education, Geologic mapping, Hydrologic data collection/studies, GAP Analysis
Southern California Earthquake Center (University consortium): Earthquake hazard research and assessment
Utilities: Seismic studies, Hydrologic data collection/studies
NatureServe: NBII, Geospatial Support, Decision Support System
Association of Fish and Wildlife Agencies: chronic wasting disease
Ducks Unlimited: database development and data access for Latin American And Caribbean waterfowl surveys
The General Public: Breeding bird survey, Bird banding, Water resources education/outreach, topographic maps, topographic mapping
International
Global: The USGS has conducted earth science studies and provided natural hazards support in foreign countries for over 50 years. Authorization is provided under the Organic Act, as revised, and the Foreign Assistance Act and related legislation when such studies are deemed by the Interior and Department of State to be in the interest of the U.S. Government.

Research and Development Criteria

Research and development (R&D) is the core of USGS mission. The USGS 2010 R&D funding associated with the budget request is \$649.3 million or 59.1 percent of the USGS budget, a net increase of \$37.7 million from the 2009 Enacted Budget. This increase is due to additional funding requested in research in Climate Impacts, A New Energy Frontier, and Changing Arctic Ecosystems and adjustments received for fixed costs and inflation.

The bureau reviews R&D investments across its disciplines and weighs the value of existing programs against changing needs and priorities. The R&D investment criteria are used to ascertain the value of its R&D programs to rigorously justify new programs and to re-evaluate

General Statement

existing programs for modification, redirection, or termination, in keeping with national priorities and needs. The investment criteria evaluate the **relevance, quality, and performance** for all R&D programs. The Director prioritizes proposed initiatives on the basis of:

- interdisciplinary science; collaboration and partnerships with Department bureaus, other government agencies, and universities (**relevance**);
- results of program evaluations; and demonstration of progress toward meeting the Department's **performance** goals and objectives.

The Director selects from the prioritized initiatives those that she feels he can accommodate within the funding target.

The USGS has always taken the integrity, objectivity and utility of our science seriously by

- conducting peer review of our research and evaluations of our programs to ensure quality, and
- surveys of customer satisfaction with our science products and services and listening sessions with stakeholders and customers to obtain feedback on product usefulness and use to ensure relevance.

This expertise enabled USGS to lead by example when the Department's R&D Council was charged with developing Interior guidelines on science integrity and peer review. We have implemented OMB's Information Quality Guidelines by,

- posting our peer review of *influential and highly influential science* on the web, http://www.usgs.gov/peer_review/
- publishing a Survey Manual Chapter on *Scientific Integrity* in 2008 <http://www.usgs.gov/usgs-manual/500/500-25.html> and developing a training video,
- publishing a Survey manual Chapter on *Fundamental Science Practices*, consistent, enterprise-wide policies that address how USGS science is carried out and how the resulting information products are developed, reviewed, approved, and released. <http://www.usgs.gov/usgs-manual/500/502-1.html>

The USGS regularly conducts internal control reviews on its programs and organizations in accordance with the OMB Circular A-123, Management's Responsibility for Internal Controls. In 2008 the USGS began using the internal control review process to validate adherence to fundamental science practices to ensure **quality** of science and to stand behind the Director's Assurance Statement regarding the USGS programs delivering mission.



**“Facing Tomorrow’s Challenges—
U.S. Geological Survey Science in
the Decade 2007 - FY 2017”**



Background

The USGS science strategy is outlined in Circular 1309, *Facing Tomorrow's Challenges – U.S. Geological Survey Science in the Decade 2007 – 2017*. The document was created to identify science goals and priorities that unite bureau capabilities toward challenges for the future. The strategy outlines areas where natural science can make substantial contributions to the Nation and the world. It identifies opportunities for USGS to better use its scientific capabilities to serve DOI and the Nation. In doing so, it is intended to inform long-term approaches to USGS program planning, technology investment, partnership development, and workforce and human capital strategies.

While this high-level strategy does not cover *all* aspects of USGS work, it does outline areas where natural science can make substantial contributions to the well-being of the Nation and the world.

This strategy is intended to inform long-term approaches to USGS program planning, technology investment, partnership development, and workforce and human capital strategies. This science strategy builds upon a hierarchy of planning documents. It provides a science-based response to the overarching DOI strategic plan and is a follow-up to the 1993 publication, “The U.S. Geological Survey: A Vision for the 21st Century.”

This strategy is intended to inform long-term USGS program planning, technology investment, partnership development, and workforce and human capital strategies.

The choice of strategic science directions was guided by the view that complexities of measuring, mapping, understanding, modeling, and predicting the status and trends of natural and managed resources in the US transcend the traditional USGS structure and require broad interdisciplinary thinking and action. The science strategy defines priority areas and opportunities where USGS can serve the Nation’s pressing needs. This strategy unites and integrates all USGS capabilities and takes advantage of its strengths and unique position as a non-regulatory Federal science agency with national scope and responsibilities.

Implementing these strategic directions will enable the USGS to be the best science agency it can be and strengthen the Nation with the information needed to meet the challenges of the 21st century.

The Science Strategy was published in 2007.



Understanding Ecosystems and Predicting Ecosystem Change: Ensuring the Nation's Economic and Environmental Future

Societal Concerns

Large-scale, rapid change is taking place in all natural systems throughout the world. Growing human populations and substantial alterations to landscapes, oceans, and the atmosphere have caused widespread changes in the global distribution and abundance of organisms. Changes in biodiversity alter ecosystem processes, productivity, and structure, and reduce resilience of ecosystems to future environmental change. Permafrost melting, landscape fragmentation, mining scars, forest clearing, and coral reef bleaching are just some of the many examples of ecosystem change. People value ecosystems in their own right, and as they decline or collapse, environmental foundations upon which human society has been built may begin to erode. Effective management of ecosystems and natural resources depends on a thorough knowledge of types and distributions of ecosystems and their attributes, in concert with a comprehensive understanding of ecosystem processes.

What's Needed

The USGS reports on the state of the Nation's terrestrial, freshwater, and coastal/marine ecosystems and studies the causes and consequences of ecological change, monitors and provides methods for protecting and managing biological and physical components and processes of ecosystems, and interprets for policymakers

how current and future rates of change will affect natural resources and society. The USGS works in collaboration with Federal, State, and local partners and non-governmental organizations to understand the distribution, interactions, condition, and conservation requirements of organisms in an ecosystem context, and predicts changes to biodiversity resulting from land-cover change, climate change, and other impacts to ecosystems. The USGS and its partners will advance understanding, through research, of ecosystem structure, function, patterns and processes, and will develop new products, including standardized national maps of ecosystems in the United States, and will provide updated reports on the status of ecosystems and assessment of trends that will help land managers and decisionmakers make informed decisions that take into account ecosystem health and sustainability.

Drivers

USGS Ecosystem Council
DOI Adaptive Management Handbook



What's Been Done

When FWS began its process of determining the polar bear listing status within the guidelines of the Endangered Species Act in 2006, the Secretary of the Interior turned to the USGS to ensure that the best available science informed the deliberations. The USGS formed a team to interpret existing information, gather new

data, and conduct new analyses. USGS scientists improved the understanding of polar bear populations, projected numbers of polar bears in relation to sea-ice habitat, and predicted how polar bear numbers are likely to respond to projections of climate change. Observations of sea-ice decline in the Arctic Region over the past 20 years and scientific projections of additional sea-ice declines in future decades demonstrated that two-thirds of the world's polar bear population is likely to be lost by the middle of the 21st century due to a decrease in available habitat. Armed with scientific evidence that the survival of the polar bear could be in jeopardy, DOI had the information it needed to list the polar bear as a threatened species in 2008. USGS scientists are currently researching other species petitioned for listing, including the greater sage grouse and walrus.



Sustaining the ecological integrity of aquatic ecosystems while meeting human needs for water resources is a major challenge facing society. In many regions, including the Eastern United States, the growing demand for water supply and changing land use, such as urbanization, are altering hydrologic regimes in streams and rivers that society depends on for ecological services. These services include drinking, irrigation, and industrial water supplies; assimilation and removal of waste; mitigation of droughts and floods; control of river channel erosion; recreation; fisheries; and maintenance of biological diversity. Meeting the challenge of balancing human needs for water resources with protecting aquatic ecosystems requires science-based information on what aspects of natural, or unaltered, hydrologic conditions are essential for the long-term

maintenance of healthy aquatic ecosystems. The USGS has the extensive research background and interdisciplinary capabilities that position the agency to take a lead role in developing the science needed to improve management of water supply and aquatic ecosystems, especially in urban landscapes.

Significant management issues, including large and costly wildfires, habitat conversion to invasive weeds, degraded watersheds, and increasing numbers of species at risk, such as sage-grouse are all part of the sagebrush biome in which USGS is actively engaged. The USGS has a central role in conducting research to address the complex natural resource and societal issues in the sagebrush biome. USGS is leading efforts to conduct landscape-scale assessments that cross landownership jurisdictions and will provide the information needed to understand the effects of changing conditions (e.g., climate change) and land uses on sagebrush systems.

Additionally, work continues on the Chesapeake Bay to evaluate land use and land cover changes as they affect the Chesapeake Bay ecosystems with particular emphasis on the effects of increased urbanization. In 2008, USGS scientists conducted fish monitoring and assessment surveys on each of the Great Lakes and provided important scientifically valid data on the status of fish communities for resource managers to understand and effectively manage the fisheries on each of the Great Lakes.

Where We Are

2009 ARRA:	
Great Lakes Vessels	\$7.0M
Upgrading Streamgages	\$14.6M
Data Preservation	\$0.5M
2009 Appropriations:	
Great Lakes Biological Science	\$1.0M
Biologic Carbon Sequestration	\$1.5M

What's Next / 2010

A New Energy Frontier (Biofuels)	\$0.5M
Enhance the National Streamgange Network	\$5.0M
Biologic Carbon Sequestration	\$5.0M
Support for FWS Climate Change Activities	\$5.0M
Changing Arctic Ecosystems	\$4.2M



Climate Variability and Change: Clarifying the Record and Assessing Consequences

Societal Concerns

Consequences of climate change and increasing carbon dioxide are of public concern. Direct effects of warming, including heat-related deaths, such as those that occurred in Chicago in the 1990s or in Europe in 2006, are compounded by myriad indirect effects of climate change on various societal infrastructures, such as power blackouts and increasingly variable water supplies in many parts of the country. The barrage of media coverage of consequences uncovered by scientists, from increasing disease outbreaks to acidification of the oceans, is now a daily occurrence. When interactions among components of a system are not directly proportional, the system is considered nonlinear. Scientific insight into the direct and indirect, including nonlinear, effects of climate change on local and regional resources ought to be the catalyst for changes in planning and management of land, water, and other natural resources in the United States and elsewhere. If we can understand the linkages, we can better manage and adapt.

What's Needed

USGS scientists will meet the needs of DOI, policymakers, and resource managers for scientifically valid state-of-the-science information and predictive understanding of climate change and its effects. Studies of interactions among climate, earth surface processes, and ecosystems across space and time will contribute to goals of U.S.

Climate Change Science program. USGS will expand research and monitoring initiatives in the science of carbon, nitrogen, and water cycles, hydroclimatic and ecosystem effects of climate change, and land-cover and land-use change. USGS will continue studies of paleoclimate and past interactions of climate with landscapes and ecosystems, and apply knowledge gained to understanding future states and processes. Expanded and modernized USGS networks of land, water, and biological resources are crucial to rigorous analyses of future responses to climate change. USGS will provide tools to test adaptive strategies, reduce risk, and increase potential for hydrologic and ecological systems to be self-sustaining, resilient, or adaptable to climate change.

Drivers

U.S. Climate Change Science Program
Kyoto

What's Been Done

The budget restructure in 2009 brought together the funding and facilitated the development of a single set of strategic science and management goals and their implementation, a cogent set of global change specific performance measures that can be reliably measured, and related budgetary and communication strategies focused on the goals and objectives of USGS global change related research.

The National Climate Change and Wildlife Science Center is sponsoring the Southeast Regional Climate Change Assessment. This assessment will provide relevant information to biological resource managers by downscaling climate projections to the region and then stepping those changes through the landscape and physical process filters that translate climate into outcomes (e.g., habitat and population dynamics, or changes in species distributions, for key terrestrial and aquatic wildlife; changes in carbon and nutrient dynamics) for management objectives at a set of spatially and temporally nested scales.

Science Strategy

USGS scientists are conducting a proof of concept study related to carbon sequestration in the Sacramento River Delta. They are investigating potential ways to convert submerged farmland islands into "carbon farms" - sequestering carbon while expanding valuable wetland habitats that support wildlife and improve water quality.



The vulnerability of coastal communities and ecosystems to storms and erosion is heightened by continuing coastal development and projections of accelerated sea-level rise related to climate change. USGS is working with NOAA, State coastal zone managers and non-governmental organizations to develop the information and tools needed to anticipate and respond to coastal change. USGS researchers provided technical leadership in the development of *Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region*, providing a detailed assessment of the effects of sea-level rise and examining options for governments and coastal communities to plan for and adapt to rising sea levels.

The landscape of the Navajo Nation is characterized by streams that have incised easily eroded fine-grained valley-fill, and highly erodible soft bedrock units. Recent research is showing that erosion rates are highest, and most sensitive to climatic changes, in semiarid regions including the Navajo Tribal lands. Geologic mapping is highlighting those areas most susceptible to minor climatic changes, and when

combined with precipitation and land use data, can identify those areas where land use sustainability is at greatest risk, and which threatens the livelihood and culture of local residents.

Where We Are

2009 ARRA:	
Imagery	\$14.6M
Streamgauge upgrades	\$14.6M

2009 Appropriations:	
Nat. Climate Change & Wildlife Science Ctr.	\$10.0M
Geol. & Biol. Carbon Sequestration	\$3.0M
Climate Change Science	\$5.0M
Extended Continental Shelf	\$3.0M

What's Next / 2010

Climate Change Science	\$10.0M
Carbon Sequestration	\$10.0M
Support for FWS Climate Change Activities	\$5.0M
Nat. Climate Change & Wildlife Science Ctr.	\$15.0M
Changing Arctic Ecosystems	\$4.2M



Energy and Minerals for America's Future: Providing a Scientific Foundation for Resource Security, Environmental Health, Economic Vitality, and Land Management

Societal Concerns

Two issues dominate future energy/mineral availability: globalization and likelihood that environmental changes from energy and mineral extraction and consumption will factor more strongly into society's use of them. Developing countries lead global competition. Demand for resources is expected to grow. In the latter half of the 20th C., the issue of environmental effects saw increased awareness of contamination (oil spills, dam failure, acid rain, clear-cut forests, and increased carbon dioxide). Globalization and environmental impacts point to a future of a diversified energy mix, changing demands for minerals (to support innovative technologies), and lifecycle approach linking energy/mineral use to broad effects of use (e.g., exploration, extraction, recycling, disposal). Emphasis needs to be placed on consequences of land and water use, ecosystem health, and human welfare. USGS research factors in public discourse about future of energy and minerals, and it informs and engages decision makers.

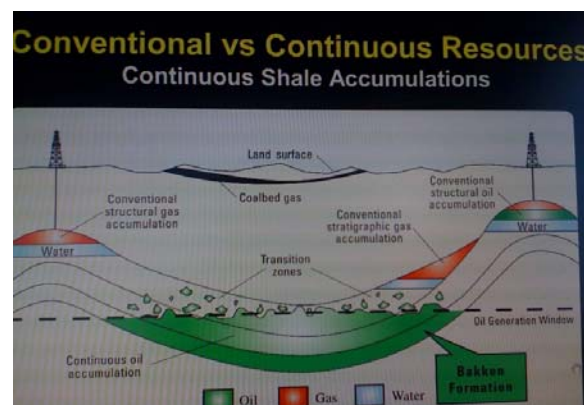
What's Needed

USGS energy and minerals resource research will focus on decisions about future natural resource security, environmental effects of resource use, economic vitality, and management of natural resources on DOI, Federal and other lands. A wide-ranging, multidisciplinary

approach is used to understand and evaluate how the complex life cycle of occurrence, formation processes, extraction methods, use, and waste products of energy and mineral resources influence, or are influenced by, landscape, hydrology, climate, ecosystems, and human health. Cumulative knowledge, long-term data, and new understanding of resource origin and assessment methodologies will improve reliability and accuracy of assessments and information, especially as the energy mix evolves and new requirements for rare and scarce materials emerge. Information will be put in economic terms so that policymakers can more clearly weigh competing alternatives. Through partnerships and collaborations, USGS natural resource knowledge and expertise helps advance the economy and improve competitiveness.

Drivers

Minerals Policy Act of 1970
 Federal Land Policy and Management Act of 1976
 National Materials and Minerals Policy, Research and Development Act of 1980
 The Energy Policy Act of 2005
 The Energy Independence and Security Act of 2007



What's Been Done

In 2008, USGS released estimates the oil in the North Dakota and Montana area known as the Bakken Formation (showing a 25-fold increase from the previous estimate, thanks to new geologic models and new drilling and production techniques), the gas hydrates on

Alaska's North Slope (the first-ever resource estimate of technically recoverable natural gas hydrates), and the potential power production from geothermal resources across the Nation. The estimates tell where resources exist, and quantities of those resources that could be produced using current technology. These estimates are crucial to the decisionmakers and resource managers who work to meet the challenge of balancing America's needs for both nonrenewable resources (e.g., water supply) and a clean and healthy environment.

USGS' long record of gas hydrate research has allowed for recent advances such as the technically recoverable resource assessment for the North Slope of Alaska released in November 2008, current efforts by the USGS and BLM to evaluate the impact of gas hydrate energy resource development in Northern Alaska, and the planning of long term production tests on this important potential energy resource. The USGS works closely with many organizations, including DOE, and is part of the Methane Hydrate Interagency Coordinating Committee. USGS is the lead research bureau for natural gas hydrates and DOI is the lead assessment agency for gas hydrates.

One important aspect of environmental protection is to establish environmental baseline conditions prior to mine development. USGS scientists are working to establish baseline environmental conditions in the Huron River area in northern Michigan where the copper industry is active. The hydrologic and geologic conditions are broadly representative of the western Lake Superior region and the Huron River area provides a natural laboratory in which to examine variability of environmental parameters and to develop efficient techniques and strategies to conduct broader-scale studies in the future.

In 2008, the USGS released the Circum-Arctic Resource Appraisal (CARA). This assessment of undiscovered conventional oil and gas resources covered all areas north of the Arctic Circle. The estimates for each province indicates that approximately 90 billion barrels of oil, 1,670 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the Arctic; approximately 84 percent is expected to occur in offshore areas. This work builds on previous USGS world petroleum assessments, which identified the Arctic region as an area of significant petroleum potential.

The USGS is the Nation's only Federal source for information about both domestic and international mineral resources and the consequences of their development. This information is available to inform decisions that affect both supply and development of mineral commodities. The USGS carries out mineral resource data collection and research that supports the needs of decision makers in land management, defense, national security, and economic policy. Key partners include other DOI bureaus, Defense logistics and stockpile agencies, the intelligence community, and the Federal Reserve, as well as State and local government agencies and private organizations with interests in managing mineral lands and anticipating future mineral supply. Domestic mineral production data reported by the USGS are supplied on a voluntary basis by 18,000 establishments. These data become part of the basis on which the Board of Governors of the Federal Reserve prepares its index of industrial production, a principal economic indicator. Similarly, the USGS partners with geological surveys around the world to conduct research resulting in estimates of global distribution of undiscovered mineral resources, the basis of future mineral supply.



What's Next / 2010

A New Energy Frontier

\$3.0M



A National Hazards, Risk, and Resilience Assessment Program: Ensuring the Long-Term Health and Wealth of the Nation

Societal Concerns

Natural hazards threaten U.S. safety, security, economic well-being, and natural resources. Sudden extreme events (hurricanes, wildfires, flash floods, earthquakes), capture public attention. Equally threatening are effects of slower, chronic hazards related to climate change (drought and ecosystem collapse). Much of U.S. infrastructure is aging and vulnerable to hazards. Expanding urbanization of coastal zones, floodplains and wildland-urban interfaces heightens risk of future disasters. With disaster-relief costs mounting, the U.S. needs a clear understanding of potential threats, societal vulnerability to these threats, and strategies for resilience. Need for action is urgent. Until recently number of lives lost to natural hazards in the U.S. each year has declined, but the cost of response to and recovery from disasters continues to rise. Working with partners, USGS will build understanding through assessment of hazards, societal risks, and vulnerabilities, providing managers/policymakers at all levels with tools to make better and more cost-effective decisions.

What's Needed

The USGS collects accurate and timely information from modern earth observation networks, assesses areas at risk from natural hazards, and conducts focused research to improve hazard predictions. In addition, USGS works actively with the

Nation's communities to assess the vulnerability of cities and ecosystems and to ensure that science is effectively applied to reduce losses. The USGS will develop a national risk-monitoring program, built on a robust underpinning of hazard assessment and research, to visualize and provide perspectives at multiple scales of vulnerability and resilience to adverse land change and hazards. Accurate observations, focused research, and timely communications will safeguard people and property and keep natural hazards from becoming natural disasters.

Drivers

Multi Hazards Planning & Budget Initiatives
NEHRP Reauthorization Act of 2004
Disaster Relief Act of 1974 (P.L. 92–288
Stafford Act

What's Been Done

To help California's home owners and USGS joined with numerous partners to hold the Great Southern California ShakeOut—the largest earthquake drill in U.S. history. Emergency responders needed a scenario to practice for the large earthquake and they wanted one that was robust and realistic and one that would help them best prepare for actual impacts in Southern California. To develop this detailed picture, they turned to USGS. Using its extensive earthquake data and expertise, USGS helped them develop a detailed scenario of a magnitude-7.8 earthquake on the San Andreas Fault, modeling and predicting what would happen both during and after the quake. Scientific analysis of the shaking showed that with current structures, this earthquake would kill 1,800 people, injure 53,000 and cause \$213 billion in damage. On November 13, 2008, nearly 5.5 million people came together to participate in the ShakeOut drill and work to reduce their risk. By helping Southern Californians to understand the earthquake risks they face and to plan for them, USGS and its partners are working to keep this natural hazard from turning into a national catastrophe.

In 2008, the USGS released the next-generation national seismic hazard maps following an extensive review process. The maps will be considered for the 2009 version of the NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures. The new maps replace those from 2002, and will be considered for inclusion in the 2012 version of the International Building Code. These maps were developed using the best available science based on internal USGS studies as well as information available from government agencies, academic institutions, and industry.

By the end of 2009, the USGS and partners expect to have installed a cumulative total of 822 ANSS earthquake monitoring stations. This includes the completion of the national ANSS Backbone seismic network in the contiguous U.S

Five USGS volcano observatories are becoming interconnected by the National Volcano Early Warning System (NVEWS), under which all hazardous volcanoes will eventually be monitored at a level commensurate with threat.



During the past year, USGS observatories, with their university and state partner members, successfully responded to three major explosive eruptions in Alaska, continued hazardous eruption behavior of Kilauea Volcano in Hawaii, and an intense

volcanic earthquake swarm in Yellowstone National Park. Rapid dissemination of pre-eruption warnings and real-time tracking of eruptions contributes to the public welfare and community sustainability, often reducing property losses and saving lives.

In 2008, wildland fires forced Californians to flee their homes and communities. As these fires moved across the land, decisionmakers needed to know the location and sizes of the fires and the resources that were in the fires' paths. The USGS provided this information in real time over the Internet, helping firefighters and incident commanders to do their jobs. It also allowed residents, media, tourists, and other decisionmakers to monitor where the fires were and where they were headed. After the fires, scientists determined which areas were at risk for debris flows and identified locations where either invasive species or soil erosion would be likely to cause problems in the future. The USGS supports residents and decisionmakers not only during and after a fire but before the fire starts. USGS scientists are working closely with the National Weather Service to refine the accuracy of watches and warnings issued through the joint USGS/NWS/NOAA Early Warning System for Flash Floods and Debris Flows from recently burned areas in southern California. The system is designed to protect citizens who live near recently burned hillsides and utilizes information from regional precipitation forecasts and measurements.

On June 6, 2008, after a particularly wet spring in central and southern Indiana, heavy rainfall of 2 to more than 10 inches fell on ground that was already saturated, adding significantly to the streamflow of rivers that were already running at or near flood levels. This heavy rainfall resulted in severe flooding on many streams within the White River Basin. As the rain fell and waters rose, USGS streamgages transmitted real-time data about the speed of the currents and height of the rivers to the National Weather Service and other

agencies, helping them to monitor, predict, and plan for the approaching floods. The flood forecasts and warnings allowed responders to evacuate thousands of residents, prepare for disaster aid, and protect and save lives. The floods caused three deaths and hundreds of millions of dollars of damage to residences, businesses, infrastructure, and agricultural lands. Thirty nine Indiana counties were declared Federal disaster areas and the USGS used data collected before, during, and after the event to put these floods in a historical context, map the areas that were inundated at the peak of the flooding, and create profiles of how floodwaters move. By combining the historical record, data from ongoing streamgage monitoring, and data on new events, the USGS is able to develop the expertise and tools that help to enhance short-term preparation, aid, and recovery efforts, but to better understand how their flood risk may be changing over time and how they can reduce their risk to future events.



The USGS FloodPath mapping tool is a tool that can generate a flood map as many as three days in advance of a storm, then serve the map automatically on the Web, providing valuable information about flood arrival time, depth of water, and destructive potential.

Where We Are

2009 ARRA:	
Deferred Maintenance- Streamgages	\$14.6M
Streamgage upgrades	\$14.6M
Earthquake Monitoring	\$29.4M
Volcano Monitoring	\$15.2M

2009 Appropriations:	
Earthquake Program Increase	\$1.0M
Volcano Program Increase	\$1.5M
Global Seismographic Network	\$1.0M

What's Next / 2010

Enhance the National Streamgage Network	\$5.0M
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Environment and Wildlife in Human Health: A System that Identifies Environmental Risk to Public Health in America

Environmental health threats to the Nation's citizens are an inescapable consequence of the interactions between people and their physical, chemical, and biological environment. As towns and cities expand, the wildland-urban interface broadens and human wildlife interactions are more frequent. Many public health issues affecting Americans, such as avian influenza, originate outside our borders, requiring the Nation to maintain global vigilance for potential health threats. The emergence of many new human diseases in recent years is directly related to worldwide increases in population density, mobility, and environmental disruption.



Current health problems caused by zoonotic diseases (transmissible between animals and humans, such as West Nile virus and avian influenza) and environmental contamination (for example, mercury in fish, arsenic in water) are not isolated examples. Future generations will continue to be affected by many of the diseases that have

emerged or resurged during the past quarter century, regardless of whether the causes are chemical, microbial, or parasitic. Dealing with emerging and resurging diseases requires the ability to anticipate potential environmental and ecosystem health threats, recognize pathogens or contaminants when they first appear, and respond quickly and appropriately. Because many zoonotic disease outbreaks are evident in wild animal populations before they affect people, wildlife health and disease monitoring serves as an indicator of environmental and ecosystem health and is thus essential to any information system for protecting human health.

What's Needed

The USGS proposes to provide scientific and monitoring information essential for helping to identify existing, emerging, and resurging environmental and ecosystem health threats. This strategic goal will be achieved by integrating existing USGS human-health related data, by establishing an interactive information system for environmental threats, and by enhancing collaborative research with allied public health organizations. These steps will enable USGS to provide the scientific information needed for a clear understanding of the connections among all living things and the environments in which we live. The USGS proposes to develop an online data atlas of potential environmental health threats that consolidates USGS data and provides data for researchers and public-health agencies to enhance the ability to respond quickly to current threats and anticipate potential future health threats. The USGS will create new partnerships, strengthen existing ones.

Increased levels of collaboration at all levels are needed to address the Nation's environmental health-related issues. Enhanced rapid and long-term response teams to evaluate short- and long-term health implications of disasters are critical. USGS will develop and implement a national-scale, environmental health

information system that combines biological, water-quality, and geologic information with GIS decision-support tools. And USGS plans to publish a report every half decade that includes the status and trends in environmental, animal, and earth science information. The report will describe the way conditions are changing, present new findings relating to public health, and explain the methodological and research contributions that USGS has made and transferred to managers.

The CA Department of Fish and Game began investigation sea otter mortality in 1968. In 1992, supplemental evaluations were conducted by pathologists at the National Wildlife Health Center (NWHC) and associated laboratory analyses were conducted to determine the causes of death. In contrast to the findings from 1968–1989, infectious disease was found to be the primary cause of death. Necropsies performed by the NWHC on sea otter showed that nearly 40 percent of them died from parasitic, fungal, or bacterial infections.



Acanthocephalan parasites are the most common cause of death. Historic evaluations indicate that, in the past, the parasites causing this mortality were only found in small numbers within individual animals and that few otters were infected by these parasites. An increasing number of sea otters have now acquired large numbers of these parasites. The findings of brain inflammation, or encephalitis, and the fungal disease, coccidioidomycosis, are

somewhat unexpected and have led researchers to further investigate the impacts on sea otter populations and their relationship to zoonotic disease.

Drivers

Zoonotic disease outbreaks

What's Been Done

In Boulder Creek, CO, male fish are developing female characteristics, and the ratio of male to female fish is going down—changes that could be precursors of more severe impacts, including the ultimate elimination of the local population of the fish species. To help decisionmakers better understand these changes, their causes, and their implications for the future, USGS scientists conducted a study that demonstrated that exposure to endocrine disruptors (chemicals that behave like the hormone estrogen) found in wastewater is causing the feminization of local fish. These results are guiding future research on endocrine disruption, industry decisions on waste handling and treatment, and evaluations of appropriate actions to respond to endocrine disruption.

Studies on endocrine disruption are part of a larger USGS research focus on emerging contaminants--chemicals ranging from detergents to disinfectants, fragrances to fire retardants, and plastics to prescription drugs that are entering our environment. In recent years, the USGS has published more than 160 reports on emerging contaminants, helping the Nation to better understand the mixtures and levels of these chemicals, where they are coming from, and the impacts that they are having on our communities, ecosystems, and human health.

Concerns about water quality at beaches along the Great Lakes shores have prompted the need to better understand when waters are safe for recreational use. USGS researchers are working with State resource managers and Federal partners to provide improved observations and models

to inform decisions on restricting beach and water use to protect public health. Great Lakes Centers continue to refine real time capabilities to provide Great Lakes communities with data about water quality and beach health to assure them of safe use of beaches by residents.

What's Next / 2010

Nat. Climate Change and
Wildlife Science Center \$15.0M



A Water Census of the United States: Quantifying, Forecasting, and Securing Freshwater for the Future

Water is essential for healthy communities, economies, and natural environments. The U.S. needs information that summarizes a full range of freshwater quantity and quality required for human, economic, and environmental health. The USGS proposes to undertake a Water Census to account for the trends in freshwater quantity and quality for human and environmental needs. The Census will provide updates on status of quantity of freshwater available; quality of freshwater needed; how quantity and quality of available freshwater changes over time; and whether sources of water at present not considered to be a freshwater resource can be made available for human and environmental needs. Information on how much freshwater is available, and whether supply of it is increasing or decreasing over time, is essential for economic and environmental health. Improvements are needed in determining amounts of water used (for mining, livestock, power generation, supply, environmental needs). Nontraditional sources (saline, offshore freshwater aquifers) also will evaluation.

What's Needed

The USGS will develop a Water Census of the United States to inform the public and decisionmakers about the status of its freshwater resources and how they are changing; a more precise determination of water use for meeting future human, environmental, and wildlife needs; how freshwater availability is related to natural storage and movement of water, as well as engineered systems, water use, and related

transfers; how to identify water sources, not commonly thought to be a resource, that might provide freshwater for human and environmental needs; and forecasts of likely outcomes for water availability, water quality, and aquatic ecosystem health caused by changes in land use and land cover, natural and engineered infrastructure, water use, and climate.

Drivers

Circular #1331, A Strategy for Federal Science and Technology to Support Water Availability and Quality in the United States

Secure Water provision of P.L. 111-11

What's Been Done

Water contamination, water shortages, and conflicts over how to use limited water resources have become more common in the United States. With water science offices in every State, the USGS has a unique ability to conduct comprehensive studies of both the quality and quantity of our Nation's water resources, giving decisionmakers the information they need to address water issues at not only the local but also the regional and national level. Water contamination, water shortages, and conflicts over how to use limited water resources have become more common in the United States. With water science offices in every State, the USGS has a unique ability to conduct comprehensive studies of both the quality and quantity of our Nation's water resources, giving decisionmakers the information they need to address water issues at not only the local but also the regional and national level.

Since 1950, the USGS has compiled data at five-year intervals on amounts of water used in homes, businesses, industries, and on farms throughout the U.S, and has described how that use has changed with time. Water-use data, combined with other USGS information, have facilitated a unique understanding of the effects of human activity on the Nation's water resources. As water availability continues to emerge as an

important issue in the 21st century, the need for consistent, long-term water-use data will increase to support wise use of this essential natural resource.

The USGS is conducting a pilot study of water availability in the U.S. portion of the Great Lakes Basin. The study focuses on developing the understanding of the dynamics of water resources in the basin in terms of the flows and yield of water in both ground and surface water. The study also seeks to illustrate the importance of water-use data to quantifying water availability.

The River Ecosystems Model and Science (REMS) project links physical, biological, and ecological models, providing stakeholders with relevant tools and approaches to manage water, fisheries, and other resources in Western river basins, such as the Klamath Basin. These multifaceted and collaborative USGS research efforts integrate global climate patterns, multiple data sets at different scales, and information management approaches to yield multi-dimensional models of water flow, water temperature and sediment load and transport. These physical models can then be related to biological and ecological processes. Specifically, the Klamath Basin water model uses historic and simulated snow pack, stream temperatures, and instream flows to inform biological questions related to Federally-listed salmon coldwater patch use and other ecological characteristics.

USGS analysis of nutrient flow and its affect on freshwater in Cape Cod helps National Park Service make decisions about installation and removal of culverts and sea gates.

Recent helicopter electromagnetic surveys combined with geologic mapping in the Arbuckle-Simpson aquifer system of OK have provided critical information to local and state water managers, enabling them to propose better strategies for enhancing needed recharge and for increasing public

awareness of the pollution potential for this important carbonate aquifer.

Water-resources issues, particularly those of water supply, water quality, and drought management, are of key concern to the Northern Shenandoah Valley. In cooperation with the Northern Shenandoah Valley Regional Commission and other local organizations, USGS has held two joint conferences and several forums, to specifically address water-resources issues in the Shenandoah Valley and communicate the results of USGS research to local officials.

Where We Are

2009 ARRA:

Streamgauge Equipment Upgrade	\$14.6M
Streamgauge Deferred Maintenance	\$14.6M

2009 Appropriations:

National Streamflow Information Program Increase	\$2.0M
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What's Next / FY 2010

Enhance the National Streamgauge Network	\$5.0M
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Data Integration and Beyond

By providing both the big picture and specific local information, USGS earth observation and geographic information meet an astounding array of needs for knowledge about the landscape: from tracking changes in land use and human development to documenting the devastation caused by storms and wildfires. The USGS will use its information resources to create a more integrated and accessible environment for its vast resources of past and future data.

It will invest in cyberinfrastructure, nurture and cultivate programs in natural-science informatics, and participate in efforts to build a global integrated science and computing platform.

What's Needed

Natural events in the form of volcanic eruptions, earthquakes, wildland fires, floods, droughts, variable and changing climate, as well as environmental impacts from manmade toxins, invasive species, and animal-borne diseases, all affect humans and pose significant risks to society. In addition, the use of, and competition for, natural resources on the global scale has the potential to impact the Nation's ability to sustain its economy, national security, quality of life, and natural environment. Understanding health, natural resource, and hazard risks, better defining their probabilities, and forecasting their effect on the status and future of society are essential for a resilient and prosperous

United States. The Nation needs ready access to natural science information to make informed decisions on how to address the risks, and as the Nation's and the world's leading natural science and information agency, the USGS is well-positioned to accept the challenge of providing this integrated information.

National decision makers and scientists within and outside the USGS require enhanced access to decades of observational data and analysis. The key to advancing new discoveries of the Earth's complex systems and processes, as well as making decisions regarding potential risks, lies in the rigorous analysis of system interconnections and feedbacks. Central to the identification and evaluation of these connections is the accessibility of data and information across multiple scientific disciplines, geographic, temporal, and political boundaries. Data integration within the USGS is a prerequisite for joining international efforts to develop worldwide science collaboration and a computing platform that can address future challenges. The USGS will use its information resources to create a more integrated and accessible environment for its vast resources of past and future data. It will invest in cyberinfrastructure, nurture and cultivate programs in Earth-system-science informatics, and participate in efforts to build a global integrated science and computing platform.

Drivers

Global economic and environmental issues

What's Been Done

One example of the power of USGS data integration efforts comes from the U.S. Department of Agriculture (USDA). Every year, during the growing season, USDA builds a model of the agricultural landscape called the Cropland Data Layer. This model helps set the official acreage estimates for major agricultural commodities at State and county levels. To help identify types of land and land use, USDA uses the USGS

National Land Cover Database — a database derived from satellite imagery that classifies the land cover across the United States. This census of U.S. lands is so precise (describing sections 98 feet long and wide) that an area the size of a football field would contain nearly six separately classified sections. By integrating USGS methods and data into its model, USDA has not only comprehensively improved overall product accuracy and customer satisfaction, it has also made the process more efficient, allowing it to expand into additional States and deliver crop-specific land-cover information and acreage estimates to even more stakeholders. Stakeholders, in turn, use this information to monitor watershed and water quality; analyze crop-rotation patterns; monitor wildlife habitat; identify resources, such as catfish ponds; and plan for agribusiness needs such as seed, fertilizer, pesticide, fungicide, crop insurance, and the transportation and storage of grain. By providing both the big picture and specific local information, USGS earth observation and geographic information meet an astounding array of needs for knowledge about our landscape: from tracking changes in land use and human development to documenting the devastation caused by storms and wildfires.

Where We Are

2009 Enacted level: \$0.5M

What's Next for 2010

Turning the vision of science integration into reality will take a Bureau-wide effort to develop the cyber-infrastructure and informatics tools necessary to improve interconnectivity and interoperability and make USGS research and scientific findings available to decision-makers and the U.S. and global science community. To assist scientists in considering the new and challenging scientific and policy questions required to address emerging environmental and climate change issues facing the world, USGS Enterprise Information Activity is implementing delivery and hosting technologies, developing data and metadata

standards, collecting and organizing data stores, and designing application toolkits.

These activities will contribute to establishing an integrated and accessible digital environment for USGS's vast resources of past and future science data. The Integrated Information Environment provides the infrastructure, standards, systems, and methodology needed to integrate significant amounts of data required by USGS scientists.

USGS data integration activities planned for completion in 2010 include:

- Finalize and publish a Data Integration Plan that is in line with the vision of the Science Strategy.
- Establish a Data Integration Council.
- Establish an active Data Modeling Community of Practice working on USGS data and data modeling standards.
- A process model detailing workflow for creation of *The National Map*.

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Key Increases

Summary

Secretarial Initiatives

A New Energy Frontier (+\$3.0 million)

The A New Energy Frontier initiative will build upon the core capabilities of the USGS as a multidisciplinary earth science agency. The USGS will investigate an array of renewable energy sources, including geothermal, biofuels, and wind and solar energy. USGS will study geothermal resources to provide a scientific basis to improve the viability of this important and underutilized resource to contribute to the domestic energy mix. The USGS will provide the scientific base for understanding the impacts of renewable energy options on ecosystems and wildlife populations. The USGS work in renewable energy sources will support the President's and Secretary's priority of expanding the generation and transmission of renewable resources. Partners in these efforts include other Interior agencies such as NPS, FWS, BLM, and MMS, other Federal agencies such as DOE and USDA, State agencies, industry consortia, and others.

Climate Impacts (+\$22.0 million)

Responding to global climate change and its impacts requires an unprecedented integration of information from multiple science disciplines and the full range of temporal and spatial scales. The USGS will lead the agency's effort to build a Department of the Interior Climate Impacts Monitoring framework. With this effort, USGS will work toward implementation of a comprehensive plan that will combine new and existing monitoring information from multiple sources to provide more effective and timely science information on climate change and related impacts for resource management and policy decisionmaking. Building on standardized approaches developed at the national level by the National Climate Change and Wildlife Science Center (NCCWSC), regional Climate Science Hubs will be developed and coordinated according to a national science and decisionmaking strategy. USGS' strategy is to coordinate with national partners, respond to the needs of regional conservation partners, build on natural resource management climate science needs and ensure that the Hubs identified compliment FWS' Strategic Habitat Conservation Plan. As mandated in the Energy Independence and Security Act of 2007, USGS is developing methodology to assess carbon sequestration and will use this methodology to conduct a national assessment. USGS work will include both geological and biological forms of carbon sequestration. USGS will assume scientific leadership in developing methodologies to measure and assess biological carbon sequestration and greenhouse gas fluxes, and in implementing a national assessment of ecosystem carbon storage and greenhouse gas fluxes. The initiative will also allow USGS to integrate capabilities in modeling current and projected physical and biological change across extensive landscapes and aquatic systems and habitats with studies of ecosystem and population processes. USGS will provide ecological and population modeling capacity to FWS Landscape Conservation Cooperatives and provide information to FWS for use in the Strategic Habitat Conservation.

A 21st Century Youth Conservation Corps (+\$2.0 million)

Through the 21st Century Youth Conservation Corps initiative, the USGS will expand education, training, and workshop opportunities to provide more in-depth training through coursework and internships for high school and college students. This initiative would increase by 120 the total number of internships and fellowships supported or facilitated by the USGS educational program.

Key Increases

Other Increases

Extended Continental Shelf (+\$1.0 million)

This increase would provide the funds necessary to complete funding for the analysis and synthesis of data collected during two previous seafloor mapping cruises in the Arctic. Additionally, it would allow the principal investigators, working with the Department of State led Interagency Task Force on the ECS to develop plans and lay the groundwork for additional seafloor mapping expeditions, to develop a data management infrastructure for the effort, and to advance collaborative development of a successful U.S. ECS delineation.

Enhance the National Streamgauge Network (+\$5.0 million)

The USGS is conducting research to determine the potential effects of changes in climate patterns on the occurrence and distribution of freshwater. Scientists are determining how climate has changed in the past in order to forecast hydrologic responses to shifting climate conditions in the future. Streamgages are the essential monitoring tools used to track the flow of water and associated components in streams and rivers across the Nation. The USGS streamgauge network is funded in partnership with over 800 Federal, State, and local agencies. In recent years, funding for streamgages has been in jeopardy because of difficult economic conditions at the State and local level. This initiative will support the re-establishment of discontinued streamgages and support the operation and maintenance of existing streamgages. A stable hydrologic monitoring network is a cornerstone to understanding climate change – a key priority of this Administration. Experience has shown that analysis of streamflow information and synthesis with other hydrologic data will expand our knowledge of the hydrologic system and lead to improved hydrologic monitoring network design and operation. In order to fully understand the changes that climate variability exerts on our watersheds, we must understand the natural hydrologic system and how humans change that system through our movement and use of water. Further, our water use practices themselves are influenced by climate variability and it is vital that we understand these trends.

Changing Arctic Ecosystems (+\$4.2 million)

USGS has demonstrated that wide-spread loss of arctic sea ice and terrestrial permafrost-supported habitats has serious consequences for the polar bear and will be a significant long term challenge for a suite of other species and ecosystems under Department jurisdiction. The increase will support a strategic expansion of the physical-biological forecasting capacity that was successfully used to assess polar bear status. The refinement of the forecasting models made possible by this expanded effort will enhance information needed by several partners. The FWS and NPS will use the models in management decisions within the Arctic Strategies. The models will be used within the U.S.-Russia Bilateral Treaty for conservation of polar bears in the Chukchi Sea, and in permitting of oil and gas development in a new ice-reduced Arctic Ocean. Scientifically, the models will enhance the ability of USGS to predict the status of other Arctic species, such as Pacific walrus, and associated ecosystems, and enhance capacity to evaluate policy and management strategies. USGS will apply new molecular, physiological and other emerging technologies to better inform the Department's efforts to identify comprehensive conservation and mitigation actions for the broad suite of high latitude ecosystems and fish and wildlife species they support.

Sustainable Energy Development (+\$727,000)

This program represents the USGS partnership with other Interior bureaus, State and local agencies, industry and private land owners in the Wyoming Landscape Conservation Initiative committed to maintaining healthy landscapes, sustaining wildlife and preserving recreational and grazing uses while developing natural gas energy in the Green River Basin. The role of the USGS is to provide the science framework and information necessary for partners to use in making decisions on mitigation, restoration and conservation efforts. This increase will allow USGS to support field work required to maintain current data and implement scientific studies evaluating various habitat treatments and monitor at risk species such as sage grouse, song birds and pygmy rabbits. The landscape and habitats important for fish and wildlife population sustainability are undergoing rapid change in response to energy resource development and relying on aged data sets risks invalidating models and mitigation strategies. In 2010, we will build on 2009 accomplishments such as inventorying species and habitats, monitoring and assessing water resources, integrating energy resources and habitat data, and providing a robust data inventory and scalable climate change models.

General Increase for CRU (+\$2.0 million)

The 2010 President's Budget includes an increase of \$2.0 million to the Biological Resources Discipline, CRU program. This increase will enable the program to fill 23 vacant research scientist positions located in Units across the country. Research conducted at Cooperative Units is critical to the Nation's interests in balanced energy development, climate change, invasive species, infectious diseases, and threatened fish and wildlife conservation. The restoration of science capacity in CRU will enhance and expand graduate education and science training as mandated in the Cooperative Units Act, contributing to the science expertise that will be needed to meet future natural resources challenges on issues of national priority. The increase also will be used to fully leverage the funding and material support provided by the States, host universities, the Wildlife Management Institute, and partner agencies including the FWS. Finally, the funding increase will enable CRU scientists to more effectively engage in development of science-based decisionmaking and adaptive management strategies with natural resource managers to address priority needs.

Interagency Great Lakes Initiative

The 2010 budget request for the EPA includes \$475.0 million for restoration and protection of the Great Lakes. EPA, in concert with its Federal partners on the Great Lakes Interagency Task Force, will lead the development and implementation of a Great Lakes Restoration initiative. The initiative begins in 2010 by identifying \$475.0 million for programs and projects strategically chosen to target the most significant problems in the Great Lakes ecosystem and to demonstrate measurable results.

EPA has used the strategic planning work of the Great Lakes Interagency Task Force to identify five principal environmental problems for which urgent action is required. The EPA may adjust the criteria in the future as a Great Lakes Restoration Plan is developed and refined. The initiative will focus protection and restoration activities on:

- Toxic substances and areas of concern
- Invasive species
- Nearshore health and nonpoint source pollution
- Habitat and wildlife protection and restoration

Key Increases

- Information for decisionmaking and accountability

USGS anticipates it will receive \$15.0 million for research in these areas.

The Great Lakes support a \$7.0 billion annual fishery in addition to considerable revenue from tourism and recreation. Work by USGS scientists provides information to agencies and resource and land managers on deepwater science, invasive species, and wetlands and coastal habitat. The Great Lakes initiative will expand research to enhance ecosystem-based management of coastal resources by USGS partners. The USGS will integrate collaborative studies that provide forecast models and assessment to anticipate future coastal change and develop tools to effectively evaluate policy and management strategies to preserve the environmental and economic health of coastal systems.

The USGS Great Lakes Science Center (GLSC) has the lead in developing a long-term program of deepwater research for assessing status and trends of Great Lakes fish populations and management of associated databases. The GLSC works closely with the Great Lakes Fishery Commission, the FWS, seven State fishery agencies, the Ontario Ministry of Resources, and Tribal entities to provide the information necessary to manage this important fishery and restore native fisheries.

This initiative will allow deepwater researchers to incorporate state-of-the-art technology to improve survey sampling design of fish populations to better meet Federal, State, and Tribal partner needs. In 2010, the USGS will work with the EPA and other organizations to complete a year of intensive sampling in Lake Michigan that will provide important data on the effects of invasive species on the food web and on the nearshore-offshore linkages of the food web.

Shoreline changes, temperature shifts and aquatic ecosystems shifts projected in the coming years may greatly affect Great Lakes precious and unique wetlands. The USGS will conduct research that is aimed at developing long term management strategies to reduce impacts from invasive species, loss of essential habitat, and reduction in fishery and forage food within coastal ecosystems. The USGS Great Lakes Aquatic Gap Analysis Project uses multi-scale landscape models to thoroughly map aquatic habitat and living resources within the Great Lakes Basin. The USGS will provide useful mapping tools in the coastal habitats to support aquatic habitat planning and ecosystem management efforts by the FWS, the EPA, the NPS, State agencies and NGOs. The USGS will continue to support the EPA and the International Joint Commission by sustaining its commitment to the USGS Oceans Research Priority Plan which enhances Great Lakes coastal mapping, public notification, monitoring and assessment of the health of coastal beaches.

A New Energy Frontier

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
A New Energy Frontier- Energy Independence with focus on Renewables						
Renewable Energy - Wind and Solar						
Biological Research and Monitoring (\$000)	0	0		+625	625	+625
<i>FTE</i>	0	0		+1	1	+1
Coastal and Marine Geology Program (\$000)	0	0		+375	375	+375
<i>FTE</i>	0	0		0	0	0
Renewable Energy - Biofuels						
Biological Research and Monitoring (\$000)	0	75		+400	475	+400
<i>FTE</i>	0	0		0	0	0
Geographic Analysis and Monitoring (\$000)	0	0		+300	300	+300
<i>FTE</i>	0	0		+1	1	+1
Hydrologic Networks and Analysis (\$000)	0	0		+200	200	+200
<i>FTE</i>	0	0		0	0	0
Minerals Resources Program (\$000)	0	0		+100	100	+100
<i>FTE</i>	0	0		0	0	0
Renewable Energy - Geothermal						
Energy Resources Program (\$000)	500	500		+1,000	1,500	+1,000
<i>FTE</i>	3	3		+1	4	+1
Total Requirements (\$000)	500	575		+3,000	3,575	+3,000
Total FTE	3	3		+3	6	+3

Summary of 2010 Program Changes for A New Energy Frontier-Energy Independence with Focus on Renewables

Request Component	(\$000)	FTE
A New Energy Frontier- Energy Independence with focus on Renewables		
Renewable Energy		
• Biological Research and Monitoring	+1,025	+1
• Coastal and Marine Geology Program	+375	0
• Geographic Analysis and Monitoring	+300	+1
• Hydrologic Networks and Analysis	+200	0
• Minerals Resources Program	+100	0
• Energy Resources Program	+1,000	+1
TOTAL Program Changes	+3,000	+3

Justification of 2010 Program Changes

The 2010 budget request includes \$3,575,000 and 6 FTE for A New Energy Frontier - Energy Independence with Focus on Renewables Initiative, a net program change of +\$3,000,000 and +3 FTE from the 2009 Enacted level.

A New Energy Frontier- Energy Independence

(+\$3,000,000 / +3 FTE)

The A New Energy Frontier - Energy Independence initiative will build upon the core capabilities of the USGS as a multidisciplinary earth science agency. The USGS will investigate an array of renewable energy sources, including geothermal, biofuels, wind and solar. USGS will study geothermal resources to provide a scientific basis to improve the viability of this important and underutilized resource to contribute to the domestic energy mix. The USGS will provide the scientific base for understanding the impacts of renewable energy options, such as wind, solar, and biofuels on ecosystems and wildlife populations. The USGS work in renewable energy sources will support the President's and Secretary's priority of expanding the generation and transmission of renewable resources. As a multidisciplinary agency, the USGS is well-positioned to engage the multiple partners participating in these complicated natural resource issues. These partners include other Interior agencies such as NPS, FWS, BLM, and MMS, other Federal agencies such as DOE and USDA, State agencies, industry consortia, and others. The USGS is a leader in modeling, ecological and geological research; synthesis of information necessary to inform decision-makers; and development of analytical tools necessary to both evaluate and predict outcomes of decisions on natural resources.

Wind and Solar Energy (+\$1,000,000) — The USGS will use its ecological, modeling and geological capabilities to address the scientific challenges associated with developing relatively new technologies of wind and solar energy to support Department agencies (e.g., FWS, BLM, NPS, MMS) in making informed decisions about the implementation and operation of alternative energy production on public lands, both onshore and offshore. In addition to the impacts to wildlife populations from direct strikes and habitat loss from the placement of turbine and solar farms, there are the effects on viewsheds and airsheds, habitat degradation, fragmentation, and additional collision threats from the thousands of infrastructure (e.g. roads and transmission lines) estimated for maintenance and energy delivery. The USGS will enhance and test models that improve predictions of these impacts on ecosystems and wildlife, and the marine environment. The USGS science will support decisions made by the MMS about offshore wind platforms by synthesizing and interpreting existing geologic data, targeting the collection of new data to address critical gaps about wind turbine impacts to the seafloor and deep-sea communities, including corals, as well as evaluating potential impacts of these turbines to sea ducks and shore birds.

Biofuels (+\$1,000,000) — The USGS conducts research on the environmental effects associated with biofuels development such as increased soil and wind erosion, water quality impairment associated with the use of agrochemicals, greater demand for irrigation and process water, sedimentation of wetlands and riparian areas, and the increased fragmentation of grasslands. The effects of land-use changes to increase biofuel production will potentially have far-reaching and long-term impacts on the continental landscape such as affecting existing and potential ecosystem goods and services, especially in areas that are important habitats for migratory birds and waterfowl or systems which now provide water quality protection or soil carbon sequestration.

Geothermal (+\$1,000,000) — Geothermal energy constitutes one of the Nation’s largest sources of renewable and environmentally benign electrical power, yet the installed capacity falls far short of estimated geothermal resources. As part of the Energy Policy Act of 2005, the USGS conducted an assessment of the moderate- and high-temperature geothermal resources of the United States, those resources capable of generating electricity. The assessment estimates the electric power generation potential of conventional identified geothermal resources at ~9,000 megawatts (MW), of conventional undiscovered resources at ~30,000 MW, and of unconventional Enhanced Geothermal Systems (EGS) resources at ~500,000 MW. Subsequent work will highlight geothermal energy resources located on public lands, particularly working in conjunction with BLM and USDA-FS. In order to augment the results of the national assessment, studies will be undertaken to perform life cycle models of geothermal systems; understand the geologic and hydrologic aspects of unconventional geothermal systems development and provide a framework for future assessments of resource potential, including deep sedimentary basin environments, and; create online databases and GIS products to support current and future assessments and support local and national land resource management.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Request	Program Change Accruing in 2010	Program Change Accruing in Out-years
# of systematic analyses and investigations completed (BUR) (ERP)	0	0	0	0	0	0	0	1
# of formal workshops or training provided to customers (BUR) (ERP)	0	0	0	0	0	0	1	0
Comments	The performance measure changes indicated above are changes as a result of activities to be conducted in the Energy Resources as part of the A New Energy Frontier- Energy Independence initiative							
# of systematic analyses and investigations completed (BRM)	0	0	0	0	0	0	0	3
Total Projected Cost (\$000) (BRM)	0	0	0	0	0	0	0	630
Projected Cost per systematic analysis (whole dollars) (BRM)	\$210,000							
Comments (BRM)	Systematic analyses typically require 1 to 5 years for completion.							
# of formal workshops and training provided to customers (BRM)	0	0	0	0	0	0	0	5
Total Projected Cost (\$000) (BRM)	0	0	0	0	0	0	0	450

2010 Initiatives

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Request	Program Change Accruing in 2010	Program Change Accruing in Out-years
Projected Cost per workshop (whole dollars) (BRM)	\$90,000							
Comments (BRM)	For workshops, which support land managers in applying the science, and are a shorter-term product, the USGS used the average unit cost of \$90,000 based on the technical assistance and proportional share of the science management work activity.							

Program Overview

The need for new energy sources has resulted in increasing interest and exploitation of “alternative” technologies such as geothermal, solar, biofuels, and wind. Renewable energy resources are an important component of the domestic energy mix, not only as new energy sources, but in light of climate change policies because they are low carbon dioxide emitting sources of energy. Geothermal energy is one of the most promising, but presently underutilized, of these energy resources. A recent USGS national geothermal resource assessment indicated that significantly more electricity could be produced from this renewable, domestic resource. Developing these energy sources could impact private and public lands and natural resources across the Country and our coastlines. Rapidly accelerating development has the potential to affect the availability and quality of wildlife habitat, ecosystem services, and water and air quality. For Interior agencies to make informed decisions, they need scientific information that encompasses the scope of the likely build-out under various alternative energy development scenarios.

Commercial wind development is the fastest growing energy sector in the Country, with more than 20,000 commercial, land-based turbines in operation in the U.S., and predictions of more than 155,000 turbines by 2012. “Wind farms” are primarily proposed for public lands in the West, and for rural lands in the Northeast and Midwest, where public lands are scarce. Wind farms are also proposed for both “near” and “off” shore coastal water of the U.S. and along the Great Lakes. The BLM has received a large number of proposals for construction of utility-scale solar energy projects on lands they administer in Arizona, California, Nevada, New Mexico, and Utah. Utility-scale solar energy facilities consist of large arrays of solar collectors on the ground. The arrays generate large amounts of electricity for the transmission grid. Environmental impacts from the installation of turbines and solar collectors could result in the direct loss and increased fragmentation of wildlife habitat and ecosystem services (e.g., clean water, wildlife corridors, erosion control, pollinators). MMS is responsible for evaluating the issues associated with renewable energy project development, including all foreseeable potential monitoring, testing, commercial development, operations, and decommissioning activities in Federal waters. Near and off-shore renewable energy development will have effects on the marine and human environment that include marine fisheries and seabird habitat and migratory routes.

The infrastructure to transmit and process the new energy may affect even more acreage than the arrays, turbines and other infrastructure used to collect it, as DOE estimates that over 12,000 new miles of transmission lines may be needed to move wind energy alone. Energy extraction may also entail development of urban centers in previously rural lands, further affecting habitat. The project footprint and potential environmental impacts of these actions at full build-out has not been estimated and will vary slightly depending on the combination of

energy sources. Additionally, their impacts must be considered in addition to those from the development and transportation of biofuels and traditional energy sources. Because of the magnitude of our energy needs, any combination of actions has the potential to physically transform our public and rural lands and our coastal areas.

The USGS has led *in situ* ecological studies in the Northern Great Plains for decades and possesses considerable expertise in ecosystem service provisioning, ecosystem structure and function, wildlife studies, biological carbon sequestration, and other services. Research is needed to determine how to mitigate the effects and evaluate the influence of biofuel development on ecosystem services, and water use and availability under various climate scenarios. The research will evaluate the complete life-cycle of biofuels production for greenhouse gas production, energy inputs, trade-offs with other conservation programs (e.g. Farm Bill) and potential for energy independence. A multidisciplinary understanding of ecosystem services and of land use changes under climate change, based on validated simulation modeling, will help promote informed policy development and sustainable management decisions. These modeling products will support policy decisions and spatially explicit user driven modeling.

2010 Program Performance

Wind and Solar Energy

The USGS will develop a decision-support framework for selecting wind development and mitigation sites for the purposes of conserving trust resources. Components such as management objectives, decision alternatives and predictive models would be established in concert with Federal and State partners. This initiative seeks to move the existing body of research on ecosystem and wildlife disturbances by development forward by relating it to decisions. The results from this structure will enable agencies to make decisions consistent with their natural resource and regulatory missions and communicate the rationale of their decisions to stakeholders. The solar energy component of the initiative will canvass land use agencies tasked with making decisions about solar farms to elicit the components of their decision problem, clarify their objectives, and obtain the critical uncertainties related to this type of land use on wildlife and ecosystems.

In 2010, the USGS will:

- Develop and validate models for use as decision-support tools to predict the impacts of mortality and habitat loss to avian and terrestrial wildlife populations associated with the likely build-out scenarios associated with the infrastructure (e.g., roads, transmission lines) planned to support development of these power sources. (Biological Research and Monitoring: +\$425,000);
- Conduct exploratory research to identify the types and scope of potential impacts associated with the development of solar energy farms in the desert Southwest such as impacting the ecology of desert-adapted species, changes to surface and groundwater budgets, and erosion. (Biological Research and Monitoring: +\$200,000); and
- Develop the mapping framework for offshore wind-energy development including the production of a regional digital seafloor map, in conjunction with MMS, State agencies and other Federal mapping, charting, and regulatory agencies, that would be used to inform the evaluation and regulation by MMS, NPS and FWS of offshore wind-energy development by sites and their adjacent regions. (Coastal and Marine Geology: +\$375,000).

Biofuels

Research is needed to determine how to mitigate the effects and evaluate the influence of biofuel development. The research will evaluate the complete life-cycle of biofuels production for greenhouse gas production, energy inputs, trade-offs with other conservation programs (e.g. Farm Bill) and potential for energy independence. A multidisciplinary understanding of ecosystem services and of land use changes under climate change, based on validated simulation modeling, will help promote informed policy development and sustainable management decisions.

In 2010, the USGS will:

- Determine life-cycle effects of biofuel production in relation to greenhouse gas production and energy inputs including trade-offs with other conservation programs (e.g. Farm Bill) and potential for energy independence;
- Develop and validate models that simulate the effects of increased biofuel production on ecosystem services and forecast land use changes under climate change scenarios;
- Document combined impacts of land use and climate change on soil properties;
- Model and validate alternate landscape futures (e.g., transgene flow, spread of transgenic plants) based on scenarios combining demand for biofuel crops with several climate trajectories; and
- Document how biofuel production changes stream flow and water quality as well as ground-water availability in local and regional aquifers.

(Biological Research and Monitoring: +\$400,000; Mineral Resources: +\$100,000; Hydrologic Networks and Analysis: +\$200,000; and Geographic Analysis and Monitoring: +\$300,000.)

Geothermal

The proposed funding would support studies to increase our understanding of this underutilized, but potentially important resource. In 2010, the USGS work activities planned are as follows:

- **Life Cycle Models for Geothermal Systems** – A critical issue in evaluating the nature and extent of geothermal resources is developing an improved understanding of the formation and evolution of the permeable faults and fractures that form most geothermal reservoirs. Characterizing and quantifying the interrelationships among the various geologic and geochemical parameters and effects on fluid and heat transport is critical to understanding what creates and maintains fracture permeability. Research will be devoted to the acquisition and analysis of data on the nature and evolution of geothermal systems in diverse environments. These studies will support the development of an improved geothermal resource assessment methodology relating geospatial observations to accurate predictions of the spatial and temporal frequency and distribution of geothermal reservoirs.
- **Unconventional Geothermal Resources** - There are several unconventional geothermal resources that have potential for electrical generation, the most promising being Enhanced Geothermal Systems (EGS). EGS are geothermal resources that require some form of engineering to develop the permeability necessary for the circulation of hot water or steam and the recovery of heat for electrical power generation. The provisional evaluation of EGS in the USGS assessment indicates that the electric power production potential from EGS is

substantially larger than that from all conventional geothermal resources. Yet, significant questions remain regarding EGS development, and new research studies, in coordination with DOE, will be directed at understanding the geologic and hydrologic aspects of EGS development and providing a framework for future assessments of EGS resource potential, including deep sedimentary basin environments.

- **Online Databases and GIS Products** – As part of the resource assessment effort, supporting geological, geophysical, geochemical, and hydrologic data are being combined into databases and geospatial (GIS) maps for analysis. To provide detailed data to complement the assessment, to develop a solid foundation for future assessments, and to maintain comprehensive information on geothermal energy resources and development, these regional and system-specific databases will be placed online and updated on a regular basis. As new data and system understandings are developed in the two activities described above, they will be added to the databases and GIS maps (Energy Resources Program: \$1,000,000)

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A 21st Century Youth Conservation Corps

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
A 21st Century Youth Conservation Corps						
Enterprise Information Resources	0	0	0	+2,000	2,000	+2,000
FTE	0	0	0	+25	25	+25
Total Requirements (\$000)	0	0	0	+2,000	2,000	+2,000
Total FTE	0	0	0	+25	25	+25

Summary of 2010 Program Changes for A 21st Century Youth Conservation Corps

Request Component	(\$000)	FTE
Enterprise Information Resources	+2,000	+25
TOTAL Program Changes	+2,000	+25

Justification of 2010 Program Changes

The 2010 budget request for the 21st Century Youth Conservation Corps initiative is \$2,000,000 and 25 FTE, a program change of +\$2,000,000 and +25 FTE from the 2009 Enacted Budget.

A 21st Century Youth Conservation Corps (+2,000,000 / +25 FTE)

This initiative allows the USGS to expand existing efforts to additional universities across the country, build additional relationships with key partners, and connect with more of the next generation of scientists. Additionally, it will support the expansion of USGS efforts to assist with scientific and technical training for Tribes to assist with developing the competencies needed to manage Tribal resources effectively.

This initiative supports additional internships for approximately 120 college students, more summer youth academies, expansion of scientific and technical training offerings to Tribes, and improvements to existing mechanisms for using technology to support these efforts. This initiative would enhance awareness of USGS as an employer of choice improving the ability to recruit mission critical competencies; increasing creativity and innovation with new talent; preparing for succession, and improving Tribal management of Native American resources.

This initiative advances Secretarial priorities for enhancing opportunities for America's youth to explore and obtain careers in the natural sciences and to support Tribal self-governance. The initiative would improve performance including increasing the number of internships and fellowships supported and/or facilitated by the USGS educational program by 120.

Internships will consist of temporary and limited appointments with the USGS or through cooperative agreements with technical and professional organizations with established internship programs. These internships will be targeted toward members of under-represented

2010 Initiatives

groups and connect them with USGS science projects. The USGS typically uses internships of 10 to 12 weeks to connect students with meaningful opportunities to expand their exposure to scientific projects, enhance their knowledge of key scientific concepts, and encourage students to pursue scientific careers in the public service.

The USGS has a long history of working cooperatively with Tribes to develop and provide scientific and technical training to assist Tribes with managing their natural resources. This initiative provides an opportunity to leverage the investments in these training and expand the reach to additional Tribal members and use technology to develop distance learning mechanisms to deliver scientific and technical course content.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
Percent of interns that take further science course work or receive degrees	N/A	N/A	N/A	N/A	Baseline	TBD	TBD	TBD
Comment	The influential BEST report found that the most effective enhancement programs are viewed as part of a workforce continuum, building institutional relationships and providing skills that enable students to advance on and succeed at the next academic level (<i>A Bridge for All</i> , BEST (building Engineering & Science Talent, 2004)							
Percent of students that felt well-matched with mentor and project	N/A	N/A	N/A	N/A	Baseline	TBD	TBD	TBD
Comment	The matching of a student with their mentor and project is recognized as one of the most important factors in a successful youth development program. (<i>SOARS: A Research-With -Evaluation Study of a Research and Mentoring Program for Underrepresented Students in Science, Ethnography & Evaluation Research (E&ER) group</i> , University of Colorado at Boulder, 2005.)							
Percent of Tribe members that rate USGS technical and scientific training as satisfactory or above.	N/A	N/A	N/A	N/A	Baseline	TBD	TBD	TBD
Total # of internships and fellowships supported and/or facilitated by the USGS educational program (EIR)	55	70	55	55	55	175	+120	0
Comment	Change in 2010 results from the proposed 21st Century Youth Conservation Corps initiative.							
<p>Note: Projected costs may not equal program change as these are full costs, which may include funds from other sources and (or) use averages.</p> <p>Column A: The level of performance and costs expected in 2010 at the 2009 level plus funded fixed costs. Reflects the impact of prior year funding changes, management efficiencies, absorption of prior year fixed costs, and trend impacts, but does not reflect the proposed program change.</p> <p>Column D: Outyear performance beyond 2010 addresses lagging performance — those changes occurring as a result of the program change (not total budget) requested in 2010. It does <u>not</u> include the impact of receiving the program change again in a subsequent out-year.</p>								

Program Overview

The success of the USGS is directly connected to the quality and availability of a workforce, which is dependent upon children choosing to pursue an education in science, technology, engineering or math. The USGS has a long and successful history of outreach to youth through science fairs, speakers, open houses, and scouting activities. In addition, the USGS provides meaningful student internships and supports summer youth academies to encourage careers in the natural sciences, particularly for members of under-represented groups. The USGS is currently engaged in a variety of educational activities over a range of instructional levels, in both formal and informal settings. This is accomplished by coordinating student internships, conducting workshops and presentations at national science and science education meetings, coordinating national earth science events, maintenance and development of the Bureau's principal educational web site, and responding to the science education requests of our partners in professional science societies. The USGS also works closely with other Federal science agencies on a range of initiatives for purposes of maintaining national preeminence and workforce requirements in science and technology. While successful, these efforts do not reach the volume of youth that is necessary to provide a pipeline to ensure the availability of future employees.

The USGS focuses on encouraging youth to pursue education and careers in the sciences including student internships with universities such as City College of New York, the University of Puerto Rico, Tennessee State University, and Gateway Community College, Phoenix, AZ. Each of these institutions has a diverse student population and the USGS enjoys strong partnerships with faculty and administrators. These partnerships help ensure that academic programs address USGS mission needs and access to high potential students. The USGS provides meaningful short-term internships for students that encourage their pursuit of a degree in science and help them make a connection to the value of public service.

In addition to college-level efforts, the USGS supports a limited amount of high school-level programs, such as the GeoForce program at the University of Texas in Austin. This program reaches high potential Hispanic high school students and offers a summer academy focused on connecting them with nature and the sciences. Students travel to various locations throughout the US to explore real world challenges and see the value of science to improve understanding, inform decision making, and improve resource management.

2010 Program Performance

The requested funds would allow the USGS to expand efforts to reach new groups, build additional relationships with key partners, and connect with the next generation of scientists. Additionally, it would support the expansion of USGS efforts to assist with scientific and technical training for Tribes. The requested funds would allow for additional internships, additional youth activities, expansion of scientific and technical training offerings to Tribes, and improvements to existing mechanisms for using technology to support these efforts. The initiative would improve the USGS' ability to recruit mission critical competencies; increasing creativity and innovation by bringing in new talent with the latest scientific and technical competencies available; preparing for succession, and contributing to the improvement of tribal management of Native American resources.

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Climate Impacts

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Climate Impacts						
Carbon Sequestration						
Geologic Carbon Sequestration						
Global Change (\$000)	1,000	1,500		+3,500	5,000	+3,500
<i>FTE</i>	1	1		+5	6	+5
Biologic Carbon Sequestration						
Global Change (\$000)	0	1,500		+3,500	5,000	+3,500
<i>FTE</i>	0	1		+5	6	+5
Climate Change Science						
Global Change (\$000)	2,300	4,000		+5,000	9,000	+5,000
<i>FTE</i>	3	5		+8	13	+8
USGS National Climate Change and Wildlife Science Center						
Global Change (\$000)	1,500	10,000		+5,000	15,000	+5,000
<i>FTE</i>	1	10		+20	30	+20
Support for FWS Climate Change Activities						
Biological Research and Monitoring (\$000)	0	0		+5,000	5,000	+5,000
<i>FTE</i>	0	0		+8	8	+8
Total Requirements (\$000)	4,800	17,000		+22,000	39,000	+22,000
Total FTE	5	17		+46	63	+46

Summary of 2010 Program Changes for Climate Impacts

Request Component	(\$000)	FTE
Climate Impacts		
• Global Change	+17,000	+38
• Biological Research and Monitoring	+5,000	+8
TOTAL Program Changes	+22,000	+46

Justification of 2010 Program Changes

The 2010 budget request for the Climate Impacts initiative is \$39,000,000 and 63 FTE, a net program change of +\$22,000,000 and +46 FTE from the 2009 Enacted Budget.

Climate Impacts (+\$22,000,000 / +46 FTE)

Responding to global climate change and its impacts requires an unprecedented integration of information from multiple science disciplines and the full range of temporal and spatial scales.

2010 Initiatives

The USGS will lead the agency's effort to build a Department of the Interior Climate Impacts Monitoring framework. With this effort, USGS will work toward implementation of a comprehensive plan that will combine new and existing monitoring information from multiple sources to provide more effective and timely science information on climate change and related impacts for resource management and policy decisionmaking.

Building on standardized approaches developed at the national level by the National Climate Change and Wildlife Science Center (NCCWSC), regional Climate Science Hubs will be developed and coordinated according to a national science and decisionmaking strategy. The Hubs will be co-located at universities and will be developed collaboratively by USGS and its conservation partners to include FWS, other Interior bureaus, and other Federal, State and regional partners. USGS' strategy is to coordinate with national partners, respond to the needs of regional conservation partners, build on natural resource management climate science needs and ensure that the Hubs identified compliment FWS' Strategic Habitat Conservation Plan. The NCCWSC will facilitate synthesis of downscaled information from the regional hubs with relevant USGS physical and biological information from the Ecosystem Strategy, the Global Change Program and other national science programs for applications to the ecoregional and local needs of Federal, State, Tribal and local partners.

As mandated in the Energy Independence and Security Act of 2007, USGS is developing methodology to assess carbon sequestration and will use this methodology to conduct a national assessment. USGS work will include both geological and biological forms of carbon sequestration. USGS will assume scientific leadership in developing methodologies to measure and assess biological carbon sequestration and greenhouse gas fluxes, and in implementing a national assessment of ecosystem carbon storage and greenhouse gas fluxes.

The initiative will also allow USGS to integrate capabilities in modeling current and projected physical and biological change across extensive landscapes and aquatic systems and habitats with studies of ecosystem and population processes. USGS will provide ecological and population modeling capacity to FWS Landscape Conservation Cooperatives and provide information to FWS for use in the Strategic Habitat Conservation.

Carbon Sequestration (+\$7,000,000/ +10 FTE) — An increase of \$7.0 million from the Carbon Sequestration Initiative is provided to USGS to focus on geological and biological carbon sequestration research, including starting a national assessment of the geological storage capacity for carbon sequestration, and developing a methodology for national assessment of biological carbon sequestration. These activities were authorized in the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140), which calls for comprehensive assessment of geologic and biologic carbon sequestration to enable decision-makers to evaluate the full range of sequestration options. This \$7.0 million supplements \$3.0 million received in 2009 for ongoing and increased activities in both geological and biological carbon sequestration.

The 2010 carbon sequestration budget increase is \$7,000,000, of which \$3,500,000 will go to support the assessment of geological carbon sequestration using the methodology developed with 2008 funding, and an equal amount will support the development of the methodology to assess current and potential biological carbon sequestration.

Funds for the geologic carbon sequestration will be used to (1) begin a national assessment of the Nation's resources for geologic sequestration of carbon dioxide (CO₂) in saline formations and oil and gas reservoirs (physical traps); (2) coordinate and manage groups of geologists and

computer scientists from USGS, and other Federal and State agencies working with USGS on the national assessment; and (3) conduct research on technical issues and data gaps that impact uncertainties in the ability to assess CO₂ storage resources.

Funds for biological carbon sequestration will be used to (1) develop a methodology for assessment of the Nation’s resources for biological carbon sequestration; (2) establish mechanisms for consultation concerning biological carbon sequestration resource assessment with DOI resource managers and stakeholders from other Federal and State agencies and from the private sector; and (3) identify technical issues and data gaps that impact uncertainties in the ability to assess biological carbon sequestration.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of systematic analyses and investigations completed			5	10	20	30	+10	+10
Total actual/ projected cost (\$000)			\$1,250	\$2,500	\$5,000	\$7,500	+\$2,500	+\$2,500
Actual/projected cost per scientific report or other product (whole dollars)			\$250,000	\$250,000	\$250,000	\$250,000	\$250,000	\$250,000
Comments	This measure includes investigations, analyses, and preparation and publication of reports, interim products, and other products related to methodology development and implementation for assessment of geological and biological carbon sequestration.							
# of workshops or training provided to customers (annual)			1	4	12	15	+3	+2
Total Projected Cost (\$000)			\$100	\$150	\$300	\$375	+\$75	\$50
Projected Cost per Workshop (whole dollars)			\$25,000	\$25,000	\$25,000	\$25,000	+\$25,000	+\$25,000
Comments	Science and decision-making boards, partnerships and stakeholder engagement will be used to determine user needs and delivery requirements. Out-year costs per tool may decrease as knowledge base on customer requirements increases.							
% of surface area with temporal and spatial research and modeling and assessment/data coverage			60% 3/5	60% 6/10	75% 15/20	83% 25/30	+8	+10

Program Overview

Geologic Carbon Sequestration

Geological storage of carbon dioxide in porous and permeable rocks involves injection of CO₂ into a subsurface rock unit and displacement of the fluid that initially occupied the pore space. This principle operates in all types of potential geological storage formations such as oil and gas fields and deep saline aquifers. Because the density of CO₂ is less than formation water, it will be buoyant in pore space filled with water and rise vertically until it is retained beneath a permeability barrier (seal). If the structure of the seal forms a trap with vertical and horizontal closure, CO₂ will accumulate in the same manner that buoyant fluids like crude oil and natural gas accumulate in nature. In addition to identification of adequate pore volume for CO₂ storage, a critical issue for evaluation of storage resources is the integrity and effectiveness of the seal that will retain the CO₂.

In 2009, USGS completed a 12-month project to develop a methodology to assess the geologic resources for CO₂ storage in physical (oil and gas) traps and saline formations. The draft report (Burruss, Brennan, and others, 2009, Development of probabilistic methods for assessment of CO₂ storage resources, USGS Open-file report, 2009, 125 p.) is done and awaiting release. This report was authorized in the EISA. It is based on extensive USGS experience with national and international assessments of energy, water, and mineral resources.

Biological Carbon Sequestration

Biological carbon sequestration refers to both natural and deliberate processes by which CO₂ is removed from the atmosphere and stored in vegetation, soils, and sediments. Biological carbon storage is susceptible to disturbances such as fire, disease, and changes in climate and land use. Deliberate biological sequestration can be accomplished through forest and soil conservation practices that enhance the storage of carbon (such as restoring and establishing new forests, wetlands, and grasslands) or reduce CO₂ emissions (such as reducing agricultural tillage and suppressing wildfires). The capacity of ecosystems to sequester additional carbon is uncertain, and the potential future vulnerability of biological carbon storage is difficult to predict. Decisions about biological carbon sequestration require careful consideration of priorities and tradeoffs among multiple resources. Assessment of biological carbon sequestration resources will require quantifying the factors that control potential sequestration, and providing information that can be used in complex resource management decisions and policies.

USGS scientific expertise is broadly interdisciplinary and uniquely qualified to assess the wide range of biological carbon sequestration resources. USGS scientists work at the multiple spatial scales that are necessary to link national assessments to regional and local needs. USGS historical datasets provide information needed to test and update time-dependent models that are used to estimate potential future carbon sequestration and greenhouse gas fluxes. The extensive land and resource management experience of the Interior provides an essential practical context for applying information about potential rates and capacities of carbon storage in ecosystems.

The USGS is leading a Department process to develop a methodology for a National Assessment of Biological Carbon Sequestration Resources. This activity, authorized by the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140), was initiated in 2009 and will continue in 2010.

2010 Program Performance

The USGS will conduct a National Assessment of Geological Storage Capacity for Carbon Dioxide. In order to accomplish a national assessment, a number of activities will be conducted in 2010:

- Convene a National assessment committee of geoscientists from Interior (USGS, BLM, MMS), State geological surveys, DOE, EPA, and private industry to prioritize geological provinces within the United States for assessment. The committee will review initial definitions of storage assessment units (SAUs) and provide recommendations on potential revisions of SAU definitions.
- USGS will create assessment teams assigned to the highest priority provinces. Assessment teams will be led by USGS scientists who will have final responsibility for quantitative resource assessments. Teams will consist of USGS, State, and other Federal scientists as needed to complete assessments of individual basins.
- During the first year of the assessment (2010), a key goal will be evaluation of the effectiveness of the assessment methodology described in the USGS Open-file Report. Based on experience with practical application of the methodology, USGS will revise the methods, input parameters and forms, and output formats as needed to improve the effectiveness and efficiency of the numerical methods for estimating storage resources.
- Concurrent with the assessment activities there will be a research task that will address key technical issues and data gaps that were identified during development of the assessment methodology. For example, at present there is no quantitative definition of "injectivity," a term used to define the "ease" of injecting CO₂ into a storage formation. The USGS needs to develop quantitative estimates of this concept so that it can be incorporated into the numerical methodology. Also, the current methodology could not define the statistical dependencies of the volumes of storage resources in multiple SAUs within individual assessment provinces. These dependencies must be evaluated numerically so that resource estimates for individual SAUs can be aggregated into regional and national estimates of storage resource. In addition, the current methodology estimates the distribution of CO₂ storage resources in individual SAU's only. Statistical algorithms need to be devised to aggregate these distributions over geologic provinces that contains multiple SAUs and into regional and national estimates of storage resource potential. Other research gaps include (1) in-place CO₂-water-rock interactions over a range of pressure, depth, and formation water chemistry; (2) properties of seals and estimates of probabilities of seal failure; and (3) movement and effects of CO₂ injection plumes.

The national assessment will be conducted in coordination with a number of organizations, in order to maximize the usefulness of the assessment to a variety of partners and stakeholders. This effort will be coordinated with the DOE, especially National Energy Technology Laboratory (NETL) and DOE's regional sequestration partnerships program. Particular emphasis will be placed on collaborative activities with NETL and their partnerships to build on their progress to date in storage assessment and to eliminate duplication of effort. Assessment activities will also be coordinated with EPA, as EPA has jurisdiction over a number of issues related to carbon sequestration including the potential impact on groundwater availability and contamination; regulatory issues related to their Underground Injection Control (UIC) program; and input to criteria for evaluation of Environmental Impact Statements for CO₂ sequestration projects. USGS will also work closely with the other Interior bureaus, such as BLM to evaluate the

2010 Initiatives

potential for geologic sequestration on lands under their responsibility. Interactions with the States will also be an integral part of this effort.

USGS is leading a Department process to develop a methodology for a National Assessment of Biological Carbon Sequestration Resources. This activity, authorized by the EISA, is being initiated in 2009. In order to complete the assessment methodology in 2010, the following activities will be conducted:

- USGS scientists will meet with natural resource managers and other stakeholders from Interior (BLM, NPS, FWS, BIA, MMS), USDA, DOE, EPA, State agencies, and private industry to identify key questions and concerns about a national assessment of biological carbon sequestration resources. Stakeholder consultations will be an integral part of the process of developing the assessment methodology
- USGS geospatial data experts will compile and integrate existing spatial datasets and inventories related to current and recent historical ecosystem carbon storage and greenhouse gas fluxes. This activity will utilize existing USGS and Interior land cover and remote sensing applications, such as Land Cover Trends and LANDFIRE, and will build on existing cooperation with USDA, EPA, and others. The resulting integrated geospatial database will be used to estimate current and recent historical ecosystem carbon storage and greenhouse gas fluxes.
- USGS scientists will compile spatially explicit scenarios for potential future climate change, land-use change, and economic trends that might affect management decisions and policies relevant to carbon sequestration and greenhouse gas fluxes. The timescale of these scenarios will be limited by the timescale of available projections, typically on the order of a few decades. Uncertainties will be estimated to the extent possible based on quantitative analysis and expert judgment.
- Teams of USGS and Department experts, working in cooperation with stakeholders and other experts, will develop methods for assessment of carbon sequestration and greenhouse gas fluxes in specific ecosystems and regions. These methods will be consistent with current and recent historical trends, and will quantify uncertainties including the risk of rapid carbon loss via processes such as wildfire, permafrost melt, and loss of estuarine sediments that may be exacerbated by climate change. Specific methods will be reviewed by a national team of experts and stakeholders to assure that they will support a consistent and comprehensive national assessment methodology.
- USGS scientists, using expertise in working with geospatial data, remote sensing applications, and ecosystem modeling, have developed a data/model system to describe storage and fluxes of carbon in relationship to climate change and land use for broad-scale landscapes. This system will be deployed in prototype applications using the scenarios and assessment methods described above. The system is potentially capable of providing a framework for national assessment of biological carbon storage and greenhouse gas fluxes. Initial work will include the validation of prototype local to regional simulations for scientific quality and for usefulness in carbon management.
- Concurrent with the development of the assessment methodology, there will be a research task to identify key technical issues and data gaps. This activity will draw on lessons learned from all of the above activities. Ongoing research is an essential component of USGS resource assessments.

The USGS will work with partners to identify areas and ecosystems most promising for managed sequestration or most at risk for rapid loss of carbon. These areas and ecosystems will have highest priority for initial implementation of the national assessment. During the first

stages of the assessment, particular emphasis will be placed on evaluating the effectiveness of the biological sequestration assessment methodology.

Climate Change Science (+\$5,000,000/ +8 FTE) — The 2010 budget request for Climate Change Science initiative is \$10,000,000 and 13 FTE, a net program change of +\$5,000,000 and 8 FTE from the 2009 Enacted Budget.

Based on recommendations provided by Federal, State, Academic, and NGO scientists, managers, and policymakers, the USGS will continue to develop a Department of the Interior Climate Impacts Monitoring effort that will provide the science for Department and other Federal, State, and local resource managers and decisionmakers to proactively and effectively adapt to and mitigate the impacts of climate change on managed resources. Through this monitoring effort, USGS will establish a multi-scale national strategy for understanding and monitoring both the changes to ecosystems and natural resources that result from climate change and the efficacy of our responses to these changes. USGS researchers and non-USGS collaborating scientists, programs, and resource managers will have the ability to track environmental indicators linked to climate change causes and impacts. USGS will also make available science applications and related data that will support the development of scenario and forecast-based decision-support tools for Department resource and land managers and State and Federal policymakers (see Applications).

Funding in 2010 will support the enhancements of data integration and information delivery and the continued development of a Collaborative Observation and Research (CORE) area in the Yukon River Basin of Alaska, where dramatic changes in the hydrology of the landscape are underway because of permafrost thaw. 2010 funding will also support strategic research and development across the full range of USGS capabilities and in partnership with other Federal agencies, with emphasis on coastal vulnerability forecasting, climate variability and abrupt climate change, completion of a multi-year effort to document and analyze land cover trends for the Nation, and efforts to develop decision-support tools to enable resource managers and policymakers to cope with and adapt to a changing climate. Accomplishments in 2010 for the Climate Impacts Monitoring effort also will include the initiation of two climate gradient transects in the mid-continent and eastern regions, as well as the establishment of two national collaborative surveys of forest and soil carbon. Additionally, USGS will further develop and test ecosystem forecasting models that utilize climate monitoring data collected from the Climate Impacts Monitoring effort to predict ecosystem change at scales useful to resource managers for more effective decisionmaking.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of systematic analyses and investigations completed			7	81	86	91	+5	+16

2010 Initiatives

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
Total actual/ projected cost (\$000)			\$1,750	\$13,500	\$14,750	\$16,000	+\$1,250	+\$4,000
Actual/projected cost per scientific report or other product (whole dollars)			\$250,000	\$250,000	\$250,000	\$250,000	\$250,000	\$250,000
Comments	<p>This measure includes decision support tools delivered to stakeholders. Costs of decision support tool development include baseline research, field testing and customer workshops to determine user needs and delivery requirements. Out-year costs per tool may decrease as knowledge base on customer requirements increases. Cost per unit is an average from the program contributing to the Global Change Activity.</p> <p>This measure combines outputs from several USGS programs into a new budget activity.</p>							
# of workshops or training provided to customers (annual)			3	11	13	15	+2	+6
Total Projected Cost (\$000)			\$75	\$275	\$325	\$375	+\$50	\$150
Projected Cost per Workshop (whole dollars)			\$25,000	\$25,000	\$25,000	\$25,000	+\$25,000	+\$25,000
# of gigabytes collected annually				2.8	2.8	2.8	0	+8.4
# of gigabytes managed and distributed cumulatively				22.2	22.2	22.2	0	30.6
% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements (Global Change) (PART) (Number of completed eco-region assessments out of a total of 84 eco-regions).			78% (66/84)	87% (73/84)	100% (84/84)	100% (84/84)	+13%	Planned completion 2010

Program Overview

Climate change is one of the biggest challenges the world faces and is a top priority for the USGS. Climate change and its impacts on natural resources are a key concern for resource managers in Interior and for many of our external partners at State, Federal, and local levels. The Climate Change Science component of the USGS Global Change activity includes the

Climate Impacts Monitoring effort; Global Change Research and Development; and Global Change Science Applications and Decision Support. In 2010 and beyond, work within the Climate Change Science activity includes the development and implementation of the framework for a comprehensive, national climate effects research and monitoring network; in continuation of the rigorous scientific research that provides the data, new knowledge, inputs to modeling, and other outcomes that are required to understand, assess, adapt and mitigate climate change; and in efforts to build partnerships and to translate scientific findings into real life applications and decision support tools.

The goal of Global Change is to be the primary provider of scientific information on past, present, and future climates and their effects on Earth and human systems to fulfil the mission of the USGS. Understanding of climate change impacts is used to provide perspectives for policymakers and to support land and resource managers.

Global Change funded projects support the goals of the U.S. Climate Change Science Program (CCSP) to (1) improve knowledge of the Earth's past and present climate and environment, including its natural variability; (2) improve quantification of the forces bringing about changes in the Earth's climate and related systems; (3) reduce uncertainty in projections of how the Earth's climate and related systems may change in the future; (4) understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes; and (5) explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change.

Results of scientific activities are communicated to customers in academia, resource management agencies, and the general public through project reports and peer-reviewed scientific papers, Websites, databases, and meetings with stakeholders. Metrics of program success in past years have included the number of reports and publications, number of people accessing Websites, and the frequency of meetings with stakeholders. As part of its effort in conducting and evaluating climate change science and climate impacts monitoring activities, USGS will initiate an evaluation of these activities in 2010. This review will be conducted by an independent panel established for this purpose as part of the overall planning framework for the Global Change activity.

2010 Program Performance

Department of the Interior Climate Impacts Monitoring — Responding to global climate change and its impacts requires an unprecedented integration of information from multiple science disciplines and the full range of temporal and spatial scales. In 2010 the proposed funds will allow for implementation of the Climate Impacts Monitoring effort through four primary components of the network design:

- Strengthen USGS monitoring and research assets within the pilot study in the Yukon River Basin of Alaska that addresses the impacts of accelerated global warming on native communities, energy resources, Federal trust resources, and permafrost thaw leading to increases in global warming itself. This is a key partnership with the State of Alaska, the Canadian government, and other U.S. Federal agencies that will provide enhanced decision support for eight FWS Refuges and three National Parks, and will leverage multiple foundation programs established by Interior, NOAA, NSF, and USDA.
- Initiate two climate transects in the mid-continent and eastern regions, in order to understand and anticipate potential climate-induced environmental changes occurring over

2010 Initiatives

time and across different landscapes. This effort will leverage USGS, NPS Vital Signs, and the NSF National Ecosystem Observing Network data collection and analysis programs.

- Initiate regional Climate Impacts Monitoring effort for tracking critical environmental indicators- including carbon. Currently, the nation has inadequate and incomplete tracking capability of key environmental elements, yet the changes in carbon occurring in the forests and soils from global warming could have a significant effect on ecosystem health and the national economy. This regional monitoring capability will allow USGS to map ecosystem and resource sensitivity to climate change. This effort leverages both USGS programs and the USDA-Natural Resources Conservation Service (NRCS) capabilities.
- Develop ecosystem forecasting models that will utilize the data collected from the Climate Impacts Monitoring effort to predict ecosystem change at scales useful to resource managers for more effective decisionmaking.

Global Change Research & Development – In 2010, research and development will continue across the full range of USGS capabilities and in partnership with other Federal agencies. Particular areas of focus will include:

Coastal Vulnerability Forecasting – In order to help coastal communities and coastal resource managers anticipate and respond to changes in the vulnerability of the coastal zone from persistent processes, extreme events and climate change; USGS will invest in geospatial data, in the development of assessment and forecast modeling tools, and will further cement a partnership with NOAA to develop decision-support tools for changing coastal conditions and vulnerability. This project activity complements the priorities and directions of the USGS Coastal and Marine Geology Program and will be implemented collaboratively with that program. It is anticipated that this project will, with contributions from other USGS programs and in partnership with other Federal agencies, be enhanced over future years leading to improved and more widely available products to assist coastal managers in anticipating and responding to coastal change due to storms, erosion, and sea-level rise.

The goal of this partnership is to provide decisionmakers in the coastal region with high quality science-based information that enables them to understand, anticipate, and adapt to a changing climate, including sea level rise. The USGS and NOAA are ideally suited to lead a U.S. coastal climate activity with their complementary missions to conduct research, monitor, and perform assessments of hazards and resources, and to conserve and manage coastal and marine resources. Through research, observations, and sharing of ongoing agency programs, the two science agencies will address the needs of national, regional, and local coastal decisionmakers for tools and information to anticipate and adapt to climate change. This new partnership will be based on the following principles:

- Decisionmakers in the coastal region will be active partners as the Department addresses their needs for data, tools, and information products;
- The highest quality environmental and social science available will be applied at the spatial and temporal scales required for decisions;
- Standards and protocols will be developed and used to maximize the accessibility and utility of the research, monitoring, assessment and mapping data collected by multiple partners; and

- Tools and information developed for addressing climate change and variability will be provided to decisionmakers with guidance and training that communicates the benefits, costs, and limitations.

Climate Variability and Abrupt Change – In 2009, USGS completed three Synthesis and Assessment Products (SAP) under the auspices of the US Climate Change Science Program (CCSP). These three assessments led by USGS addressed the topics of Arctic paleoclimate as a way to understand Arctic amplification; abrupt Climate Change; and Thresholds of Change in Ecosystems. Building upon these assessments and on long-term work conducted in USGS Global Change R&D, activities in 2010 will focus on areas including the following:

- improved understanding of past Earth climates to inform modeling and forecasting of current and future climates in the Arctic, Pacific Coast, Gulf Coast and Atlantic Coastal Margin, including studies of sea-ice history and Earth's history of abrupt climate change,
- improved understanding of landscape and vegetation responses to climate change including responses to aridification, sea level rise, changes in land cover and land use patterns, and temperature and precipitation changes, and
- implications of climate change and variability for future habitats and biological diversity as well as impacts on human communities and resources.

Complete Documentation of Land Cover Trends for the Lower 48 – In 1999, the USGS began a comprehensive analysis of trends in land cover across the United States using the entire available satellite record. Satellite images from multiple time slices from 1973 through 2000 are being used together with statistical sampling and field verification to characterize the spatial and temporal characteristics of land cover change across the conterminous United States, and to document the regional driving forces and consequences of change. In 2010, this analysis will be complete for the lower 48 States, providing the foundational data for the first ever national assessment of trends in land cover and the impacts of those trends on land management practices, economic health and sustainability, and social processes. These data and the assessment, when complete, will also provide the basis for improved prediction of future changes in support of local and regional decisionmaking.

Global Change Science Applications & Decision Support – In 2010, the Science Applications and Decision Support element of the USGS Global Change program will continue its efforts to develop decision-support tools that enable resource managers and policymakers to cope with and adapt to a changing climate. Decision-support will be developed through new partnerships, enhancement of existing collaborations, and in training the next generation of applications scientists.

In the 2009-2010 academic year the USGS is supporting graduate students at Massachusetts Institute of Technology (MIT) through the MIT/USGS Science Impact Collaborative. These students are working on climate change impacts and adaptation studies in Florida's Everglades National Park, along the coast of Maine, and in the Southwestern U.S. training the next generation of applications scientists for the Nation. Additionally, the USGS is transitioning Earth-science research results to the operational missions of partnering agencies through the Science Applications and Decision Support element of the Climate Impacts Monitoring effort.

2010 Initiatives

USGS National Climate Change and Wildlife Science Center (+\$5,000,000/ +10 FTE) — The 2010 budget request for the National Climate Change and Wildlife Science Center (NCCWSC) is \$15,000,000 and 30 FTE, a net program change of +\$5,000,000 and +20 FTE from the 2009 Enacted Budget.

Building on standardized approaches developed at the national level by the NCCWSC, regional Climate Science Hubs will be developed according to the national strategy. National coordination of research and modeling at the regional hubs will ensure uniformity of downscaling and forecasting models and standardized information to support management for fish and wildlife managers for regional partnership collaborations including the FWS Landscape Conservation Cooperatives. The NCCWSC will facilitate synthesis of downscaled global climate models from the regional hubs with relevant USGS physical and biological information from the Ecosystem Strategy, the Global Change program, the Climate Impacts Monitoring effort and other national science programs for applications to the ecoregional and local needs of Federal, State, Tribal and local partners. The NCCWSC will gather, incorporate and disseminate updated information from the new models, applications and forecasts developed by the regional hubs. Assessment and synthesis of this body of work is essential for regional scenario building in support of coordinated conservation planning among Interior bureaus and other national and regional efforts. The NCCWSC regional Climate Science Hubs will provide direct contact between scientists and fish and wildlife managers to develop and evaluate models and tools for implementation in iterative adaptive management approaches based on sound science. Partner efforts integral to activities and outcomes at the NCCWSC regional hubs include the FWS Landscape Conservation Cooperatives, BLM National Landscape Conservation System, Forest Service Climate Change Resource Center, NPS Ecosystem Restoration and Endangered Species Programs, Climate Change Impacts on Tribal Trust Species and Resources, NASA, NOAA and EPA among others.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of systematic analyses and investigations completed			5	10	20	30	+10	+10
Total actual/ projected cost (\$000)			\$1,250	\$2,500	\$5,000	\$7,500	+\$2,500	+\$2,500
Actual/projected cost per scientific report or other product (whole dollars)			\$250,000	\$250,000	\$250,000	\$250,000	\$250,000	\$250,000
Comments	This measure includes national downscaled climate models to regional scales for measuring ecological and population response to climate change, and vulnerability and risk assessments delivered to stakeholders. Costs of model development includes assessment and synthesis of global climate models with physical and biological research results at regional scales, and applications of models in natural resource management with evaluation and validation of adaptive management applications.							

2010 Initiatives

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of workshops or training provided to customers (annual)			1	4	12	15	+3	+2
Total Projected Cost (\$000)			\$100	\$150	\$300	\$375	+\$75	\$50
Projected Cost per Workshop (whole dollars)			\$25,000	\$25,000	\$25,000	\$25,000	+\$25,000	+\$25,000
Comments	Science and decision-making boards and stakeholder workshops will determine user needs and delivery requirements. Out-year costs per tool may decrease as knowledge base on customer requirements increases. Cost per unit is an average from the programs contributing to the National Climate Change and Wildlife Science Center.							
% of surface area with temporal and spatial research and modeling and assessment/data coverage to meet targeted fish and wildlife adaptation planning and adaptive management requirements (National Climate Change and Wildlife Science Center) (BUR) (Number of completed down-scaled global models to regional scales out of a total of 12 regional flora and fauna climate change adaptation models and forecasts.			60% 3/5	60% 6/10	75% 15/20	83% 25/30	+8	+10

Program Overview

Climate change is one of the biggest challenges the world faces and is one of the top priorities for the USGS. Climate change and its impacts on natural resources are a key concern for natural resource managers in the Department of the Interior and our external partners at Federal, State, regional and local levels. In 2008, Congress requested establishment of a national center to increase the capacity of Federal natural resource agencies to respond to global warming. In particular, natural resource managers need forecasts of the adaptation of fish and wildlife, and other vital flora and fauna, to climate change. The USGS responded by developing the NCCWSC. The intent was to support research, assessment and synthesis of global climate change data for use at regional levels; to downscale and evaluate global climate change models to spatial and temporal scales appropriate for adaptive management of species

2010 Initiatives

and their habitats; and to facilitate data integration and outreach to collaborators and stakeholders. USGS' ability to provide such forecasts and to develop effective adaptive management strategies is dependent on a thorough understanding of the ecological and population responses of vulnerable species and habitats to climate change. Inherent in this effort is the ability to link physical climate models and ecological and biological responses at appropriate spatial and temporal scales for better management of species and habitats.

To further the goals of the NCCWSC, the focus in 2008 was on targeted research to assist fish and wildlife managers with species management issues, and to gather partner and stakeholder input into the future priorities and organization of the Center. Regional stakeholder workshops in 2009 focus on development of regional climate science partnerships within existing regional infrastructures to address priorities that are to be determined by scientific and decisionmaking oversight boards. Downscaled models of climate effects on flora and fauna are being developed and tested, and coordinated with applications and validation in local adaptive management plans. In 2010, the focus of the Center will include enhancements and expansion of: national down-scaled climate forecasts for regional evaluations and forecasting; establishment of co-located regional climate science partnership hubs to carry out priority ecological and populations modeling; workshops to further develop regional Climate Science Hubs (with input from the broad community of stakeholders); and development of partnerships in the adaptive management model to provide prioritization of research to forecast the impacts of climate change on ecological function, population response and fish and wildlife adaptation. The latter will inform further prioritization of research, and validation of models, for specific use by fish and wildlife managers. The Center will continue efforts started in 2009 to provide adaptive management models in addressing adaptation issues of resource managers.

As part of its effort in conducting and evaluating the success of the National Climate Change and Wildlife Science Center, USGS will conduct an external review of all projects and regional hub activities during 2010. This review will be conducted by the external science and decision making oversight boards that are an integral component of the joint decision making and collaborative structure of the NCCWSC.

In 2008, five research projects were implemented to investigate the responses of fish, wildlife, birds and vegetation to climate change: 1) impacts of climate change on bird conservation in arid and semi-arid regions of North America; 2) fate of endangered species in San Francisco Bay tidal marshes in response to sea level rise; 3) impacts of past and future stream temperature and flow changes on survival of endangered Atlantic salmon populations (<http://pubs.usgs.gov/fs/2008/3044/>); 4) potential influence of climate change on the survival of at-risk native salmonids; and 5) influence of climate change on migration and feedground use by Rocky Mountain ungulate populations and impacts on vegetation. In 2009, the National Climate Change and Wildlife Science Center Summary Workshop Report was released, with recommendations of over 100 partner and stakeholder groups; three regional stakeholder workshop; establishment of the Southeast Regional Assessment science partnership; and planning of three other regional climate science hubs (in conjunction with Federal, State and university collaborators); coordination of regional research planning in adaptive management with fish, wildlife, conservation, and land management agencies; and a national workshop to finalize recommendations for full implementation of Center activities.

2010 Program Performance

NCCWSC supports the Department's goal to improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment. The goal of the NCCWSC is to fulfil the congressional request for USGS to improve the science capacity for Federal agencies to respond to global warming and enhance science capacity in Federal land management and wildlife agencies.

Results of scientific activities are communicated to customers in academia, resource management agencies, and the general public through models, decision support tools, project reports and peer-reviewed scientific papers, Websites, databases, and meetings with stakeholders. Metrics of program success in past years have included the number of products including models, reports and publications, number of people accessing Websites, and the frequency of meetings with stakeholders. These outputs support the intermediate outcome goal of ensuring availability of long-term environmental and natural resource information, data, tools, and systematic analyses needed by fish and wildlife, land and other natural resource managers for informed decision making.

The USGS programs that will provide support to the NCCWSC were evaluated under the following Performance Improvement programs: Biological Research and Monitoring.

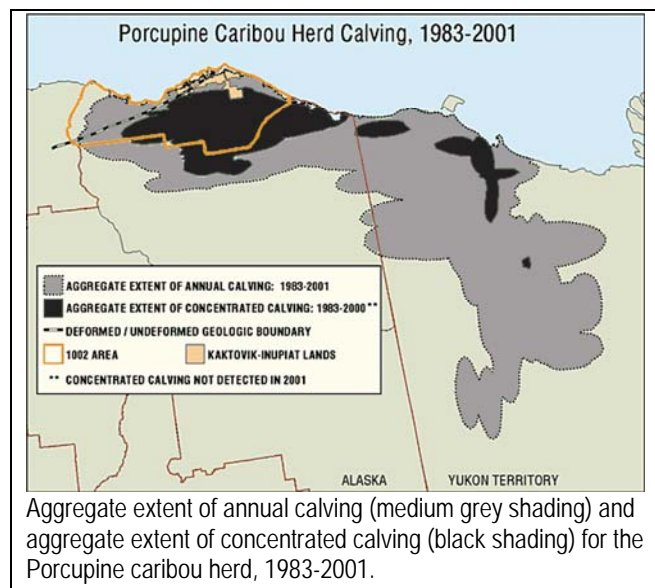
In response to the recommendations, the follow-up actions proposed in 2008 include:

- Focus research in the following high priority areas: population and habitat status and trends; causes and consequences of climate change, landscape change, and aquatic system change; vulnerability and risk analysis, and uncertainty assessment,
- Develop a plan to maximize access to research and data and provide timely forecasts on the condition of the Nation's biological resources under projected climate change scenarios.

Support for FWS Climate Impacts

Activities (+5,000,000 / +8 FTE) — The 2010 budget request for Support for FWS Climate Impacts Activities is \$5,000,000 and 8 FTE.

USGS is requesting the increase in order to support the recognized needs of FWS for a stronger scientific foundation to protect refuges and Trust Species. This scientific information will help FWS implement Strategic Habitat Conservation under conditions of climate change, including consequent sea level rise and other stresses to ecosystems. The USGS-FWS collaboration will benefit other Interior, Federal, State, Tribal, academic and private ecoregional fish, wildlife and land conservation efforts by providing an integrated ecological and population modeling capacity across the Nation.



2010 Initiatives

This vital activity will help to merge large-scale global change information with more local information that is relevant to resource managers. The increase will be used to integrate USGS capabilities in modeling current and projected physical and biological change across extensive landscapes and aquatic systems with studies of ecosystem and population processes. The new models will be applied to adaptive management of fish and wildlife faced with climate change. This will require strengthened population and ecosystem modeling capacities at the regional and local levels, better integration of remotely-sensed and other existing datasets and standardization of monitoring protocols in local applications, and a renewed focus on analytical support for FWS and state and tribal managers.

Program Performance Change

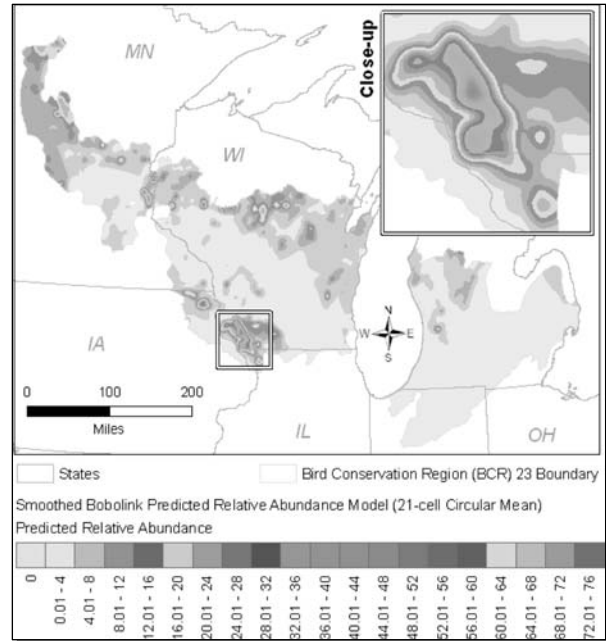
	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
# of systematic analyses and investigations completed	0	0	0	0	0	0	0	16
Total Projected Cost (\$000)	0	0	0	0	0	0	0	\$3,360
Projected Cost per systematic analysis (whole dollars)	\$210,000							
Comments	Systematic analyses typically require 1 to 5 years for completion.							
# of formal workshops and training provided to customers	0	0	0	0	5	5	+5	13
Total Projected Cost (\$000)	0	0	0	0	\$450	\$450	0	\$1,170
Projected Cost per workshop (whole dollars)	\$90,000							
Comments	For workshops, which support land managers in applying the science, and are a shorter-term product, the USGS used the average unit cost of \$90,000 based on the technical assistance and proportional share of the science management work activity.							

Program Overview

The USGS will provide ecological and population modeling capacity to FWS Landscape Conservation Cooperatives and information to FWS geospatial specialists. These specialists will characterize species-habitat interactions for Strategic Habitat Conservation. USGS ecological and population modelers will:

- Identify and determine the status of key ecosystem processes, and anticipate and react to stresses on ecosystems,
- Identify and design monitoring for fish and wildlife resources that are vulnerable to climate change,

- Describe landscape-specific adaptation strategies that take advantage of wildlife corridors,
- Identify resources offered by landscapes, and freshwater and ocean systems to support resilience and redundancy for fish, wildlife and plant populations and habitats,
- Develop new strategies to protect and restore coastal and marine resources under climate change and sea level rise conditions, and
- Work closely with FWS and State and Tribal managers on the design and analysis of adaptive management projects that evaluate management approaches and assessment methodologies.



Predicted relative abundance of Bobolink

Products will include:

- Tools to assist natural research managers in evaluating management alternatives,
- Recommendations for adaptation to challenges raised by rapid climate change for both terrestrial and aquatic systems, and
- Monitoring designs to support adaptation to climate change by natural resource managers.

The program change request recognizes the FWS need for a stronger scientific foundation to protect refuges and Trust Species and implement Strategic Habitat Conservation under conditions of climate change, including consequent sea level rise, and other stresses to ecosystems. The increase will be used to integrate USGS capabilities in modeling current and projected physical and biological change across extensive landscapes and aquatic systems and habitats with studies of ecosystem and population processes. This multi-scale approach is necessary to integrate large-scale global change information with more local information relevant to resource managers, thereby supporting adaptive management for fish and wildlife in the face of climate change. It will require strengthened population and ecosystem modeling capacities at the regional and local levels, better integration of remote-sensed and other existing datasets, standardization of monitoring protocols, improved large-scale syntheses, and a renewed focus on analytical support for FWS and State and Tribal managers. The USGS will provide ecological and population modeling capacity to FWS Landscape Conservation Cooperatives and provide information to FWS for use in Strategic Habitat Conservation. The USGS-FWS collaboration will benefit other DOI, Federal, State, Tribal, academic and private ecoregional fish, wildlife and land conservation efforts by providing an integrated ecological and population modeling capacity across all national efforts.

2010 Program Performance

The requested increase for the FWS Climate Impacts Initiative would result in 16 new systematic analyses and investigations delivered to customers in the outyears and five new formal workshops and training provided to customers in 2010 and 18 in the outyears.

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2010 President's Budget Request - BA in thousands
 Crosswalk of DOI Goals to Budget Activities
 (Dollars in Thousands)

Account/Budget Activity	DOI Goals			TOTAL
	Improve the Understanding of National Ecosystems and Resources Through Integrated Interdisciplinary Assessment	Improve the Understanding of Energy and Mineral Resources to Promote Responsible Use and Sustain the Nation's Dynamic Economy	Improve Understanding, Prediction, and Monitoring of Natural Hazards to Inform Decisions by Civil Authorities and the Public to Plan for, Manage, and Mitigate the Effects of Hazard Events on People and Property	
Surveys, Investigations, and Research				
Geog Res., Investigations & Remote Sensing	143,940			143,940
Geologic Hazards, Resources, and Processes	74,351	81,367	91,263	246,981
Water Resources Investigations	227,881			227,881
Biological Research	199,274			199,274
Enterprise Information	36,593	4,412	4,964	45,969
Global Change	58,177			58,177
Science Support	55,086	6,644	7,495	69,225
Facilities	84,655	10,258	11,484	106,397
SIR Appropriation, Total	879,957	102,681	115,206	1,097,844

Goal Performance Table

Target Codes:	SP = Strategic Plan Key measures	TBD = Targets have not yet been developed
	PART = PART Measure	UNK = Prior year data unavailable
	BUR = Bureau specific measure	NA = Long-term targets are inappropriate to determine at this time
Type Codes:	C = Cumulative Measure	A = Annual Measure F = Future Measure

End Outcome Goal 1.4: Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
% of targeted science products that are used by partners or customers for land or resource decision making (SP)	A	90%	93%	93%	≥90%	93%	≥90%	≥90%	0	≥90%
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
% of North American migratory birds for which scientific information on their status and trends are available (SP) (BRM)	A	26%	26%	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	0	27.1% (176/650)
X% of focal migratory bird populations for which scientific information is available to support resource management decisionmaking (USGS in coordination with FWS) (BRM)	A	UNK	56.88%	57.02%	57.16%	55.18%	55.22%	55.23%	+0.01%	55.28%
Comment	This performance measure is shared with the FWS. Changes are due to advances in knowledge through research on bird species identified by the FWS. Program performance is measured by quantifying contributions to science related to these species.									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of focal migratory bird populations for which species pages are available through the NBII (BIMD)	A	UNK	UNK	8%	15%	15%	22%	29%	+7%	51%
% of targeted fish and aquatic populations for which information is available regarding limiting factors (SP) (BRM)	A	31%	31%	38.66% (46/119)	41% (49/119)	41% (49/119)	41% (49/119)	41% (49/119)	0	43% (51/119)
% of targeted invasive species for which scientific information and decision support models are available to improve early detection (including risk assessments) and invasive species management (SP) (BRM)	A	51.6%	51.6%	54% (3.25/6)	54% (3.25/6)	54% (3.25/6)	54% (3.25/6)	54% (3.25/6)	0	54% (3.25/6)
X% improvement in detectability limits for selected, high priority environmentally available chemical analytes (BRM)	A	UNK	6%	12%	19%	19%	26%	33%	+7%	40%
Comment	Detectability limits will be improved through development of ultraclean procedures with higher-quality reagents.									
% of complete historical bird banding records available electronically	A					0	0	0	0	0
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
Increase long-term trend precision (decrease bias) for existing species monitored through the Breeding Bird Survey to enable a detection of 50% population decline of relevant species within 20 years (BRM)	A	UNK	0.008	0.008	0.008	0.008	0.008	0.008	0	0.008

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
X% of CRU students that work on subsequent fish and wildlife science advance degrees or obtain employment in the fish and wildlife or other natural resources field, within targeted dates post-graduation (CRU)	A	UNK	95%	95%	95%	95%	95%	95%	0	95%
X% of US land with land characterization and species distribution information available for resource management decision-making updated in the last 5 years (BIMD)	C	23.3%	42.3%	34%	36.4%	37%	40%	65%	+25%	65%
% US federally listed threatened and endangered fish species for which species profiles, occurrence data and maps are available through the NBII (BIMD)	C	UNK	UNK	17.5%	20% (28/138)	20% (28/138)	20% (28/138)	20% (28/138)	0	23% (32/138)
X% of North American amphibians and reptiles for which scientific information on their status (species distribution) are available in a standardized and exchangeable format, to improve conservation plans of federal and state agencies (BIMD)	C	90% (558/620)	91% (564/620)	92% (570/620)	93% (576/620)	93% (576/620)	93% (576/620)	93% (576/620)	0	93% (576/620)

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
X% of North American mammals for which scientific information on their status (species distribution) are available in a standardized and exchangeable format, to improve conservation plans of federal and state agencies (BIMD)	C	93% (434/467)	94% (439/467)	94% (439/467)	95% (444/467)	95% (444/467)	95% (444/467)	95% (444/467)	0	95% (444/467)
X% of the Nation's 65 principal aquifers with monitoring wells used to measure responses of water levels to drought and climatic variations to provide information needed for water-supply decisionmaking (SP) (WRD)	C	61%	61%	60% (39/65)	60% (39/65)	58% (38/65)	62% (40/65)	62% (40/65)	0%	62% (40/65)
Comment	The decrease in 2007 is the result of a decrease in funding to the Cooperative Water Program. Level performance continues in 2008 with a slight increase in performance anticipated for 2009. It is important to note that due to the current economic downturn, States are finding it more and more difficult to meet existing commitments. Therefore, these numbers might actually decrease even though USGS funding has held steady. USGS is hopeful the target for 2009 will be maintained in 2010.									
X% of targeted contaminants for which methods are developed to assess potential environmental and human health significance (SP) (WRD)	C	20%	85%	41% (78/188)	33% (76/232)	48% (138/287)	33% (76/232)	33% (76/230)	0	33% (Determined annually)
Comment	The target list (denominator) for this performance measure is redefined each year based on the chemicals for which methods were developed in the previous year and additional chemicals that are added based on current priorities. The annual target of 33% of the annual list assures that significant progress toward measuring new and understudied environmental contaminants is achieved each year. The list of chemicals for which methods will be developed in 2010 will be defined in September 2009 following a reassessment of priorities and accumulation of input from other agencies.									
X% of streamflow stations with real-time measurement/ reporting of water quality (WRD)	C	7% (520/7451)	9%	11% (820/7451)	11% (826/7508)	11.6% (787/7551)	11.9% (901/7551)	12% (910/7551)	+0.1%	12.4% (937/7551)

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
X% of U.S. with ground water quality status and trends information to support resource management decisions (WRD)	C	39%	58%	68%	70%	76%	80%	85%	+5%	100%
X% of States with web based Streamflow statistics tools to support water management decisions (WRD)	C	10% (5/50)	14% (7/50)	18% (9/50)	26% (13/50)	28% (14/50)	34% (17/50)	34% (17/50)	0	40% (20/50)
Comment	See http://water.usgs.gov/osw/streamstats/sonline.html for current national status.									
X% of river basins that have streamflow stations (SP) (WRD)	C	82% (1825/2223)	81% (1800/2223)	81% (1800/2223)	84% (1870/2223)	79% (1765/2223)	84% (1765/2102)	86% (1800/2102)	+2%	88% (1850/2102)
Total Actual/Projected cost streamgauge (national average) (\$000)		23,725	24,300	24,300	26,180	24,710	26,475	27,732	+1,257	30,525
Actual/Projected cost per streamgauge (national average) (whole dollars)		13,500	13,500	13,500	14,000	14,000	14,500	15,000	+500	16,500
Comment	<p>The measure "% of river basins that have streamflow information" assumes a single streamgauge in each basin, where 2,102 basins are defined nationwide by 8-digit hydrologic unit codes; however, many basins require more than one streamgauge to accurately assess conditions. This metric may never attain 100% because not all basins may require streamflow data (e.g., a basin with no population may not require any assessment of flood risk or land use changes).</p> <p>For 2009, the target was re-baselined to reflect the number of HUC units in the continental United States to provide for greater accuracy in reporting.</p> <p>It is possible that some decline in performance from that estimated from 2009 to 2010 may occur due to State and local funding partners budget issues; however, it is anticipated that USGS Water Science Centers will attempt to hold streamgauge operation and maintenance costs level by controlling costs, within their Centers in order to maintain the stability of the streamgauge network. It is important to note that any anticipated loss of streamgages may be exacerbated by the fact that the U.S. Army Corps of Engineers expects that funding for approximately 50 cooperatively funded streamgages in NY, MD, and PA will be discontinued in 2009 and additional streamgages discontinued in 2010.</p> <p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgauge network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgauge network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p>									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% improvement in accuracy of watershed (SPARROW) model prediction for total nitrogen and total phosphorus (measured as reduced error) (WRD)	C	31%	24%	20%	20%	20%	20%	20%	0	20%
X% of ground-water stations that have real-time reporting capability in the ground water climate response network (WRD)	C	67% (233/347)	47%	52% (181/347)	53% (290/544)	54% (290/544)	54% (324/598)	54% (324/598)	0%	54% (324/598)
Comment	<p>During 2006 and 2007, the network in total grew more than the number of wells reporting real-time because funding partners opted to fund more non-real-time stations. As a result, the relative proportion of the network that is reporting real-time declined. Real-time measurement continues to grow in the USGS-funded portion of the network.</p> <p>The numerator represents the number of ground-water stations with real-time reporting capacity within the network while the denominator represents the total number of sites within the climate response network.</p> <p>The USGS has requested to redefine this measure. As noted in the 2006 and 2007 year-end reports, overall expansion of the network can result in a decrease in the performance metric because not all of the new wells added to the network are real-time.</p> <p>In 2008, the network was expanded to include both Federal and cooperatively funded wells to make a larger climate network; as a result of that change the denominator has changed. The mixture of wells that make up the network as well as the total number of wells in the network will continue to change over time. Therefore, the percentages for 2009 and 2010 are expected to change slightly while the number of wells tallied to compute those percentages could change significantly. The refined measure was proposed and approved and will, beginning in 2011, more accurately measure the USGS performance of the climate response network.</p>									
% of U.S. with streamwater quality data for status and trends assessment and information to support resource management decisions (WRD)	C	UNK	UNK	16.6%	UNK	33.4%	49.8%	66.8%	+17%	100%
Discontinued streamgages, cableways, and ground-water well remediated	A					0	0	0	0	0
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of streamgages upgraded with high data rate radios to increase frequency of radio transmission	C					4,500	4,900	5,300	+400	6,500
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
% of discharge measurements made with hydroacoustic instruments	C					35%	40%	45%	+5%	70%
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
X% of U.S. with ground water availability status and trends information to support resource management decisions (WRD)	C	7% (4.5/65)	8% (5.5/65)	9% (6/65)	11% (7/65)	11% (7/65)	12% (8/65)	14% (9/65)	+2%	18% (12/65)
Total Actual/Project cost ground water status (\$000)		1,575	1,925	2,100	2,625	2,625	3,280	4,050	770	6,000
Actual/Projected cost per ground water status (whole dollars)		350,000	350,000	350,000	375,000	375,000	410,000	450,000	40,000	500,000
Comment	<p>Regional studies in 2007 included Carolina Coastal Plain, Denver Basin, Central Valley, Michigan Drainage Basin, Mississippi Embayment, and Basin and Range carbonate aquifers. Changes reflect the addition of one new study area in 2008 (Columbia Plateau), one in 2009 (High Plains), and another in 2010 (Floridan).</p> <p>The average cost per study varies depending on the scope and complexity of the studies being conducted in any given year. Initially, studies were smaller in scope resulting in a smaller average cost per study. Over time, the scope of studies has expanded requiring more funding per study.</p> <p>Measure indicates the number of regional ground-water evaluation projects (status and trends in ground-water availability) that coincide with the Nation's 65 principal aquifers, as designated in the National Atlas. Average cost per project is \$450,000, though actual costs can range from <\$300,000 to >\$600,000 per project per year, depending on the scope and complexity of the study. Project costs include salaries, travel, training, vehicles, supplies, report production, and printing.</p>									
% of proposed streamflow stations currently in operation that meet one or more federal needs (WRD)	C	61% (2700/ 4425)	62% (2742/ 4425)	62% (2742/ 4425)	64% (2845/ 4425)	62% (2940/ 4744)	62% (2940/ 4744)	63% (2990/ 4744)	+1%	65% (3100/ 4744)
Total Actual/Project cost streamflow stations (\$000)		35,100	36,450	37,017	39,830	41,160	42,630	44,850	+2,220	51,150

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Actual/Projected cost per streamflow stations (whole dollars)		13,000	13,293	13,500	14,000	14,000	14,500	15,000	+500	16,500
Comment	<p>The change in 2008 was a result of the increase for NSIP streamgauge operations and the increases for Hazards Assessment and Mitigation. The number of streamgages and the number of those gages that meet Federal needs can fluctuate from year to year as streamgauge funding is a cooperative endeavor with numerous Federal and non-Federal partners.</p> <p>During 2008 the denominator was re-baselined due to the reevaluation of requirements for the national network based on comments from external review by the National Research Council and changes to USGS water quality networks. This baseline increase of 319 streamgages makes the changes in 2009 and 2010 more difficult to assess, but the number of streamgages that will likely decrease is the best estimate available.</p> <p>This performance measure is very sensitive to losses of streamgages from the network. Streamgages identified to be fully funded by NSIP are sometimes targeted by funding partners to lose cooperative funds with the assumption that NSIP will replace the lost funds. There is a possibility that the number of streamgages losses could be less than estimated here for 2010. It is important to note that any anticipated loss of streamgages may be exacerbated by the fact that the U.S. Army Corps of Engineers expects that funding for approximately 50 cooperatively funded streamgages in NY, MD, and PA will be discontinued in 2009 and at least that number in 2010.</p> <p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgauge network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgauge network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p>									
% of surface area of the conterminous U.S. for which high-resolution geospatial datasets are cataloged, managed, and available through <i>The National Map (SP) (NGP)</i>	C	UNK	UNK	99.71% (698/700)	100% (700/700)	99.86% (699/700)	99.86% (699/700)	100% (700/700)	0	100% (700/700)
Comment	The National Geospatial Program continues to maintain the geospatial data layers over the conterminous US. There are 7 data layers to maintain.									
Square miles of the US with updated high resolution elevation data (NGP)	A					93,153	58,000	58,000	0	50,000
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget. Not a cumulative measure.									
Square miles of the US with high resolution, leaf off, <1m imagery data (NGP)	A					79,751	75,000	200,000	*+125,000	75,000
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget. *Increase due to National Geospatial Intelligence Agency (NGIA) Border Program. Not a cumulative measure.									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of total cost FSA and USGS saved through partnering with other entities for imagery acquisition of 1-meter NAIP orthoimagery (NGP)	A	44% (3.23/7.35)	41% (4.43/10.8)	32% (2.3/7.2)	36% (5.0/14.0)	27%	36% (5.0/14.0)	40% (5.6/14)	+4%	40% (5.6/14)
Comment	The USGS expects an increase of FSA-contributed funds in 2009 and 2010 over the 2008 level.									
% of data acquisition costs for <i>The National Map</i> funded by partners (NGP)	C	47%	74%	59.3% (11.9/20)	60% (12/20)	71% (14/20)	60% (12/20)	71% (14/20)	+11%	71% (14/20)
Comment	Numerator is the total funds contributed by partners; the denominator is the total funds used to purchase data. The USGS expects partner funding to remain at the 2008 level.									
% of time that USGS managed geospatial data and information dissemination systems (i.e., Geospatial One-Stop Portal, <i>The National Map</i> , NSDI Clearinghouses) are accessible online to customers (NGP)	C	UNK	UNK	UNK	Baseline	97%	97%	98%	+1%	99%
Comment	NGP will monitor, log, and summarize the NGP geospatial data dissemination IT systems' accessibility times. The time will be the average for these systems divided by 24x7x365. The systems' availability will be reliant on the Department's Enterprise Services Network. In 2008 USGS baselined the number to enable the bureau to establish a realistic projection of the online availability of USGS databases and applications such as <i>The National Map</i> . There were several DOI Enterprise Services Network system outages across the country during August and September 2008.									
% of customers that identify or indicate (via a survey) that USGS NGP Outreach materials and activities (information and publications, conferences, training and workshops) met their needs/ requirements (NGP)	C	UNK	UNK	UNK	Baseline	20%	20%	30%	+10%	75%
Comment	In 2008, this measure was baselined to determine the number of customers. The percent of customers is expected to increase in 2010 based on 2009 results.									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of GIO partners reporting satisfaction with partnership agreements (NGP)	C	UNK	UNK	UNK	Baseline	75%	75%	80%	+5%	90%
% of total cost of geospatial data and geospatial services saved through Geospatial Line of Business Joint Business Case (NGP)		UNK	UNK	UNK	UNK	UNK	Baseline	TBD	TBD	TBD
Comment	The OMB Geospatial Line of business is a cross-government project that is standardizing and consolidating geospatial data and services across the Federal government. The Geospatial SmartBuy Agreement, issued by the General Services Administration on March 6, 2009, will be awarded and contracts available in mid-May 2009. 2009 is the baseline year.									
% of US surface area with contemporary land cover data needed for major environmental monitoring and assessment programs (SP) (Geography)	C	65%	94%	95% (286/300)	100% (300/300)	99.3% (298/300)	40% (120/300)	100% (463/463)	+60%	40% (120/300)
Comment	In 2009, USGS will begin the next generation land cover dataset. Efforts in 2010 will focus on completing the 2006 NLCD product for the conterminous U.S. only. These areas will be included in the next NLDC updated product of 2011.									
X% of data accessible: X% of satellite data available from archive within 24 hours of capture (Geography)	C	97.2%	98.7%	95% (285/300)	95% (285/300)	95% (285/300)	95% (285/300)	100% (300/300)	+5%	100% (300/300)
Total Actual/Projected Cost scene (\$000)		43,725	40,159	40,962	40,962	40,962	40,159	40,159	0	40,159
Actual/Projected Cost per scene (whole dollars)		14.64	14.64	14.64	14.64	14.64	14.64	14.64	0	14.64
Comment	Measures the percent of scenes captured and made available to users within 24 hours (numerator is the number of scenes available (300 in 2010) and denominator is the number of scenes collected (300) every 24 hours.									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements (# of completed eco-region assessments out of a total of 84 eco-regions) (Global Change)	C	37%	48%	61% (51/84)	69% (58/84)	71% (60/84)	86% (72/84)	100% (84/84)	+14%	Measure completed in 2010.
% of surface area with temporal and spatial research and modeling and assessment/data coverage to meet targeted fish and wildlife adaptation planning and adaptive management requirements (NCCWSC) (# of completed down-scaled global models to regional scales out of a total of 12 regional flora and fauna climate change adaptation models and forecasts.		UNK	UNK	UNK	UNK	60% (3/5)	60% (6/10)	83% (25/30)	+23%	+10%
X% of US with regional geologic map coverage that is available to customers through the NGMDB	C	53%	55%	60.4%	63%	64.6%	65%	67%	+2%	73%
Total Actual/Projected Cost square mile (\$000)					23,460	23,460	23,460	23,460	0	
Actual/Projected Cost per Square Mile (whole dollars)					1,750	1,750	1,750	1,750	0	
Comment	The percentages shown above are calculated by dividing the coverage (maps published) within last year by square miles of the U.S. which is 3.7 million square miles.									

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
X% of geologic investigations in National Park Service (NPS) units that are cited for use by the NPS within three years of delivery (NCGM)	A	80%	80%	100%	80%	92%	80%	80%	0	80%
Comment	The percentages shown above are calculated by dividing the # of pubs used by NPS within 3 years by the total # of pubs produced for NPS. An 80% target was chosen in consultation with OMB as a target for customer use of USGS investigations.									
X% of EDMAP students that work on subsequent geoscience degrees or obtain a job in a geoscience field (NCGM)	A	94%	95%	94%	95%	100%	95%	95%	0	95%
Comment	The percentages shown above are calculated by dividing the EDMAP trained students (grant recipients) who went on in geoscience fields (education or employment) by the number of students able to be reached within 4 years after their training to confirm status. Of those trained, most have stayed in the geosciences. The resulting consistently high percentage is an indication that the training / mentoring provided by the program is effective.									
X% of U.S. with geologic maps that are being integrated into ground-water availability status and trends to support resource management decisions (NCGM)	A	5%	6%	8%	10%	12%	11%	12%	+1%	15%
Comment	The percentages shown above are calculated by dividing the number of aquifers with completed geologic mapping by the number of principal aquifers, which is 65. 2008 Plan reflects program growth.									
# of counties or comparable jurisdictions that have adopted hazard mitigation measures based in part on geologic mapping and research (NCGM)	A	10	12	14	14	17	15	15	0	16

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of NPS units for which environmental characterization based on airborne remote sensing is provided as digital GIS products and for which products are cited or use by NPS within 2 years (C&M)	C	50% (6/12)	50% (7/14)	60% (10/16)	75% (12/16)	75% (12/16)	75% (12/16)	80% (19/24)	+5%	85%
% of regional and major topical studies for which interpretive and synthesis products are cited by identified partners and users within 3 years of study completion (C&M)	C	80% (23/29)	80% (24/30)	80% (25/32)	80% (26/32)	80% (26/32)	80% (25/31)	80% (26/32)	0	80%
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (2127/ 2127)	100% (2157/ 2157)	100% (2879/ 2879)	100% (2530/ 2530)	100% (5513/ 5513)	100% (4436/ 4436)	100% (3007/ 3007)	0	100% (3104/ 3104)
% satisfaction with scientific and technical products and assistance (SP)	A	96%	91%	90%	≥90%	93%	≥90%	≥90%	0	≥90%
Efficiency and Other Output Measures										
Average cost per sample for selected, high priority environmentally available chemical analytes (BRM)	A	\$700	\$680	\$680	\$650	\$660	\$640	\$621	-\$19	\$600
Actual/Projected Cost per sample (whole dollars)		700	680	680	650	660	640	621	-19	600
Comment	Average cost per sample decrease as a result of developing new methods for analysis, adoption of computerized chromatographic or other automated techniques, and improvements in instrumentation. Increase is partially offset by increased costs of reagent chemicals for analyses due to increases in costs of manufacturing petrochemical products and costs of shipping.									
# of gigabytes collected annually (Total)	A	6,140.8	76,768.8	96,337.8	24,554.8	134,138.8	145,009.8	129,502.8	-15,507	129,502.8
# of gigabytes managed and distributed cumulatively (Total)	C	109,842	190,210.8	282,347.6	253,660.4	414,880.4	559,827.2	689,570.0	+129,742.8	1,078,225.6

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of terabytes collected annually (Geography)	A	438.8	537.9	96	278	535.2	270	270	0	270
# of terabytes managed and distributed cumulatively (Geography)	C	2,887.4	3,425.3	4,255.9	3,556.6	3,840.6	4,300	4,600	+300	5,400
# of systematic analyses and investigations completed (Total)	A	2,127	2,157	2,879	2,530	5,513	4,436	3,007	-1,429	3,104
Total Actual/Projected Cost systematic analyses (\$000) (National Average)						1,782,711	811,480	831,890	+20,050	830,400
Actual/Projected Cost per systematic analysis (whole dollars) (National Average)		220,000	230,000	240,000	250,000	250,000	250,000	260,000	+10,000	280,000
Comment	<p>Correction: In 2008 USGS rebaselined this measure using a new system, the Information Products Data System (IPDS). The pilot is done and full implementation is underway, but definitions of categories to include are still being refined. As these definitions weren't fully applied in 2008, the actual was reported in error and should be corrected to 4,681. The error cascades into out year targets and the corrected 2009 target should be 2,940. The 2010 target and years beyond have been adjusted to reflect the rebaseline correction.</p> <p>Cost per systematic analyses ranges from \$100,000 – \$400,000. Cost per scientific product is an average that includes the cost of writing, editing, peer review, and publication of each product, as well as the cost of the studies from which the products are derived. Reimbursements from other Federal agencies are included in the calculation.</p>									
# of formal workshops or training provided to customers (Total)	A	403	313	392	195	386	269	300	+31	325
Total Actual/Projected Cost workshop (\$000) (National Average)						13,882	12,083	13,006	+923	13,802
Actual/Projected Cost per workshop (whole dollars) (National Average)		4,000	6,000	8,000	10,000	10,000	12,000	15,000	+3,000	20,000
Comment	<p>Cost per workshop is a national average for technical assistance that includes the cost of agenda development, revenue, and materials. Cost ranges from \$200 to \$30,000 per workshop.</p>									
# of data standards used in implementing <i>The National Map</i> (NGP)	A	22	22	22	22	22	22	22	0	22

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of students complete degree requirements for MS, PhD, and post doctoral program under the direction and mentorship of Unit Scientists (CRU)	A	100	103	95	90	83	90	90	0	120
Amount of fire-related data and information available online via the NBII, to assist land managers in fire management decision making (BIMD)	C	1.5gb	15.42gb	23.3gb	30gb	35gb	35gb	40gb	+5gb	45gb
Comment	Measure is cumulative; target reflects normal growth.									
# of Natural History Museum specimen data records available online via the NBII, to assist researchers in identifying and addressing threats to human and animal health (BIMD)	C	20 million	57.6 million	59.3 million	60 million	60 million	79 million	61 million	-18 million	63 million
Comment	Much work in this area suspended in 2009 due to budget cuts. No records actually lost.									
# of NBII Clearinghouse metadata records (BIMD)	C	UNK	UNK	29,170	41,000	41,000	41,500	42,000	+500	43,500
Comment	Measure is cumulative; target reflects normal growth.									
Amount of invasive species data and information available online via the NBII, to assist in modeling and forecasting the spread of invasives (BIMD)	C	800 mb	1,127 mb	1,441 mb	1,441 mb	1,542 mb	2,400 mb	1,750 mb	-650	2,050 mb
Comment	Some work in this area slowed in 2009 due to budget cuts. No records actually lost.									
Average cost per gigabyte of data available through servers under Program control (BIMD)	C	\$63,000	\$17,155	\$3,794	\$3,794	\$3,794	\$3,794	\$3,794	0	\$3,794

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Average cost per analytical result, adjusted for inflation, is stable or declining over a 5-year period (WRD)	A	\$8.63	\$8.34	\$8.08	\$8.64	\$7.87	\$8.26	\$8.26	0	\$8.84
Comment	The cost of each analytical result will increase by 5 percent in 2009. The National Water Quality Lab (NWQL) was forced to institute a price increase due to a unilateral increase by GSA in lease costs at the Denver Federal Center. Through efficiencies and cost containing measures the NWQL was able to contain the price increase to only 5 percent in 2009 and 2010.									
# of real-time streamgages reporting in NWIS-Web (WRD)	A	6,246	6,496	6,728	6,830	6,936	6,940	7,100	+160	7,200
Total Actual/Projected cost real-time streamgages (\$000)		84,321	87,696	90,828	95,620	95,200	95,200	99,400	+4,200	118,800
Comment	The number of streamgages reporting data in real-time will be enhanced by funds received under the American Recovery and Reinvestment Act as some older radio transmitters are being replaced with high data rate radio transmitters.									
# real-time ground-water sites reporting in NWIS-Web (WRD)	A	796	917	983	984	1,120	1,130	1,140	+10	1,170
Comment	Exceeded 2008 target because of increased interest by partner agencies, who contributed additional funding amounts that were not anticipated when targets were set.									
# real-time water-quality sites reporting in NWIS-Web (WRD)	A	1,125	1,102	1,249	1,249	1,402	1,410	1,418	+8	1,442
Comment	Exceeded 2008 target because of increased interest by partner agencies, who contributed additional funding amounts that were not anticipated when targets were set.									
X% of WRD streamflow stations with 30 or more years of record (WRD)	C	58%	59%	59%	58% (3970/ 6830)	60%	57% (4080/ 7200)	58% (4120/ 7050)	+1%	60% (4320/ 7200)
Total Actual/Project cost streamflow stations (\$000)		48,897	51,597	53,589	55,580	59,160	61,200	61,800	+600	71,280
Actual/Projected cost per streamflow stations (whole dollars)		13,500	13,500	13,500	14,000	14,500	15,000	15,000	0	16,500

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	<p>The denominator changes every year because it reflects the number of streamgages reporting in real time in NWISWeb. For this measure, the denominator changes annually because the measure represents the number of streamgages with 30 or more years of record as a percentage of the total number of streamgages in operation. Since the total number of streamgages changes each year, the denominator must change if this measure is to reflect the state of the streamgaging network accurately.</p> <p>Although performance decreases for NSIP in 2009, the \$2M increase allows USGS to help stabilize the streamgage network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgage network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p>									
X% of daily streamgages (streamflow stations) with data that are converted from provisional to final status within 4 months of day of collection (WRD)	C	10% (5/50)	20% (10/50)	24% (12/50)	29% (15/50)	28% (14/50)	29% (14/50)	32% (16/50)	+3%	35% (18/50)
Comment	The percentage is derived by dividing the numerator, which represents the number of states that successfully convert provisional data to final status within 4 months, by the denominator which is the total number of States, 50.									
# of hours for fieldwork, compilation, and publication of a typical geologic map (NCGM)	A	3,070	2,980	2,890	2,810	2,786	2,720	2,670	-50	2,620
# of EDMAP students trained each year (NCGM)	A	62	66	58	60	44	45	45	0	45
Total actual/projected cost student (\$000)					473,000	473,000	473,000	510,000	+37,000	510,000
Actual/projected cost per student (whole dollars)					7,880	7,880	7,880	8,500	+620	8,500
Comment	Costs shown for the training above are obtained from grant DI-1s.									
# of digital geographic information products for priority National Park Service units that provide environmental characterization based on airborne remote sensing (C&M)	C	10	8	10	10	10	10	11	+1	12

Goal Performance Table

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Fraction of significant landfalling hurricanes (coterminous US) for which post-storm assessments of impact are developed (C&M)	A	3/3	¾	0/1	≥3/4	2/2	≥3/4	≥3/4	0	≥3/4
% of open Ocean and Great-Lakes shoreline of coterminous US for which up-to-date characterization of the shoreline is provided (C&M)	C	62%	80%	80%	90%	90%	90%	95% (5700/6000)	+5%	95% (5700/6000)
Cost of collection and processing of airborne remote sensing data for coastal characterization and impact assessments (C&M)	C	.56	.55	.57	.35	.50	.45	.32	-.13	.30

End Outcome Goal 2.4: Improve the understanding of Energy and Mineral Resources to Promote Responsible Use and Sustain the Nation's Dynamic Economy.

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
% of targeted science products that are used by partners or customers for land or resource decision making (SP)	A	86.5%	87.5%	99%	≥90%	95%	≥90%	≥90%	0	≥90%
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of energy and mineral resource information and systematic analyses needed by land and resource managers for informed decision making										
# of targeted basins/areas with energy resource assessments available to support management decisions (SP) (ERP)	A	7	6	5	5	5	5	5	0	5

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of targeted non-fuel mineral commodities for which up-to-date deposit models are available to support decision making (SP) (MRP)	C	0%	0%	0%	7%	7%	20%	53%	+33%	100%
Comment	The denominator is the total number of targeted commodities identified by internal and external experts in the rebaselining process in 2007. The 15 commodities are copper, lead, zinc, molybdenum, nickel, cobalt, chromium, beryllium, platinum-group metals, potash, rare earth elements, phosphate rock, titanium and titanium dioxide, iron ore, and gold.									
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (10/10)	100% (11/11)	100% (11/11)	100% (8/8)	100% (8/8)	100% (8/8)	100% (9/9)	0	100% (10/10)
% satisfaction with scientific and technical products and assistance (SP)	A	97.5%	97.5%	97%	≥80%	97%	≥80%	≥80%	0	≥80%
Efficiency and Other Output Measures										
# of gigabytes collected annually (ERP)	A	97.793	158.048	37.409	20.038	1.173	3.1189	3.3229	+0.204	3.3831
# of gigabytes managed and distributed cumulatively (Total)	C	367.42	525.559	563.047	561.164	564.22	567.751	573.538	+5.787	584.027
# of metadata records (Data Preservation)	C	UNK	UNK	UNK	UNK	UNK	New measure baseline	TBD	TBD	TBD
# of systematic analyses and investigations completed (Total)	A	10	11	11	8	8	8	9	+1	10
Total Actual/Projected Cost systematic analyses (\$000) (ERP)		19,110	9,900	7,800	13,750	13,750	13,750	13,750	0	
Average cost of a systematic analysis or investigation (ERP)	A	\$2.73M	\$1.98M	\$1.3M	\$2.75M	\$2.46M	\$2.75M	\$2.75M	0	\$2.75M
Comment	2007 actual exceeded target. Target cost per systematic analysis is based on a National average that includes research in varied terrain, conditions, and geographic locations. The analyses completed in 2007 did not include extreme conditions and the cost was therefore were lower than the National average.									
Average cost of a systematic analysis or investigation (MRP)	A	\$4.18M	\$4.3M	\$3.7M	\$4.9M	\$4.7M	\$4.9M	\$9.0M	+\$4.1M	\$5.0M

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	The increased average cost estimated for 2010 results from the decrease in MRP in 2007 and the description of fixed and other costs in 2008 and 2009. These budget fluctuations have postponed the completion of two projects thereby increasing project costs and the overall average cost for 2010.									
# of formal workshops or training provided to customers (Total)	A	16	15	15	14	14	14	17	+3	16
Total Actual/Projected cost workshop (\$000)		120,000	120,000	120,000	120,000	120,000	120,000	120,000	0	
Actual/Projected cost per workshop (whole dollars)		15,000	15,000	15,000	15,000	15,000	15,000	15,000	0	
# of mineral commodity reports available for decisions (MRP)	A	746	690	717	700	649	700	720	+20	720
Comment	In 2008 publication of commodity data was changed to improve cost efficiency, reducing the number of reports for the same amount of data. This change was captured in the 2008 actual but not in the 2009 target which should be 650.									

End Outcome Goal 4.2: Improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
% of communities/ Tribes using DOI science on hazard mitigation, preparedness and avoidance for each hazard management activity (SP)	C	45%	48%	50%	53%	53%	53%	55%	+2%	56%
% of targeted science products that are used by partners or customers for land or resource decision making (SP)	A	UNK	UNK	UNK	UNK	87%	≥90%	≥90%	0	≥90%

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Provide information to assist communities in managing risks from natural hazards										
# of areas for which detailed hazard assessments are completed (SP)	C	UNK	49	51	53	53	55	58	+3	64
Comment	The cost per hazard assessment ranges from \$100K and \$1.0M. Cost is strongly dependant on complexity of the hazard accessibility of the site.									
Total Actual/Projected cost hazard assessment (whole dollars)			600,000	600,000	600,000	6,000,000	6,000,000	6,000,000	0	6,000,000
# of urban areas for which detailed earthquake hazard maps are completed (EHP)	A	3	3	3	4	4	4	5	+1	6
# of metropolitan regions where Shakemap is incorporated into emergency procedures (SP) (EHP)	A	5	5	5	5	5	5	5	0	5
# of GSN next-generation systems deployed (of 87 needed)* (EHP)	C					1	9	9	0	9
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
% of potentially hazardous volcanoes with published hazard assessments (SP) (VHP)	C	62.8% (44/70)	64.3% (45/70)	65.7% (46/70)	67.1% (47/70)	67.1% (47/70)	68.6% (48/70)	Replaced in 2009 by new measure below because redefining the measure baseline (denominator) to align with definition of moderate to very high threat volcanoes in VHP's blueprint for the future, the National Volcano Early Warning System (NVEWS; OFR 2005-1164).		
% of moderate to very high threat volcanoes with published hazard assessments (denominator reset to 101) (SP) (VHP)	C	UNK	UNK	UNK	UNK	UNK	47.5% (48/101)	48.5% (49/101)	+1.0%	50.5% (51/101)

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of monitoring and telemetry nodes upgraded (e.g., analog to digital conversion, added sensors, improved power systems, upgraded radio transmitters and receivers) (VHP)	A					12	13	12	-1	10
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
% of very high threat volcanoes with at optimal level monitoring (X number of 18) (VHP)	C					22.2%	22.2%	22.2%	0	22.2%
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
<i>Use Rate: Landslide Hazards: # of responses to inquiries from the public, educators, and public officials to the National Landslide Information Center on hazard mitigation, preparedness and avoidance strategies for landslide hazards (LHP)</i>	A	5,200	1,600	1,600	1,600	1,600	1,200	1,200	0	1,200
Comment	With the efficiency and improvement of the Landslide Hazards Program web site, more users are able to get the information that they need without making a specific inquiry.									
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100%	100%	100% (248/ 248)	100% (239/ 239)	100% (221/ 221)	100% (232/ 232)	100% (247/ 247)	0	100% (247/ 247)
% satisfaction with scientific and technical products and assistance (SP)	A	UNK	UNK	87%	≥80%	87%	≥80%	≥80%	0	≥80%
Efficiency and Other Output Measures										

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of systematic analyses and investigations completed (Total)	A	6	4	248	239	221	232	247	+15	247
Actual/Projected Cost per systematic analyses (whole dollars) (National Average)				80,000	100,000	100,000	110,000	110,000	0	120,000
Comment	<p>The omnibus restores external grant funding and provides partial coverage of fixed costs, resulting in an increase in the expected number of systematic analyses produced in 2009.</p> <p>In the 2007 Plan, a new baseline was established for the systematic analyses. The decline in publications in 2008 is due to the increased level of response to eruptions of Mount St. Helens, Augustine, and Kilauea. The estimate for 2009 is based on the average rate of release for years without major hazard events. National average ranges from \$20,000 to \$200,000.</p>									
Cumulative number of ANSS seismic monitoring stations (EHP)	C	40 cuml. 563)	27 (cuml. 723)	63 (cuml. 786)	17 (cuml.803)	19 (cuml. 805)	17 (cuml. 822)	12 (cuml. 834)	+12	0 (cuml.834)
Comment	<p>Average cost per sensor (purchase and install) varies by the type of sensor installed and its performance requirement, from \$5,000 to about \$75,000. For example, the 17 sensors that were purchased in 2008 -for installation in 2009- cost an average of about \$50,000. The President's Tsunami Initiative, which increased funding to the program in 2005, did not include funding for new seismic stations in the U.S. Thus, the number of new stations has decreased every year as development funding dwindles (see figure at end of narrative). An exception occurred when partner contributions from the National Science Foundation in 2004 installed 95 stations well above the target. Note that significant performance improvements were realized in 2005-2006 in the GSN program from Tsunami Initiative funding in that program. In 2009, under a CR at the 2008 enacted level, the program would retain ~\$0.8M of ANSS development funds, which will be used to expand the network. By 2010, under a current services budget, ANSS development funding will end, as operating costs increase for sensors and processing systems that were installed the previous year(s). This results in no new sensors targeted for 2010. An over-target request is being submitted that will allow further expansion of ANSS in BY2010 (+\$3.2 million for +100 new sensors).</p> <p>Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.</p>									
# of formal workshops or training provided to customers (Total)	A	19	15	14	12	19	12	13	+1	13
Total Actual/Projected Cost workshop (\$000) (VHP)		120	120	120	120	120	120	120	0	120
Actual/Projected Cost per workshop (whole dollars) (VHP)		30,000	30,000	30,000	30,000	30,000	30,000	30,000	0	30,000

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment (Geomag)	Workshop number and costs vary from year to year depending on program objectives, partner contributions and other factors. For example, in one year, a small number of low-cost workshops may be held in another year, one or two large workshops may be held to bring multiple stakeholder groups together. Workshop costs may also span fiscal years because planning may begin 1-2 years in advance.									
# of sites (mobile or fixed) monitored for ground deformation to identify volcanic activity (VHP)	C	88	94	159	170	174	175	185	+10	200
# of areas in the U.S. for which models exist that are used to interpret monitoring data (LHP)	C	4 1/3	4 2/3	5	5 1/3	5 1/3	5 2/3	6	+1/3	7
# of volcanoes for which information supports public safety decisions (VHP)	C	51	51	52	52	52	52	Redefined in 2009 to align with definition of basic real time monitoring in VHP's blueprint for the future, the National Volcano Early Warning System (NVEWS; OFR 2005-1164).		
Total Actual/Projected cost volcanoes (\$000)		2,000	0	1,000	0					
Actual/Projected Costs per # volcano (whole dollars)		1,000,000		1,000,000	800,000	800,000	800,000	800,000	0	800,000
Comment	The cost depends strongly on: (1) location – whether access is by truck, helicopter, or ship + helicopter and (2) complexity of the installation—whether basic, short-period, analog seismic networks or includes digital broadband seismic, GPS, webcams, etc. Permitting on protected federal lands can also be a substantial cost.									
X% of potentially active volcanoes monitored (VHP)	C	72.9% (51/70)	72.9% (51/70)	74.3% (52/70)	74.3% (52/70)	74.3% (52/70)	74.3% (52/70)	Redefined in 2009 to align the numerator to basic real time monitoring and denominator to moderate to very high threat volcanoes as defined in VHP's blueprint for the future, the National Volcano Early Warning System (NVEWS; OFR 2005-1164).		
% of moderate to very high threat volcanoes with at least basic real time monitoring (VHP)	C	UNK	UNK	UNK	UNK	UNK	37.6% (38/101)	37.6% (38/101)	0	39.6% (40/101)
X% data availability for real-time data from the GSN (GSN)	A	89%	88%	87.8%	86%	87%	84%	88%	+4%	90%
Comment	Omnibus restores cuts proposed in President's request and provides an increase for upgrading stations. These increases will show improvements to 88% in current and out years.									

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Data processing and notification costs per unit volume of input data from sensors in monitoring networks (in cost per gigabyte) (GSN)	A	0.79 \$k/GB	1.30 \$k/GB	1.19 \$k/GB	1.33 \$k/GB	0.89 \$k/GB	1.33 \$k/GB	1.30 \$k/GB	-0.03 \$k/GB	1.20 \$k/GB
Comment	Omnibus restores cuts proposed in President's request and provided increase that will improve performance and decrease unit cost to \$1.30 \$k/GB in 2009 relative to original target.									

End Outcome Goal 5.1: Increase Accountability

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
Obtain unqualified audit (SP)	A	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	--	Unqualified Opinion
Establish and maintain an effective, risk-based internal control environment as defined by the Federal Manager's Financial Integrity Act (FMFIA) and revised OMB Circular A-123 (SP)	A	100%	100%	100%	100%	100%	100%	100%	0	100%
Intermediate Outcome Measures and Bureau and Outcome Measures Improved Financial Management										
Corrective actions: Percent of material weaknesses, and material non-compliance issues that are corrected on schedule (SP)	A	UNK	UNK	UNK	UNK	UNK	100%	100%	0	100%

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
<i>Corrective Actions:</i> Percent of established targets in Financial Performance Metrics met as defined in FAM No. 2003-015. (SP)	A	100%	100%	100%	100%	100%	100%	100%	0	100%

End Outcome Goal 5.2: Advance Modernization/Integration

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
Percent of systems and lines of business/ functional areas associated with an approved blueprint that are managed consistent with that blueprint (SP)	A	UNK	UNK	UNK	UNK	100%	100%	100%	0	100%
Percent of IT systems that have Certification and Accreditation (C&A) and are maintaining C&A status (SP) (EIS&T)	A	100%	100%	100%	100%	100%	100%	100%	0	100%
Comment	USGS has 12 major systems and all have undergone and are maintaining their C&A status.									
Intermediate Outcome Measures and Bureau and Outcome Measures E-Government and Information Technology Management										
<i>Efficient IT Management.</i> Score achieved on the OMB Enterprise Architecture Framework (SP) (EIS&T)	A	Level 4	Level 3	Level 4 – complete Level 3 – Use and Results	Level 4	Level 4 on “Completion” “Use,” and “Results” categories	Level 4 in all areas	Level 4 in all areas	0	Level 4 in all areas

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	The Enterprise Architecture (EA) framework measures maturity on a scale of 1-5 in the following areas: completion, use, and results. 2008 scoring achieved: Bureau-level EA program actively contributes towards DOI achieving a score of 4 in the "Completion" section and 4 in both the "Use" and "Results" in support of OMB EA Maturity Framework 2.2, PMA Scorecard, and OMB's Proud to Be.									
<i>Efficient IT Management</i> . Stage achieved on the GAO IT Investment Management Framework (SP) (EIS&T)	A	100% stage 3	63% stage 3	70% stage 3	74% stage 3	100% stage 3	100% stage 3	100% stage 3	0	100% stage 3
Comment	The GAO's ITIM framework is a maturity model composed of 5 progressive stages of maturity that an agency can achieve in its IT investment management capabilities. For each maturity stage, the ITIM describes a set of critical processes/key practices that must be in place for the agency to achieve that stage. The ITIM is used to analyze a USGS investment management process and to determine its level of maturity. Evaluation of maturity is performed by capturing the status of implementation of the key practices across the 5 maturity stages. The status data includes (a) rating (executed, partially executed, not executed, N/A); (b) summary of evidence/comments; (c) point of contact. If the key practice has not been met, information required to evaluate progress toward execution of the key practice is captured, including (a) gap assessment, (b) planned actions; (c) responsibility; and (d) planned date.									
<i>Efficient IT Management</i> . Score achieved on the NIST Federal IT Security Assessment Framework (SP) (EIS&T)	A	4.5	3.37	3.5	4.5	3.99	5.0	5.0	0	5.0
Comment	The goal in 2009 is to make further progress in achieving a strong, secure NIST framework. . The Annual Internal Control Review (ICR) assessments follow NIST Special Publication 800-53A security control procedures. 800-53A, "Guide for Assessing the Security Controls in Federal Information Systems," is a companion guideline to NIST SP 800-53, "Minimum Security Controls for Federal Information Systems." Each NIST publication provides guidance for implementing the steps in the NIST Risk Management Framework. Results from the ICR assessments define the level of security control maturity as identified in the NIST Federal IT Security Assessment Framework. NIST level 1 is whether a policy is in place; level 2 is whether procedures to implement the policy are in place; level 3 is whether the policy and procedures are implemented and actually used; level 4 is whether the security controls are tested or scanned or if a contingency plan is in place; level 5 is whether all systems are fully integrated. All 12 USGS systems were assessed using the ICR template provided by DOI which contained a roll-up process to determine the level of maturity by system. Results were aggregated to determine average percentage score.									
<i>Implement Records Management Strategy</i> . % of all bureaus and offices developing consistent records management policy (SP) (EIR)	A	100%	100%	100%	100%	100%	100%	100%	0	100%

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
<i>IT Investment Management</i> Annual % of USGS IT investments reviewed, approved, and monitored through the CPIC process. (EIS&T)	A	100%	100%	100%	100%	100%	100%	100%	0	100%
Comment	USGS has 7 IT investments and manages 2 DOI investments (Geospatial Line of Business and Geospatial One-Stop).									
% of earth science instructors in the U.S., K-16, using USGS educational materials (EIR)	A	UNK	UNK	UNK	UNK	Baseline	K-12 = 32%; Levels 13-16 = 78%	K-12 = 32%; Levels 13-16 = 78%	0	K-12 = 32%; Levels 13-16 = 78%
% of customers satisfied with service from USGS IT Service Desk (EIS&T)	A	95.9%	94%	95.9%	94% 4559/ 4850)	96.7%	94% 4559/ 4850)	94% 4559/ 4850)	0	94% 4559/ 4850)
Comment	USGS Service Desk users are randomly sampled whenever a service is requested. The numerator is the number of responses that indicate positive satisfaction; the denominator is the total number of surveys returned.									
% of identified USGS security incidents that receive corrective action within timeframes required by the DOI Incident Response Policy (EIS&T)	A	50%	75%	95%	100%	86%	100%	100%	0	100%
Total USGS public web content managed by the enterprise web infrastructure (EIR)	A	UNK	UNK	UNK	UNK	UNK	Baseline	TBD	0	TBD
Comment	In 2009 the USGS is working on a methodology for the Baseline.									
Total # of internships and fellowships supported and/or facilitated by the USGS educational program (EIR)	A	55	55	70	55	55	55	175	+120	175
Efficiency and Other Output Measures										
# of new and legacy information products added to the USGS publications database (EIR)	C	67,500	70,351	71,717	67,500	44,502	67,500	67,500	0	67,500

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	All of the products counted are official USGS publications. The USGS estimates that 67,500 will be added each year through 2010. Per the USGS Survey Manual chapter SM 1100.1, a USGS information product is "the compilation of scientific communication or knowledge such as facts, data, or interpretations in any medium (e.g., print, digital, Web) or form, including textual, numerical, graphical, cartographic, or audiovisual, to be disseminated to a defined audience or customer, scientific or nonscientific, internal or external." Legacy products are those created in the past, and not currently in electronic format. To add these to the database, they must be scanned, converted to a machine-manipulative form, and then entered.									
# of online bibliographic records (EIR)	A	3,872	6,381	4,992	6,381	2,444	6,381	6,381	0	6,381
Comment	The USGS estimates that 6,381 records will be added each year through 2010.									
Intermediate Outcome Measures and Bureau and Outcome Measures										
Human Capital Management										
<i>Worker Competency:</i> % of employees who have resolved competency gaps in specified occupational groups identified as critical occupations in the Department (SP)	C	65%	77%	77%	79%	75%	75%	76%	+1%	79%
Comment	The results of the 2008 Federal Human Capital Survey indicated that USGS employees have the right skills and abilities to accomplish the mission of the organization.									
<i>Diversity:</i> The % of managers who have completed the 4-hour required minimum annual diversity/EEO training	A	UNK	UNK	39.2%	30%	78%	30%	85%	+5%	95%
Comment	In 2008, 78 percent of USGS managers completed EEO/Diversity training. The 78 percent actual far exceeded the goal of 30 percent set for 2008. Given the marked improvement and the fact that this year the USGS is making more EEO/Diversity training available to managers, the USGS has raised its 2009 target to 80 percent for 2009. Based on this, the USGS expects to continue improving in this area through 2013.									
<i>Diversity:</i> The # of MD-715 identified deficiencies that have been corrected	A	UNK	UNK	3	3	3	1	1	0	1
<i>Collaboration Capacity:</i> # of volunteer hours per year supporting DOI mission activities (SP)	A	UNK	UNK	138,761	200,000	143,792	144,000	Rebaseline	--	Rebaseline
Comment	The USGS is currently rebaselining this measure based on new reporting capabilities being put in place.									

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
<i>Cooperative Conservation Internal Capacity: # of employees trained in collaboration and partnering competencies</i>	C	UNK	UNK	150 FTE	4,339 FTE	4,106 FTE	*4,500 FTE	4,000 FTE	-500	4,500
Comment	*The USGS target assumed employees viewing the Department's "Together We Can" video and recording their training in DOI LEARN. For USGS, DOILEARN recorded only 5 employees viewing the video due to a number of hosting and DOILEARN interface issues. The number that actually viewed the video in various venues could be greater, but we have no proof in the required system (DOI LEARN).									
<i>Cooperative Conservation Internal Capacity: % of organizations that have trained and developed employees in collaboration and partnering competencies (SP)</i>	C	UNK	UNK	41%	50%	46%	*60%	60%	0%	53%
<i>Cooperative Conservation External Capacity: # of conservation projects that actively involve the use of knowledge and skills of people in the area, and local resources in priority setting, planning, and implementation processes (SP)</i>	A	UNK	UNK	90	92	91	92	96	+4	100
Intermediate Outcome Measures and Bureau and Outcome Measures Organizational Reviews and Acquisitions										
<i>Increase Competition: Percentage of eligible service contract actions over \$25,000 awarded as performance-based acquisitions (SP)</i>	A	48%	25%	50%	50%	57.1%	50%	50%	0	50%
Intermediate Outcome Measures and Bureau and Outcome Measures Performance-Budget Information										

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of programs with demonstrated use of performance measures in budget justifications and decisions (SP)	A	UNK	UNK	100%	100%	100%	100%	100%	0	100%
% of programs that can estimate marginal cost of changing of performance (SP)	A	UNK	UNK	100%	100%	100%	100%	100%	0	100%
Intermediate Outcome Measures and Bureau and Outcome Measures Facilities Improvement										
Overall condition of buildings and of structures (as measured by the FCI) that are mission critical and mission dependent (as measured by the API), with emphasis on improving the condition of assets with critical health and safety needs (SP)	A	UNK	0.150	0.124	0.133	0.128 65,300/ 510,141	0.133 (67,247/ 509,616)	0.115 (58,612/ 510,141)	-0.009	0.107 54,338/ 510,141
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
Percent change in the Operating Costs (operations and maintenance costs) per square foot of buildings that are "Not-Mission Dependent" as reported in the Federal Real Property Profile (FRPP) in the current fiscal year compared to the previous fiscal year. (SP)	A	UNK	\$3.15sf 0%	\$3.03sf -1.6%	\$2.94sf -3%	\$2.94sf -3%	\$ 2.38sf 31%	\$2.33sf 3%	\$2.26sf -3%	-\$2.07sf -3%

Goal Performance Table

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Percent change in the total number of buildings (office, warehouse, laboratory, and housing) reported as "Under Utilized" or "Not Utilized" in the Federal Real Property Profile (FRPP) in the current fiscal year compared to the previous fiscal year (SP)	A	UNK	UNK	83%	-5%	-5%	-7.9	-5%	-5%	-5%
Percent of assets targeted for disposal that were disposed (SP)	A	UNK	26%	100%	50% (8/19)	11.7% (17/2)	24% (25/6)	42% (19/8)	-24%	42% (12/5)
PART Efficiency and Other Output Measures										
# of bureau condition assessments in progress or completed (within a 5-year cycle) (Facilities)	C	9	9	14	23	+10 Cuml 33	+9 Cuml 42	+6 Cuml 6	-3	+25 Cuml 31
# of deferred maintenance and capital improvements (cumulative) (Facilities)	C	80	63	70	80	76	87	123	+36	185

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Budget at a Glance
(Dollars in Thousands)

	2008 Actual	2009 Enacted	Fixed Costs Changes	Δ Internal Transfers	Program Changes	2010 Request
Appropriation: Surveys, Investigations and Research						
Geographic Research, Investigations, & Remote Sensing						
Land Remote Sensing	61,457	61,718	339		0	62,057
Geographic Analysis and Monitoring	16,266	10,598	237		300	11,135
Establish A New Energy Frontier Initiative - Biofuels	NA	NA			300	[300]
National Geospatial Program			932	69,816	0	70,748
Realign National Geospatial Program				69,816		[69,816]
Total, GRIRS	77,723	72,316	1,508	69,816	300	143,940
Geologic Hazards, Resources, & Processes						
Geologic Hazard Assessments	85,651	90,585	1,178		-500	91,263
Eliminate Funding for Arkansas Seismological Observatory (EHP)	NA	[500]			-500	[0]
Geologic Landscape & Coastal Assessments	80,614	72,381	1,095		875	74,351
Ocean and Coastal Frontiers (CMG)						
Expand Funding for Extended Continental Shelf (CMG)	NA	[3,000]			1,000	[4,000]
Establish A New Energy Frontier Initiative - Wind and Solar (CMG)	NA	NA			375	[375]
Eliminate Funding for California Sea Floor Mapping (CMG)	NA	[500]			-500	[0]
Geologic Resource Assessments	77,211	79,176	1,741		450	81,367
Establish A New Energy Frontier Initiative - Biofuels (MRP)	NA	NA			100	[100]
Establish A New Energy Frontier Initiative - Geothermal (ERP)	NA	[500]			1,000	[1,500]
Eliminate Funding for Nye County, Nevada Mineral Resource Assessment (MRP)	NA	[650]			-650	[0]
Total, GHRP	243,476	242,142	4,014	0	825	246,981

Budget at a Glance

Budget at a Glance (Continued) (Dollars in Thousands)

	2008 Actual	2009 Enacted	Fixed Costs Changes	Δ Internal Transfers	Program Changes	2010 Request
Water Resources Investigations						
Hydrologic Monitoring, Assessments & Research	151,367	150,786	3,042		1,992	155,820
Enhance the National Streamgauge Network (NSIP)	NA	NA			5,000	[5,000]
Establish A New Energy Frontier Initiative - Biofuels (HNA)	NA	NA			200	[200]
Eliminate Funding for San Diego, CA Aquifer Mapping (GWRP)	NA	[900]			-900	[0]
Eliminate Funding for Hood Canal Dissolved Oxygen Study (HRD)	[197]	[270]			-270	[0]
Eliminate Funding for San Pedro Partnership Monitoring & Reporting (HRD)	[295]	[295]			-295	[0]
Eliminate Funding for Long-Term Estuary Group (HRD)	[492]	[400]			-400	[0]
Eliminate US-Mexico Transboundary Aquifer (HRD)	[492]	[500]			-500	[0]
Reduce Funding for Lake Champlain Basin Toxic Materials (HNA)	[492]	[497]			-343	[154]
Eliminate Expanded Monitoring of Water Resources in Hawaii (HNA)	[492]	[500]			-500	[0]
Cooperative Water Program	62,849	64,078	1,483		0	65,561
Water Resources Research Act Program	6,304	6,500	0		0	6,500
Total, WRI	220,520	221,364	4,525	0	1,992	227,881
Biological Research						
Biological Research and Monitoring	141,275	146,416	2,681		8,668	157,765
Expand Funding for Sustainable Energy Development	[1,477]	[750]			727	[1,477]
Provide Funding for Climate Change/Science Support for FWS	NA	NA			5,000	[5,000]
Provide Funding for Changing Arctic Ecosystems	NA	NA			4,200	[4,200]
Establish A New Energy Frontier Initiative - Biofuels	NA	[75]			400	[475]
Establish A New Energy Frontier Initiative - Wind and Solar	NA	NA			625	[625]
Eliminate Funding for Molecular Biology at LCS	[788]	[800]			-800	[0]
Eliminate Funding for San Francisco Salt Pond Restoration	[492]	[500]			-500	[0]
Eliminate Funding to NatureServe	[984]	[984]			-984	[0]
Biological Information Management & Delivery	22,422	21,965	231		0	22,196
Cooperative Research Units	16,174	16,949	364		2,000	19,313
Provide General Increase for Cooperative Research Units Vacancies	NA	NA			2,000	[2,000]
Total, BR	179,871	185,330	3,276	0	10,668	199,274

Budget at a Glance (Continued)
(Dollars in Thousands)

	2008 Actual	2009 Enacted	Fixed Costs Changes	Δ Internal Transfers	Program Changes	2010 Request
Enterprise Information						
Enterprise Information Security and Technology	24,514	25,176	1,087		0	26,263
Enterprise Information Resources	16,775	17,478	228		2,000	19,706
Provide Funding for A 21st Century Youth Conservation Corps Initiative	NA	NA			2,000	[2,000]
National Geospatial Program	69,082	69,816	0	-69,816	0	0
Realign National Geospatial Program				-69,816		[-69,816]
Total, EI	110,371	112,470	1,315	-69,816	2,000	45,969
Global Change						
	7,383	40,628	549		17,000	58,177
Increase Funding for National Climate Change & Wildlife Science Center	[1,477]	[10,000]			5,000	[15,000]
Increase Funding for Carbon Sequestration	[984]	[3,000]			7,000	[10,000]
Enhance Funding for Climate Change Science	NA	NA			5,000	[5,000]
Total, GC	7,383	40,628	549	0	17,000	58,177

Budget at a Glance

Budget at a Glance (Continued) (Dollars in Thousands)

	2008 Actual	2009 Enacted	Fixed Costs Changes	Δ Internal Transfers	Program Changes	2010 Request
Science Support	67,167	67,430	1,795		0	69,225
Total, SS	67,167	67,430	1,795	0	0	69,225
Facilities						
Rental Payments and Operations & Maintenance		94,802	4,274		0	99,076
Rental Payments	72,479				0	0
Operations & Maintenance	19,592				0	0
Deferred Maintenance & Capital Improvement	7,898	7,321	0		0	7,321
Total, Fac	99,969	102,123	4,274	0	0	106,397
TOTAL, SIR (w/o ARRA)	1,006,480	1,043,803	21,256	0	32,785	1,097,844
American Recovery and Reinvestment Act of 2009		140,000				
TOTAL, SIR (w ARRA)	1,006,480	1,183,803	21,256	0	32,785	1,097,844

Program Increases

Component	2010 Program Change (\$000)	Page Reference
A New Energy Frontier	+3,000	C-7
A 21st Century Youth Conservation Corps	+2,000	C-15
Climate Impacts	+22,000	C-19
Extended Continental Shelf	+1,000	I-55
Enhance the National Streamgauge Network	+5,000	J-35
Changing Arctic Ecosystems	+4,200	K-6
Sustainable Energy Development	+727	K-7
General Increase to Cooperative Research Units	+2,000	K-51
Total	+39,927	

A New Energy Frontier- Energy Independence

(+\$3,000,000 / +3 FTE)

The A New Energy Frontier- Energy Independence initiative will build upon the core capabilities of the USGS as a multidisciplinary earth science agency. The USGS will investigate an array of renewable energy sources, including geothermal, biofuels, wind and solar. USGS will study geothermal resources to provide a scientific basis to improve the viability of this important and underutilized resource to contribute to the domestic energy mix. USGS will provide the scientific base for understanding the impacts of renewable energy options, such as wind, solar, and biofuels on ecosystems and wildlife populations. USGS work in renewable energy sources will support the President's and Secretary's priority of expanding the generation and transmission of renewable resources. As a multidisciplinary agency, the USGS is well-positioned to engage the multiple partners participating in these complicated natural resource issues. These partners include other Interior agencies such as NPS, FWS, BLM, and MMS, other Federal agencies such as DOE and USDA, State agencies, industry consortia, and others. USGS is a leader in modeling, ecological and geological research; synthesis of information necessary to inform decision-makers; and development of analytical tools necessary to both evaluate and predict outcomes of decisions on natural resources.

A 21st Century Youth Conservation Corps

(+\$2,000,000 / +25 FTE)

This initiative allows the USGS to expand existing efforts to additional universities across the country, build additional relationships with key partners, and connect with more of the next generation of scientists. Additionally, it will support the expansion of USGS efforts to assist with scientific and technical training for Tribes to assist with developing the competencies needed to manage Tribal resources effectively.

Program Increases

The activities supported by this initiative include additional internships for approximately 120 college students, more summer youth academies, expansion of scientific and technical training offerings to Tribes, and improvements to existing mechanisms for using technology to support these efforts. This initiative would enhance awareness of USGS as an employer of choice improving the ability to recruit mission critical competencies; increasing creativity and innovation with new talent; preparing for succession, and improving Tribal management of Native American resources.

This initiative advances Secretarial priorities for enhancing opportunities for America's youth to explore and obtain careers in the natural sciences and to support Tribal self-governance. The initiative would improve performance including increasing the number of internships and fellowships supported and/or facilitated by the USGS educational program by 120.

Internships will consist of temporary and limited appointments with the USGS or through cooperative agreements with technical and professional organizations with established internship programs. These internships will be targeted toward members of under-represented groups and connect them with USGS science projects. USGS typically uses internships of 10 to 12 weeks to connect students with meaningful opportunities to expand their exposure to scientific projects, enhance their knowledge of key scientific concepts, and encourage students to pursue scientific careers in the public service.

The USGS has a long history of working cooperatively with Tribes to develop and provide scientific and technical training to assist Tribes with managing their natural resources. This initiative provides an opportunity to leverage the investments in these training and expand the reach to additional Tribal members and use technology to develop distance learning mechanisms to deliver scientific and technical course content.

Climate Impacts

(+\$22,000,000 / +46 FTE)

Responding to global climate impact and its effects requires an unprecedented integration of information from multiple science disciplines and the full range of temporal and spatial scales. The Secretary's Climate Impacts initiative will allow the USGS to expand its efforts in climate change science. The USGS is leading a multi-agency effort to build a Department of the Interior Climate Impacts Monitoring effort that will provide more effective and timely science information on climate change and related impacts for resource management and policy decisionmaking. With the initiative, the USGS will implement the Climate Impacts Monitoring effort through four primary components of the network design. Building on standardized approaches developed at the national level by the National Climate Change and Wildlife Science Center (NCCWSC), regional Climate Science Hubs will be developed according to the national strategy. The NCCWSC will facilitate synthesis of downscaled global climate models from the regional hubs with relevant USGS physical and biological information from the Ecosystem Strategy, the Global Change Program and other national science programs for applications to the ecoregional and local needs of Federal, State, Tribal and local partners. As mandated in the Energy Independence and Security Act of 2007, USGS is developing methodology to assess carbon sequestration and will use this methodology to conduct a national assessment. USGS work will include both geological and biological forms of carbon sequestration. USGS will provide scientific leadership in developing methodologies to measure and assess biological carbon sequestration and greenhouse gas fluxes, and in implementing a national assessment of ecosystem carbon storage and greenhouse gas fluxes. The initiative will enable USGS to integrate capabilities in modeling current and projected physical and biological change across extensive landscapes and aquatic systems and habitats with studies of ecosystem and

population processes. USGS will provide ecological and population modeling capacity to FWS Landscape Conservation Cooperatives and provide information to FWS for use in Strategic Habitat Conservation.

Extended Continental Shelf

(+\$1,000,000 / 0 FTE)

This increase would provide the funds necessary to complete funding for the analysis and synthesis of data collected during two previous seafloor mapping cruises in the Arctic. Additionally, it would allow the principal investigators, working with the Department of State led Interagency Task Force on the ECS to develop plans and lay the groundwork for additional seafloor mapping expeditions, to develop a data management infrastructure for the effort, and to advance collaborative development of a successful U.S. ECS delineation.

Enhance the National Streamgauge Network

(+\$5,000,000/0 FTE)

The USGS is conducting research to determine the potential effects of changes in climate patterns on the occurrence and distribution of freshwater. Scientists are determining how climate has changed in the past in order to forecast hydrologic responses to shifting climate conditions in the future. Streamgages are the essential monitoring tools used to track the flow of water and associated components in streams and rivers across the Nation. The USGS streamgauge network is funded in partnership with over 800 Federal, State, and local agencies. In recent years, funding for streamgages has been in jeopardy because of difficult economic conditions at the State and local level. This initiative will support the re-establishment of discontinued streamgages and support the operation and maintenance of existing streamgages. A stable hydrologic monitoring network is a cornerstone to understanding climate change – a key priority of this Administration. Experience has shown that analysis of streamflow information and synthesis with other hydrologic data will expand our knowledge of the hydrologic system and lead to improved hydrologic monitoring network design and operation. In order to fully understand the changes that climate variability exerts on our watersheds, we must understand the natural hydrologic system and how humans change that system through our movement and use of water. Further, our water use practices themselves are influenced by climate variability and it is vital that we understand these trends.

Changing Arctic Ecosystems

(+\$4,200,000 / +8 FTE)

USGS has demonstrated that wide-spread loss of arctic sea ice and terrestrial permafrost-supported habitats has serious consequences for the polar bear and will be a significant long term challenge for a suite of other species and ecosystems under Department jurisdiction. The increase will support a strategic expansion of the physical-biological forecasting capacity that was successfully used to assess polar bear status. The refinement of the forecasting models made possible by this expanded effort will enhance information needed by several partners. The FWS and NPS will use the models in management decisions within the Arctic Strategies. The models will be used within the U.S.-Russia Bilateral Treaty for conservation of polar bears in the Chukchi Sea, and in permitting of oil and gas development in a new ice-reduced Arctic Ocean. Scientifically, the models will enhance the ability of USGS to predict the status of other Arctic species, such as Pacific walrus, and associated ecosystems, and enhance capacity to evaluate policy and management strategies. USGS will apply new molecular, physiological and other emerging technologies to better inform the Department's efforts to identify comprehensive conservation and mitigation actions for the broad suite of high latitude ecosystems and fish and wildlife species they support.

Program Increases

Sustainable Energy Development

(+\$727,000 / 0 FTE)

This program represents the USGS partnership with other Interior bureaus, State and local agencies, industry and private land owners in the Wyoming Landscape Conservation Initiative committed to maintaining healthy landscapes, sustaining wildlife and preserving recreational and grazing uses while developing natural gas energy in the Green River Basin. The role of the USGS is to provide the science framework and information necessary for partners to use in making decisions on mitigation, restoration and conservation efforts. This increase will allow USGS to support field work required to maintain current data and implement scientific studies evaluating various habitat treatments and monitor at risk species such as sage grouse, song birds and pygmy rabbits. The landscape and habitats important for fish and wildlife population sustainability are undergoing rapid change in response to energy resource development and relying on aged data sets risks invalidating models and mitigation strategies. In 2010, we will build on 2009 accomplishments such as inventorying species and habitats, monitoring and assessing water resources, integrating energy resources and habitat data, and providing a robust data inventory and scalable climate change models.

General Increase for CRU

(+\$2,000,000 / 0 FTE)

The 2010 President's Budget includes an increase of \$2.0 million to the Biological Resources Discipline, CRU program. This increase will enable the program to fill 23 vacant research scientist positions located in Units across the country. Research conducted at Cooperative Units is critical to the Nation's interests in balanced energy development, climate change, invasive species, infectious diseases, and threatened fish and wildlife conservation. The restoration of science capacity in CRU will enhance and expand graduate education and science training as mandated in the Cooperative Units Act, contributing to the science expertise that will be needed to meet future natural resources challenges on issues of national priority. The increase also will be used to fully leverage the funding and material support provided by the States, host universities, the Wildlife Management Institute, and partner agencies including the FWS. Finally, the funding increase will enable CRU scientists to more effectively engage in development of science-based decisionmaking and adaptive management strategies with natural resource managers to address priority needs.

**2010 Priority Goals and Resources by DOI Goal
Increases (\$39,927)**

Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Biological Research and Monitoring Program	A New Energy Frontier	+1,025	+3 systematic analyses and investigations completed in out-years +5 formal workshops and training provided to customers in out-years
Coastal & Marine Geology Program		+375	NA
Geographic Analysis and Monitoring Program		+300	NA
Hydrologic Networks and Analysis Program		+200	NA

Program Increases

Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Global Change	Climate Impacts	+17,000	+30 systematic analyses and investigations completed +15 workshops and training provided to customers +23% of surface area with temporal and spatial research and modeling and assessment/data coverage +14% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements
Biological Research and Monitoring Program		+5,000	+16 systematic analyses & investigations completed in out-years +13 workshops or training provided to customers
Coastal & Marine Geology Program	Extended Continental Shelf	+1,000	NA
National Streamflow Information Program	Enhance the National Streamgauge Network	+5,000	+1% of proposed streamflow stations currently in operation that meet one or more federal needs +1 systematic analyses & investigations completed
Biological Research and Monitoring Program	Changing Arctic Ecosystems	+4,200	+8 systematic analyses and investigations completed in outyears +6 workshops and training provided to customers in outyears
Biological Research and Monitoring Program	Sustainable Energy Development	+727	+3 systematic analyses and investigations completed in outyears +2 workshops and training provided to customers +6 workshops and training provided to customers in outyears

Improve the understanding of mineral and energy resources to promote responsible use and sustain the Nation's dynamic economy.			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Mineral Resources Program	A New Energy Frontier	+100	NA
Energy Resources Program		+1,000	+1 systematic analyses and investigations completed in out-years +1 formal workshops or training provided to customers

Advance Modernization/Integration			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Enterprise Information Resources Program	A 21st Century Youth Conservation Corps	+2,000	TBD # of interns that take further science course work or receive degrees TBD # of students that felt well-matched with mentor and project

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Program Decreases

Component	2010 Program Change (\$000)	Page Reference
Arkansas Seismological Observatory	-500	I-7
California Seafloor Mapping	-500	I-56
Mineral Resource Assessment for Nye County, NV	-650	I-64
San Diego Aquifer Mapping	-900	J-5
San Pedro River Partnership	-295	J-29
Hood Canal Dissolved Oxygen Study	-270	J-29
Long Term Estuary Assessment Group (LEAG)	-400	J-29
U.S.-Mexico Transboundary Aquifer Assessment Act	-500	J-30
Lake Champlain Basin Toxic Material Study	-343	J-45
Hawaii Water Resources Monitoring	-500	J-46
NatureServe	-984	K-7
Leetown Science Center	-800	K-7
San Francisco Salt Ponds	-500	K-7
Total	-7,142	

Geologic Hazards, Resources and Processes

Arkansas Seismological Observatory **(-\$500,000 / 0 FTE)**

The reduction eliminates unrequested congressional funding that does not address the highest priority science needs in FY 2010. This will keep the core program intact while allowing the USGS to make the best use of available resources. These funds are being used to for a one time purchase of seismological equipment at the Arkansas Seismological Observatory. This activity will be discontinued in 2010.

California Seafloor Mapping **(-\$500,000 / 0 FTE)**

The reduction eliminates congressional funding that was not requested by the USGS and does not address the highest priority science needs in FY 2010. This will keep the core program intact while allowing the USGS to make the best use of available resources. The 2009 funds provided are being used to support the State-led California State Waters sea-floor mapping program in cooperation with other Federal agencies. This activity will be discontinued in 2010.

Mineral Resource Assessment for Nye County, NV **(-\$650,000 / 0 FTE)**

The reduction eliminates congressional funding that was not requested by the USGS and does not address the highest priority science needs. This will keep the core program intact while allowing the USGS to make the best use of available resources. These funds are being used to initiate a mineral resource assessment of Federal lands in Nye County, Nevada in collaboration with the University of Nevada, Las Vegas and the Nevada Bureau of Mines and Geology. This activity will be discontinued in 2010.

Program Decreases

Water Resources Investigations

San Diego Aquifer Mapping (-\$900,000/0 FTE)

This reduction eliminates congressional action related to San Diego Aquifer mapping. This project is not an Administration or USGS priority and does not address the highest priority science needs in groundwater research and monitoring. This reduction will allow the core Groundwater Resources Program (GWRP) to remain intact.

San Pedro River Partnership (-\$295,000/0 FTE)

This reduction eliminates congressional action related to the San Pedro River Partnership. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Hood Canal Dissolved Oxygen Study (-\$270,000/0 FTE)

This reduction eliminates congressional action related to the Hood Canal Dissolved Oxygen Study. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Long Term Estuary Assessment Group (LEAG) (-\$400,000/0 FTE)

This reduction eliminates congressional action related to the Long Term Estuary Assessment Group (LEAG). This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

U.S.- Mexico Transboundary Aquifer Assessment Act (-\$500,000/0 FTE)

This reduction eliminates congressional action related to the U.S.- Mexico Transboundary Aquifer Assessment Act. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Lake Champlain Basin Toxic Material Study (-\$343,000/0 FTE)

This reduction eliminates congressional increases related to the Lake Champlain Basin Toxic Material Study. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact. Lake Champlain efforts underway will continue in the base funding of \$154,000.

Hawaii Water Resources Monitoring (-\$500,000/0 FTE)

This reduction eliminates congressional action related to Hawaii Water Resources Monitoring activities. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Biological Research

NatureServe

(-\$984,000 / 0 FTE)

NatureServe provides a private-sector, on-line biological information system. The USGS contracted with NatureServe in 2007 and 2008 to improve the information archive of the Natural Heritage database and make its information more interactive and available to DOI bureaus. For example, NatureServe is updating existing species profiles, reconciling data in their database with other systems to make it more inter-operable and developing new information and range maps for pollinators. The USGS proposes to eliminate this funding in 2010, as the USGS anticipates that this work will be completed in 2009. In the future, USGS will continue to collaborate with NatureServe on projects that are of mutual interest and priority.

Leetown Science Center

(-\$800,000 / -3 FTE)

San Francisco Salt Ponds

(-\$500,000 / -3 FTE)

The reduction will end two unrequested congressional actions. These projects are not Administration or USGS priorities and do not address the highest priority science needs in biology research and monitoring. This will keep the core program intact while allowing the USGS to make the best use of resources. The specific projects are molecular biology at Leetown (-\$800,000), and San Francisco salt ponds studies (-\$500,000), which would eliminate lower priority studies that focus on managing and evaluating wetland restoration.

2010 Priority Goals and Resources by DOI Goal Decreases (\$-7,142)

Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Coastal & Marine Geology Program	California Seafloor Mapping	-500	NA
Groundwater Resources Program	San Diego Aquifer Mapping	-900	NA
Hydrologic Networks and Analysis Program	Lake Champlain Basin Toxic Material Study	-343	NA
Hydrologic Networks and Analysis Program	Hawaii Water Resources Monitoring	-500	NA
Hydrologic Research and Development Program	San Pedro River Partnership	-295	NA
Hydrologic Research and Development Program	Hood Canal Dissolved Oxygen Study	-270	NA
Hydrologic Research and Development Program	Long Term Estuary Assessment Group (LEAG)	-400	NA
Hydrologic Research and Development Program	U.S.-Mexico Transboundary Aquifer Assessment Act	-500	NA
Biological Research and Monitoring Program	Leetown	-800	

Program Decreases

Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Biological Research and Monitoring Program	San Francisco Salt Ponds	-500	-1 systematic analyses or investigation completed
Biological Research and Monitoring Program	NatureServe	-984	NA

Improve the understanding of energy and mineral resources to promote responsible use and sustain the Nation's dynamic economy.			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Mineral Resources Program	Mineral Resource Assessment for Nye County, NV	-650	NA

Improve the understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.			
Subactivity or Program	Project or Item	Program Change (\$000)	Performance Impact
Earthquake Hazard Program	Earthquake Hazards General Program	-500	NA

Analysis by Activity

(Dollars in Thousands)

Activity	2009 Enacted		Fixed Costs (+/-)		Related Changes b/ (+/-)		Program Changes (+/-)		2010 Budget Request		Inc.(+) Dec.(-) from 2009	
	FTE a/	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE a/	Amount	FTE	Amount
Geographic Research, Investigations, & Remote Sensing b/	192	72,316	0	1,508	295	69,816	1	300	488	143,940	296	71,624
Geologic Hazards, Resources, and Processes	1,239	242,142	0	4,014	0	0	1	825	1,240	246,981	1	4,839
Water Resources Investigations	1,591	221,364	0	4,525	-12	0	0	1,992	1,579	227,881	-12	6,517
Biological Research	1,210	185,330	0	3,276	0	0	11	10,668	1,221	199,274	11	13,944
Enterprise Information b/	508	112,470	0	1,315	-295	-69,816	25	2,000	238	45,969	-270	-66,501
Global Change	181	40,628	0	549	0	0	38	17,000	219	58,177	38	17,549
Science Support	382	67,430	0	1,795	0	0	0	0	382	69,225	0	1,795
Facilities	51	102,123	0	4,274	0	0	0	0	51	106,397	0	4,274
TOTAL, SIR (w/o ARRA)	5,354	1,043,803	0	21,256	-12	0	76	32,785	5,418	1,097,844	64	54,041
American Recovery and Reinvestment Act of 2009	0	140,000			0	-140,000			0	0	0	-140,000
TOTAL, SIR (w ARRA)	5,354	1,183,803	0	21,256	-12	-140,000	76	32,785	5,418	1,097,844	64	-85,959

a/ The FTE's depicted in the 2009 and 2010 columns are only the staff-years associated with appropriated funding. The following components comprise the difference between USGS appropriated FTE and total FTE: Reimbursable FTE 2,672 and 2,672; Working Capital Fund FTE 312 and 307; Contributed Funds FTE 21 and 11; and Allocation Accounts FTE 11 and 11 for 2009 and 2010 respectively. USGS total FTE's for 2009 and 2010 are 8,370 and 8,419 respectively. FTE may not add to totals and subtotals, due to rounding.

b/ Includes technical adjustments (+\$69,816 to Geographic Research, Investigations, & Remote Sensing from Enterprise Information), which is proposed as part of a budget restructure that moves funding for the National Geospatial Program.

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States, its territories and possessions, and other areas as authorized by 43 U.S.C. 31, 1332, and 1340; classify lands as to their mineral and water resources; give engineering supervision to power permittees and Federal Energy Regulatory Commission licensees; administer the minerals exploration program (30 U.S.C. 641); conduct inquiries into the economic conditions affecting mining and materials processing industries (30 U.S.C. 3, 21a, and 1603; 50 U.S.C. 98g(1)) and related purposes as authorized by law; and to publish and disseminate data relative to the foregoing activities; [~~\$1,043,803,000~~]~~\$1,097,844,000~~, to remain available until September 30, [~~2010~~]~~2011~~, of which [~~\$64,078,000~~]~~\$65,561,000~~ shall be available only for cooperation with States or municipalities for water resources investigations; of which \$40,150,000 shall remain available until expended for satellite operations; and of which [~~\$7,321,000~~]~~\$7,321,000~~ shall be available until expended for deferred maintenance and capital improvement projects that exceed \$100,000 in cost: *Provided*, That none of the funds provided for the biological research activity shall be used to conduct new surveys on private property, unless specifically authorized in writing by the property owner: *Provided further*, That no part of this appropriation shall be used to pay more than one-half the cost of topographic mapping or water resources data collection and investigations carried on in cooperation with States and municipalities. (*Department of the Interior, Environment, and Related Agencies Appropriations Act, 2009.*)

Justification of Proposed Language Change

The USGS does not propose any appropriation language changes to the 2010 President's Budget request.

Appropriation Language and Citations

1. For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States,
 - **43 U.S.C. 31(a)** provides for establishment of the Office of the Director of the Geological Survey, under the Interior Department, and that this officer shall have direction of the Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain.
2. its territories and possessions, and other areas as authorized by law.
 - **43 U.S.C 31(b)** provides that, "The authority of the Secretary of the Interior, exercised through the Geological Survey of the Department of the Interior, to examine the geological structure, mineral resources, and products of the national domain, is expanded to authorize such examinations outside the national domain where determined by the Secretary to be in the national interest."
 - **43 U.S.C. 1332(a)** provides that, "It is the declared policy of the United States, that the subsoil and seabed of the Outer Continental Shelf appertain to the United States and are subject to its jurisdiction, control, and power of disposition as provided in this subchapter."
 - **43 U.S.C. 1340** provides that, "Any agency of the United States and any person authorized by the Secretary may conduct geological and geophysical exploration in the Outer Continental Shelf. ..."
3. classify lands as to their mineral and water resources;
 - **43 U.S.C. 31(a)** provides that, "The Director of the Geological Survey, ... shall have the direction of the Geological Survey, and the classification of public lands and examination of the geological structure, mineral resources, and products in the National domain. ..."
4. give engineering supervision to power permittees
 - **43 U.S.C. 959** provides that, "The Secretary of the Interior is authorized and empowered, ... to permit the use of right of way through the public lands, forest, and other reservations of the United States ... for electrical plants, poles, and lines for the generation and distribution of electrical power, ...**Provided**, that such permits shall be allowed within or through any of said parks or any forest, military, Indian, or other reservation only upon approval of the Chief Officer of the Department under whose supervision such park or reservation falls and upon a finding by him that the same is not incompatible with the public interest ..."
 - **43 U.S.C. 961** provides that, "The head of the department having jurisdiction over the lands be, and he is, authorized and empowered, ... to grant an easement for right of way, ... over, across and upon the public lands and reservations of the United States for

electrical poles and lines for the transmission and distribution of electrical power ... upon a finding by him that the same is not incompatible with the public interest ..."

5. and Federal Energy Regulatory Commission licensees;
 - **16 U.S.C. 797(c)** states that, "To cooperate with the executive departments and other agencies of States or National Governments in such investigations; and for such purposes the several departments and agencies of the National Government are authorized and directed upon the request of the commission, to furnish such records, papers and information in their possession as may be requested by the commission, and temporarily to detail to the commission such officers or experts as may be necessary in such investigations."
6. administer the minerals exploration program;
 - **30 U.S.C. 641** provides that, "The Secretary of the Interior is hereby authorized and directed, in order to provide for discovery of additional domestic mineral reserves, to establish and maintain a program for exploration by private industry within the United States, its territories and possessions for such minerals, excluding organic fuels, as he shall from time to time designate, and to provide Federal financial assistance on a participating basis for that purpose."
7. publish and disseminate data relative to the foregoing activities;
 - **43 U.S.C. 41** provides for the publication of geological and economic maps, illustrating the resources and classification of the lands, and reports upon general and economic geology and paleontology. This section also provides for the scientific exchange and sale of such published material.
 - **44 U.S.C. 1318** provides for publication, by the Geological Survey, of various reports, including a report of mineral resources of the United States, bulletins and professional papers, and monographs. This section also specifies, in some instances, numbers of copies to be printed and the distribution thereof.
 - **44 U.S.C. 1320** provides for the distribution by the Director of the Geological Survey of copies of sale publications to public libraries.
8. and to conduct inquiries into the economic conditions affecting mining and materials processing industries...and related purposes as authorized by law and to publish and disseminate data;
 - **30 U.S.C. 3** provides for inquiry into the economic conditions affecting the mining, quarrying, metallurgical, and other minerals industries. This section also provides for the dissemination of information concerning these industries.
 - **30 U.S.C. 21(a)** provides for an annual report on the state of the domestic mining minerals, and mineral reclamation industries, including a statement of the trend in utilization and depletion of resources.

Appropriation Language and Citations

- **30 U.S.C. 1603** provides for ...improved collection, analysis, and dissemination of scientific, technical and economic materials information and data from Federal, state, and local governments, and other sources as appropriate.
 - **50 U.S.C. 98g(1)** provides for scientific, technologic, and economic investigations concerning the development, mining, preparation, treatment, and utilization of ore and other mineral substances.
9. of which () shall be available only for cooperation with States or municipalities for water resources investigations;
- **43 U.S.C. 48** provides that, "...amounts received by the Geological Survey from any State, Territory or political subdivision thereof in carrying on work involving cooperation to be used in reimbursing the appropriation from which the expense of such work was paid, was from the act making appropriations for the Department of the Interior for the fiscal year ending June 30, 1928, and for other purposes, act January 12, 1927, ch. 277, 1, 44 Stat. 963, and has not been repeated in subsequent appropriation acts."
 - Similar provisions were contained in the following act: 1926 - May 10, 1926, ch. 277, 1, 44 Stat. 487.
10. of which () shall remain available until expended for satellite operations;
- **P.L. 107-43, Department of the Interior and Related Agencies Appropriation Act, 2002**
11. of which () shall be available until September 30, (), for the operation and maintenance of facilities and deferred maintenance;
- **P.L. 106-291, Department of the Interior and Related Agencies Appropriations Act, 2001**
12. of which \$1,600,000 shall be available until expended for deferred maintenance and capital improvement projects that exceed \$100,000 in cost;
- **P.L. 108-447, Consolidated Appropriations Act, 2005 (Interior and Related Agencies portion)**
13. and of which () shall be available until September 30, (), for the biological research activity and the operation of the Cooperative Research Units;
- **P.L. 104-208, Omnibus Appropriations Act, 1997 (Interior and Related Agencies portion)**
14. *Provided*, That none of these funds provided for the biological research activity shall be used to conduct new surveys on private property, unless specifically authorized in writing by the property owner:
- **P.L. 104-208, Omnibus Appropriations Act, 1997 (Interior and Related Agencies portion)**

15. Provided further, That no part of this appropriation shall be used to pay more than one-half the cost of topographic mapping or water resources data collections and investigations carried on in cooperation with States and municipalities.
- **43 U.S.C. 50** provides that, "The share of the Geological Survey in any topographic mapping or water resources investigations carried on in cooperation with any State or municipality shall not exceed 50 per centum of the cost thereof. ..."

Permanent authority:

16. Provided further, that in fiscal year 1984 and thereafter, all receipts from the sale of maps sold or stored by the Geological Survey shall be available for map printing and distribution to supplement funds otherwise available, to remain available until expended.
- **43 U.S.C. 42a** Provided further, That in fiscal year 1986 and thereafter, all amortization fees resulting from the Geological Survey providing telecommunications services shall be deposited in a special fund to be established on the books of the Treasury and be immediately available for payment of replacement or expansion of telecommunications services, to remain available until expended.
 - **43 U.S.C. 50a** with the establishment of the Working Capital Fund (WCF) in FY 1991, the Telecommunications Amortization Fund account and its end of year FY 1990 balances were included in the WCF.
17. Provided further, that, heretofore and hereafter, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the Geological Survey may, notwithstanding any other provisions of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation.
- **43 U.S.C. 50b**
18. Provided further, That in Fiscal Year 1987 and thereafter the Geological Survey is authorized to accept lands, buildings, equipment, and other contributions from public and private sources and to prosecute projects in cooperation with other agencies, Federal, State, or private.
- **43 U.S.C. 36c** This authority for contributions was in the appropriation language annually from FY 1983 through FY 1986 and was made permanent in FY 1987.
19. Provided, That upon enactment of this Act and hereafter, final costs related to the National Petroleum Reserve in Alaska may be paid from available prior year balances in this account.
- **P.L. 100–446, Department of the Interior and Related Agencies Appropriations Act, 1989**

Appropriation Language and Citations

20. Established a Working Capital Fund which is detailed in the Working Capital Fund section of this book.

- **P.L. 101–512, Department of the Interior and Related Agencies Appropriations Act, 1991**

21. Provided further, That beginning October 1, 1990, and thereafter, funds received from any State, territory, possession, country, international organization, or political subdivision thereof, for topographic, geologic, or water resources mapping or investigations involving cooperation with such an entity shall be considered as intragovernmental funds as defined in the publication titled "A Glossary of Terms Used in the Federal Budget Process."

- **P.L. 101–512, Department of the Interior and Related Agencies Appropriations Act, 1991**

This authority exempts non-Federal cooperative funds from sequester as defined in 1985 amendments (P.L. 99–177) to the Budget Impoundment and Control Act of 1974.

22. Provided further, That beginning in fiscal year 1998 and once every five years thereafter, the National Academy of Sciences shall review and report on the biological research activity of the Survey:

- **P.L. 104–208, Omnibus Appropriations Act, 1997 (Interior and Related Agencies portion)**

Administrative Provisions

From within the amount appropriated for activities of the United States Geological Survey such sums as are necessary shall be available for reimbursement to the General Services Administration for security guard services; contracting for the furnishing of topographic maps and for the making of geophysical or other specialized surveys when it is administratively determined that such procedures are in the public interest; construction and maintenance of necessary buildings and appurtenant facilities; acquisition of lands for gauging stations and observation wells; expenses of the United States National Committee on Geology; and payment of compensation and expenses of persons on the rolls of the Survey duly appointed to represent the United States in the negotiation and administration of interstate compacts: *Provided*, That activities funded by appropriations herein made may be accomplished through the use of contracts, grants, or cooperative agreements as defined in 31 U.S.C. 6302 et seq.: *Provided further*, That the United States Geological Survey may enter into contracts or cooperative agreements directly with individuals or indirectly with institutions or nonprofit organizations, without regard to 41 U.S.C. 5, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purpose of chapters 57 and 81 of title 5, United States Code, relating to compensation for travel and work injuries, and chapter 171 of title 28, United States Code, relating to tort claims, but shall not be considered to be Federal employees for any other purposes. (*Department of the Interior, Environment, and Related Agencies Appropriations Act, 2009.*)

Justification of Proposed Administrative Provisions Language Change

The USGS does not propose any administrative provisions language changes to the 2010 President's Budget request.

Administrative Provisions Language and Citations

1. From within the amount appropriated for activities of the United States Geological Survey such sums as are necessary shall be available for reimbursement to the General Services Administration for security guard services; contracting for the furnishing of topographic maps and for the making of geophysical or other specialized surveys when it is administratively determined that such procedures are in the public interest;
 - **No specific authority.** These provisions are required by reason of rulings of the Comptroller General that specific authority is required for reimbursing the General Services Administration for guard services (B-87255); and for contracting with private persons for the performance of duties with which the agency is specifically charged (15 Comp. Gen. 951).
2. construction and maintenance of necessary buildings and appurtenant facilities;
 - **No specific authority.** The Organic Act of 1879, establishing the Geological Survey and providing for "... examination of the geological structure, mineral resources, and products of the national domain" (43 U.S.C. 31) is general authorization for construction of special-purpose laboratory buildings. Specific authorization by the Congressional committees on public works is not needed because of the highly specialized purposes of the building. 40 U.S.C. 612: "The term 'public building' means any building ... which is generally suitable for office or storage space ... but shall not include any such buildings and construction projects: ... (E) on or used in connection with ... or for nuclear production, research, or development projects." 41 U.S.C. 12: "No contract shall be entered into for the erection, repair, or furnishing of any public building ... which shall bind the government to pay a larger sum of money than the amount in the Treasury appropriated for the specific purpose."
3. acquisition of lands for gauging stations and observation wells;
 - **43 U.S.C. 36(b)** provides that, "The Secretary of the Interior may, on behalf of the United States and for the use by the Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation"
4. expenses of the U.S. National Committee on Geology;
 - **43 U.S.C. 31** participation in and payment of expenses of the U.S. National Committee on Geology is a proper and necessary function of the Geological Survey, and so is authorized by the Survey's Organic Act of March 3, 1879, 43 U.S.C. 31. This Act provides that, "...The Director of the Geological Survey, which office is established, under the Interior Department, shall be appointed by the President by and with the advice and consent of the Senate. This officer shall have the direction of the Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain"

Administrative Provisions Language and Citations

5. and payment of compensation and expenses of persons on the rolls of the Survey duly appointed to represent the United States in the negotiation and administration of interstate compacts:
 - **66 Stat. 453.** The above language first appeared in the Appropriation Act for FY 1953, P.L. 82–470 (66 Stat. 453), and has been repeated in each Act since that date. Article I, Section 10, paragraph 3, of the United States Constitution provides that, No State shall, without the consent of Congress, lay any duty on tonnage, keep troops, or ships of war in time of peace, enter into any agreement or compact with another State, or with a foreign power, or engage in war, unless actually invaded, or in such imminent danger as will not admit or delay." (emphasis supplied)

Thus each interstate compact must be approved by the Congress and signed by the President. The Public Law approving each interstate compact represents the authorizing legislation.

6. *Provided*, That activities funded by appropriations herein may be accomplished through the use of contracts, grants, or cooperative agreements as defined in 31 U.S.C. 6302, et seq.
 - The above language appears in the Department of the Interior and Related Agencies Appropriations Act, 1988, as included in Public Law 100–202.
7. *Provided further*, That the United States Geological Survey may enter into contracts or cooperative agreements directly with individuals or indirectly with institutions or nonprofit organizations, without regard to 41 U.S.C. 5, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purpose of chapters 57 and 81 of title 5, United States Code, relating to compensation for travel and work injuries, and chapter 171 of title 28, United States Code, relating to tort claims, but shall not be considered to be Federal employees for any other purposes.
 - The above language appears in the Consolidated Appropriations Act, 2005 (Interior and Related Agencies portion), as included in Public Law 108–447.

Permanent Authority:

1. *Provided*, That appropriations herein and hereafter made shall be available for paying costs incidental to the utilization of services contributed by individuals who serve without compensation as volunteers in aid of work of the Geological Survey, and that within appropriations herein and hereafter provided, Geological Survey officials may authorize either direct procurement of or reimbursement for expenses incidental to the effective use of volunteers such as, but not limited to, training, transportation, lodging, subsistence, equipment, and supplies.

- **43 U.S.C. 50c**

2. *Provided further*, That provision for such expenses or services is in accord with volunteer or cooperative agreements made with such individuals, private organizations, educational institutions, or State or local government.

- **43 U.S.C 31(a)**

3. *Provided further*, That the Geological Survey (43 U.S.C. 31(a)) shall hereafter be designated the United States Geological Survey.

- **Department of the Interior and Related Agencies Appropriations Act, 1992, as included in Public Law 102–154.**

4. *Provided further*, That the United States Geological Survey may hereafter contract directly with individuals or indirectly with institutions or nonprofit organizations, without regard to 41 U.S.C. 5, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purposes of chapters 57 and 81 of title 5, United States Code, relating to compensation for travel and work injuries, and Chapter 171 of Title 28, United States Code, relating to tort claims, but shall not be considered to be a Federal employees for any other purposes.

- **Department of the Interior and Related Agencies Appropriations Act, 2000, as included in Public Law 106–113.**

5. *Provided further*, That notwithstanding the provisions of the Federal Grant and Cooperative Agreement Act of 1977 (31 U.S.C. 6301–6308), the may be United States Geological Survey is authorized to continue existing, and hereafter, to enter into new cooperative agreements directed towards a particular cooperator, in support of joint research and data collection activities with Federal, State, and academic partners funded by appropriations herein, including those that provide for space in cooperator facilities.

- **Department of the Interior and Related Agencies Appropriations Act, 2004, as included in Public Law 108–108.**

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Justification of Fixed Costs and Related Changes: USGS

(Dollars in Thousands)

	2009 Budget	2009 Revised	2010 Fixed Costs Change
Additional Operational Costs from 2009 and 2010 Jan Pay Raises			
1. 2009 Pay Raise, 3 Quarters in 2009 Budget	+\$9,334	+\$9,334	NA
<i>Amount of pay raise absorbed</i>	[\$2,334]	[\$6,357]	NA
2. 2009 Pay Raise, 1 Quarter (Enacted 3.9%)	NA	NA	+\$5,381
<i>Amount of pay raise absorbed</i>			[\$0]
3. 2010 Pay Raise (Proposed 2.0%)	NA	NA	+\$8,278
<i>Amount of pay raise absorbed</i>			[\$0]

These adjustments are for an additional amount needed to fund estimated pay raises for Federal employees.

Line 1, 2009 Revised column is an update of 2009 budget estimates based upon an enacted 3.9% pay raise versus the 2.9% request.

Line 2 is the amount needed in 2010 to fund the estimated 3.9% January 2009 pay raise from October through December 2009.

Line 3 is the amount needed in 2010 to fund the estimated 2.0% January 2010 pay raise from January through September 2010.

	2009 Budget	2009 Revised	2010 Fixed Costs Change
Other Fixed Cost Changes			
One Less Pay Day	NA	NA	NA
The number of paid days is constant.			
Employer Share of Federal Health Benefit Plans	+\$770	+\$770	+\$2,158
<i>Amount of health benefits absorbed</i>	[\$193]	[\$193]	[\$0]
This adjustment is for changes in the Federal government's share of the cost of health insurance coverage for Federal employees. For 2010, the increase is estimated at 6.5%, the estimated increase for 2009.			
Worker's Compensation Payments	\$2,995	\$2,995	+\$15
The 2009 adjustment is for actual charges through June 2008, in the costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for 2010 will reimburse the Department of Labor, Federal Employees Compensation Fund, pursuant to 5 U.S.C. 8147(b) as amended by Public Law 94-273.			
Unemployment Compensation Payments	\$625	\$625	+\$43
The 2009 adjustment is for estimated changes in the costs of unemployment compensation claims to be paid to the Department of Labor, Unemployment Trust Fund, pursuant to Public Law 96-499.			

Justification of Fixed Costs and Related Changes

	2009 Budget	2009 Revised	2010 Fixed Costs Change
Other Fixed Cost Changes (continued)			
Rental Payments	\$64,312	\$64,312	+\$4,166
<i>Amount of rental payments absorbed</i>	<i>[\$0]</i>	<i>[\$316]</i>	<i>[\$0]</i>
The adjustment is for changes in the costs payable to General Service Administration (GSA) and others resulting from changes in rates for office and non-office space as estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security; in the case of GSA space, these are paid to DHS.			
Department Working Capital Fund	\$16,350	\$16,350	+\$1,215
<i>Amount of working capital fund absorbed</i>	<i>[\$0]</i>	<i>[\$482]</i>	<i>[\$0]</i>
The 2009 revised absorption reflects changes in the working capital fund since the President's Budget. The 2010 change reflects expected changes in the charges for Department services and other services funded through the Working Capital Fund (WCF). These charges are displayed in the Budget Justification for Department Management.			

Summary of Requirements
(Dollars in Thousands)

Appropriation: Surveys, Investigations, and Research

	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Budget estimate, 2009 Enacted			5,354	1,043,803
Fixed and Related Cost Changes:				
Additional Cost in 2010 of January 2009 Pay Raise		+5,381		
Additional Cost in 2010 of January 2010 Pay Raise		+8,278		
Employer Share of Federal Health Benefit Plans		+2,158		
Worker's Compensation Payments		+15		
Unemployment Compensation Payments		+43		
Rental Payments		+4,166		
Department Working Capital Fund Charges		+1,215		
Subtotal, Fixed Cost Adjustments				+21,256
Technical Adjustment			-12	0
Subtotal, Fixed Costs and Related Changes			-12	+21,256
Program Change			+76	+32,785
TOTAL REQUIREMENTS			5,418	1,097,844

Summary of Requirements

Summary of Requirements (Dollars in Thousands)

Activity/Subactivity/Prog Element	2008		2009		Fixed Costs		Related Changes b/		Program		2010		Inc.(+)	
	Actual		Enacted		(+/-)		(+/-)		Changes		Budget		Dec.(-)	
	FTE a/	Amount	FTE a/	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE a/	Amount	FTE	Amount
GEOG RES., INVESTIGATIONS & REMOTE SENSING														
Land Remote Sensing	148	61,457	139	61,718		339				0	139	62,057	0	339
Geographic Analysis and Monitoring	105	16,266	53	10,598		237			1	300	54	11,135	1	537
National Geospatial Program b/						932		295	69,816	0	295	70,748	295	70,748
TOTAL	253	77,723	192	72,316	0	1,508	295	69,816	1	300	488	143,940	296	71,624
GEOLOGIC HAZ., RESOURCES, & PROC.														
Geologic Hazard Assessments														
Earthquake Hazards	237	53,653	234	55,760		761				-500	234	56,021	0	261
Volcano Hazards	139	22,190	137	23,901		270				0	137	24,171	0	270
Landslide Hazards	22	3,308	21	3,350		55				0	21	3,405	0	55
Global Seismographic Network	10	4,441	10	5,482		46				0	10	5,528	0	46
Geomagnetism	17	2,059	17	2,092		46				0	17	2,138	0	46
Subtotal	425	85,651	419	90,585	0	1,178	0	0	0	-500	419	91,263	0	678
Geologic Landscape & Coastal Assessments														
Earth Surface Dynamics	72	13,342	0	0		0				0	0	0	0	0
National Cooperative Geologic Mapping	132	26,626	130	27,724		439				0	130	28,163	0	439
Coastal and Marine Geology	218	40,646	215	44,657		656				875	215	46,188	0	1,531
Subtotal	422	80,614	345	72,381	0	1,095	0	0	0	875	345	74,351	0	1,970
Geologic Resource Assessments														
Mineral Resources	334	50,830	329	52,427		1,253				-550	329	53,130	0	703
Energy Resources	148	26,381	146	26,749		488			1	1,000	147	28,237	1	1,488
Subtotal	482	77,211	475	79,176	0	1,741	0	0	1	450	476	81,367	1	2,191
TOTAL	1,329	243,476	1,239	242,142	0	4,014	0	0	1	825	1,240	246,981	1	4,839
WATER RESOURCES INVESTIGATIONS														
Hydrologic Monitoring, Assessments & Research														
Ground-Water Resources Program	51	7,853	50	9,008		126				-900	50	8,234	0	-774
National Water-Quality Assessment	360	63,912	355	65,056		1,451				0	355	66,507	0	1,451
Toxic Substances Hydrology	47	13,516	32	10,767		317				0	32	11,084	0	317
Hydrologic Research & Development	243	15,423	198	13,421		266				-1,465	198	12,222	0	-1,199
National Streamflow Information Program	47	20,126	46	22,406		326				5,000	46	27,732	0	5,326
Hydrologic Networks and Analysis	225	30,537	216	30,128		556				-643	216	30,041	0	-87
Subtotal	973	151,367	897	150,786	0	3,042	0	0	0	1,992	897	155,820	0	5,034
Cooperative Water Program	709	62,849	692	64,078		1,483		-12		0	680	65,561	-12	1,483
Water Resources Research Act Program	2	6,304	2	6,500		0				0	2	6,500	0	0
TOTAL	1,684	220,520	1,591	221,364	0	4,525	-12	0	0	1,992	1,579	227,881	-12	6,517

Summary of Requirements

Summary of Requirements (Dollars in Thousands)														
Activity/Subactivity/Program Element	2008 Actual		2009 Enacted		Fixed Costs (+/-)		Related Changes c/ (+/-)		Program Changes (+/-)		2010 Budget Request		Inc.(+) Dec.(-) from 2009	
	FTE	a/ Amount	FTE	a/ Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	a/ Amount	FTE	Amount
BIOLOGICAL RESEARCH														
Biological Research and Monitoring	991	141,275	1,015	146,416		2,681			11	8,668	1,026	157,765	11	11,349
Biological Information Management & Delivery	68	22,422	68	21,965		231				0	68	22,196	0	231
Cooperative Research Units	127	16,174	127	16,949		364				2,000	127	19,313	0	2,364
TOTAL	1,186	179,871	1,210	185,330	0	3,276	0	0	11	10,668	1,221	199,274	11	13,944
ENTERPRISE INFORMATION														
Enterprise Information Security and Technology	99	24,514	99	25,176		1,087				0	99	26,263	0	1,087
Enterprise Information Resources	115	16,775	114	17,478		228			25	2,000	139	19,706	25	2,228
National Geospatial Program b/	306	69,082	295	69,816		0	-295	-69,816		0	0	0	-295	-69,816
TOTAL	520	110,371	508	112,470	0	1,315	-295	-69,816	25	2,000	238	45,969	-270	-66,501
GLOBAL CHANGE	11	7,383	181	40,628		549			38	17,000	219	58,177	38	17,549
SCIENCE SUPPORT	382	67,167	382	67,430		1,795				0	382	69,225	0	1,795
FACILITIES														
Rental Payments and Operations & Maintenance			51	94,802		4,274				0	51	99,076	0	4,274
Rental Payments		72,479		0		0				0	0	0	0	0
Operations & Maintenance	51	19,592		0		0				0	0	0	0	0
Deferred Maintenance & Capital Improvement		7,898		7,321		0		0		0	0	7,321	0	0
TOTAL	51	99,969	51	102,123	0	4,274	0	0	0	0	51	106,397	0	4,274
TOTAL, SIR (w/o ARRA)	5,416	1,006,480	5,354	1,043,803	0	21,256	-12	0	76	32,785	5,418	1,097,844	64	54,041
American Recovery and Reinvestment Act of 2009			0	140,000			0	-140,000			0	0	0	-140,000
TOTAL, SIR (w ARRA)	5,416	1,006,480	5,354	1,183,803	0	21,256	-12	-140,000	76	32,785	5,418	1,097,844	64	-85,959

a/ The FTE depicted in the 2008, 2009, and 2010 columns are only the staff-years associated with appropriated funding. The following components comprise the difference between USGS appropriated FTE and total FTE: Reimbursable FTE are 2,752, 2,672 and 2,672; Working Capital Fund FTE are 157, 312 and 307; Contributed Funds FTE are 19, 21, and 11; and Allocation Accounts FTE are 11, 11, and 11 for 2008, 2009 and 2010 respectively. USGS total FTE for 2008, 2009, and 2010 are 8,355, 8,370 and 8,419 respectively. FTE may not add to totals and subtotals, due to rounding.

b/ Includes technical adjustments (+\$69,816 to Geographic Research, Investigations, & Remote Sensing from Enterprise Information), which is proposed as part of a budget restructure that moves funding for the National Geospatial Program.

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National Geospatial Program – Restructure

National Geospatial Program Budget Changes

(Dollars in Thousands)

Activity/Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-) ^{a/}	Program Changes (+/-) ^{b/}	Budget Request	
Geographic Research, Investigations, & Remote Sensing						
National Geospatial Program	0	0	+69,816	0	69,816	+69,816
<i>FTE</i>	0	0	+295	0	295	+295
Enterprise Information						
National Geospatial Program	69,082	69,816	-69,816	0	0	-69,816
<i>FTE</i>	306	295	-295	0	0	-295
Overall Total Requirements (\$000)	69,082	69,816	0	0	69,816	-0
<i>FTE</i>	306	295	0	0	295	0

Program Overview

The National Geospatial Program (NGP) collects and integrates base national geospatial datasets, maintains standards, coordinates data discovery and access, and ensures consistent and current data are available for the Nation. The NGP meets geospatial needs of Department bureaus by making basic and advanced products and services available over the Web and through the USGS Store. Two of NGP's primary products are *The National Map* and The National Atlas, which present current, accurate, and consistent geospatial data and map services online. These products contain data and information describing the landscape of the U.S. and locational features that can be fused or integrated and displayed online or in a traditional map format. *The National Map* represents the starting point—the basic framework—from which land and resource decisions and economic and environmental policies can be made.

Partnerships Through the National Spatial Data Infrastructure (NSDI)

In 2008, the NGP developed partnerships through its NSDI Liaison Network to acquire, maintain, and steward geospatial data for *The National Map* at a cost of \$5.6 million. By acting as a coordinator with other agencies, the USGS has leveraged the \$5.6 million investment to a total value of about \$35 million. After quality assurance and control, the data will be made publicly available online for government and private use. The USGS is continuing this effort in 2009 and 2010.

Decision makers at all levels of government, including land and resource managers, emergency responders, homeland security personnel, scientists in a variety of disciplines, and citizens rely on geospatial information. Through Emergency Operations, USGS provides coordination and support to geospatial information activities associated with homeland security, homeland defense, emergency response for natural and human-made disasters, law enforcement, and the intelligence communities. Research in the Center of Excellence for Geographic Information Science (CEGIS) and a robust State-based Partnership liaison network are also essential contributors to the success of NGP.

Proposed Budget Restructure – National Geospatial Program

The Federal Geographic Data Committee (FGDC) Office of the Secretariat (OS) of the USGS provides executive support to the FGDC. The FGDC promotes and promulgates consistent data and metadata standards, system interoperability, and cross-government best business practices for geospatial resources, policies, standards, and technology. The Committee is charged with facilitating the continued building of the National Spatial Data Infrastructure (NSDI). The FGDC-OS coordinates, develops and manages the geospatial data clearinghouse, providing discovery of and collective access to geospatial data.

NGP long-term goal 1, Leadership: Provide leadership and guidance for key stakeholders to assure base thematic data is planned and collected in the most efficient and effective ways and to benefit the broadest user community. This is accomplished through developing policy, developing key standards and data models, coordinating and facilitating a governance structure, negotiating collaborative agreements with partners, developing a national geospatial enterprise architecture, establishing achievable priorities, and providing a forum for technology transfer and best practices.

NGP long-term goal 2, Operations: Implement key components of the NSDI. This is accomplished through hosting spatial datasets, Web sites, knowledge base, and tools for discovery and access; providing data integration and quality assurance of spatial data; staffing enterprise architecture, governance body, and spatial operations; conducting and sponsoring research for geospatial information science; providing contract management for operations; conducting training, education, and consultation; adopting a posture of being the data producer of last resort; and making map products accessible.

The NGP strives to improve the understanding of natural ecosystems and resources through integrated interdisciplinary assessment. The program supports USGS strategic objectives by providing an integrated approach to national geospatial coordination and standards, effective leadership and collaboration with the larger geospatial community, and tools for the discovery, access and sharing of geospatial resources.

In 2010, the NGP is divided into six components: *The National Map*, The National Atlas, Emergency Operations, CEGIS, Partnership Implementation, and FGDC-OS.

Justification of Restructure

The 2010 President's Budget request proposes to move \$69,816,000 from the Enterprise Information Activity (EI) to the Geographic Research, Investigations, and Remote Sensing Activity (Geography). This reflects a technical adjustment in order to align the USGS' geographic-based programs. The proposed restructure would provide better integration of NGP activities into a single organization; better integration of geographic data from *in situ*, aerial, and space-based remote sensing platforms; and the capability to leverage existing state-of-the-art data management, archive and dissemination capabilities at Earth Resources Observation and Science Center.

2010 Performance Restructure – Base program

Annual performance metrics for 2010 will remain the same as in the 2009 crosswalk of Performance from Current Budget Structure to Proposed Budget Structure.

For details on NGP's performance, see the table at the end of Section H.

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Science on the Landscape — Regional and Crosscutting Activities

The Science on the Landscape section showcases USGS multidisciplinary science that addresses issues important to regional partners and customers. Presented in this section are the 2010 Regional Activities (G-1), (including Regional Overviews (G-2), Regional Realignment (G-13), Priority Ecosystems Science (G-13), and Departmental Crosscuts (G-17).

2010 Regional Activities

The USGS regional construct was developed to focus on issue-based, multidisciplinary science; align USGS work more closely with partners at the local and regional level; and enhance partnerships with Department of the Interior bureaus and other Federal, State, and local agencies. Closer proximity of the three USGS regions to Interior field bureaus, and field offices and other partners allows USGS scientists and managers to understand and address land and resource management issues at the local and regional levels, increases the opportunity for partnerships, and leverages resources. Regional efforts enhance the connection of the world-renowned capabilities of USGS with the high-priority, real-time land management, urban planning, and heightened security needs of local, Federal, State, Tribal, and community managers.



Regional geographic boundaries and main offices

Regional Overviews

Eastern Region

Overview — The Eastern Region (ER) has the longest urbanized coastline extending from the Gulf Coast of Mississippi to the Atlantic coastline of Maine, and along the Great Lakes from New York to Wisconsin; coastal issues are an important focus for USGS science in response to coastal storms, erosion, and other hazards. The Eastern Region is characterized by numerous, high-density, urban population centers located along or in close proximity to shorelines, hardwood forests, and the Appalachian Mountains. Continued expansion of coastal and riverine urban centers into rural areas of the region will impact the Nation's ability to use and enjoy natural resources while increasing the number and difficulty of the challenges to protect the welfare of citizens from natural disasters and other health risks.

The Eastern Region encompasses 26 States, District of Columbia, Puerto Rico, and the Virgin Islands; 24 percent (850,000 square miles) of U.S. land mass; 45 percent of Nation's coastline; 60 percent of U.S. population; 76 of the 134 most populated metro regions; eight times the average U.S. county density; nine out of ten densest counties in Nation; and the following land cover types.

- Forest 40%
- Agriculture 26%
- Wetlands 9%
- Developed 9%
- Open Water 11% and
- Other 5%.

The Eastern Region is comprised of three geographic areas, Midwest, Northeast, and Southeast.

Partnerships — The USGS Eastern Region partners with the National Park Service (NPS), the Fish and Wildlife Service (FWS) and Minerals Management Service (MMS) to help Interior's land and resource management agencies understand environmental changes in the ecosystems they manage. In addition to the Interior bureaus, Eastern Region partners with National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration (NASA), the US Army Corps of Engineers (USACE), the Department of Agriculture (USDA), the National Weather Service (NES), Federal Emergency Management Agency (FEMA), numerous non-governmental agencies and universities and well as a number of tribes to understand the effects of climate change, to minimize the risks of hazards (both natural and man-made). Working in partnership with others, USGS Eastern Region Staff help to contribute to public health in decision making, understanding the impacts on our energy and minerals use and water and biological resources.

2010 Program Performance

Marine Protected Areas — In 2009 the USGS Eastern Region continued support for research projects in marine protected areas at the Dry Tortugas, Florida and off the U.S. Virgin Islands. In partnership with the NPS these studies are providing decision-makers with information that is being applied to ecosystem-based approaches to managing corals and reef fisheries. The results of these studies have important implications regarding the use of marine reserves as a management tool to conserve coral reef resources by documenting the potential restoration

benefits for ecologically important fish and invertebrates and recreationally targeted species; providing understanding of the benefits of marine reserves off Florida and the wider Caribbean; identifying critical habitats that require greater protection; uncovering vital linkages and genetic connectivity among sea grass, mangrove and coral habitats; explaining the role of currents in transporting disease pathogens and pollutants (from land and sea) to coral reefs; determining the causes of coral diseases and bleaching; and providing managers with increased capacity to restore degraded coral ecosystem.

Shenandoah Valley — Water-resources issues, particularly those of water supply, water quality, and drought management, are of key concern to the Northern Shenandoah Valley Regional Commission (NSVRC), a local organization consisting largely of county commissioners and mayors that serves five counties and 15 cities and towns. Fostered by Eastern Region funding, the USGS has become increasingly engaged with these stakeholders, largely through the local Regional Water Resources Policy Committee (RWRPC), in order to provide the integrated science that is needed to aid them in their decision-making processes. In cooperation with the RWRPC and other local organizations, the USGS has held two joint conferences and several forums, to specifically address water-resources issues in the Shenandoah Valley and communicate the results of USGS research to local officials. Funding from the Eastern Region, with the additional support of other USGS programs and local cooperating agencies, has facilitated collaboration among several USGS programs and local cooperators, and allowed the USGS to develop a truly integrated science effort in the Northern Shenandoah Valley.

These integrated scientific activities, which include USGS biologists, geographers, geologists and hydrologists, will culminate in an intermediate-scale, dynamic, ground-water flow model of the Opequon Creek Basin, in Virginia and West Virginia. The model is being developed so that various water-management strategies, as determined by local officials, can be evaluated. This detailed model is the result of the collaboration among hydrologists who are measuring aquifer properties and ground-water budgets and conceptualizing groundwater flow in this karst aquifer system, geologists who are mapping the detailed geology (especially the fractures, faults, and other controls on ground-water flow), and researchers who have provided additional information on ground-water flow from remotely-sensed data Light Detection and Ranging (LiDAR), and surface and borehole geophysics). Additional hydrologic inputs into the model are being provided by other researchers who are evaluating the interaction between surface and ground water, as well as the age and residence time of the ground water. In 2010, work in the Valley will focus on improving and substantially modifying the ground-water model based on the experience gained by working with the model in cooperation with local officials.

Flint River — USGS scientists working on the Water Availability for Ecological Needs Science Thrust Study in the Flint River Basin in Georgia have developed prototype modeling tools to predict aquatic response to changes in stream flow. Downscaled climate projections, land use change, and hydrologic models were developed to model changes in natural flows such as floods and droughts and those changes predicted to occur from land use change and climate change. The linkage of the models to ecological models allow the scientist to estimate changes in viability and range of aquatic biota under alternative water-use, land-use and climate change scenarios. Sensitivity analyses are being conducted in 2009 and 2010 to show areas of greatest scientific uncertainty in predicting ecosystem responses to flow alteration, and peer-reviewed manuscripts are being prepared for all components of the study.

White-Nose Syndrome in Bats — Since the winter of 2007, hundreds of thousands of hibernating, insect-eating bats from at least nine northeastern states have died as the result of a

newly-emerged disease, white-nose syndrome (WNS). This disease represents an unprecedented threat to bats of the northeastern United States and potentially to cave-hibernating bat species of the world. In collaboration with other state and federal conservation agencies, the USGS-National Wildlife Health Center (NWHC) identified a previously undescribed cold-loving fungus, *Geomyces* sp., causative of the WNS-skin infection. In addition to the ongoing diagnostic investigation to document the occurrence and spread of WNS, in 2009, the NWHC has initiated several studies, in collaboration with partners, to enhance WNS diagnostic capabilities and to increase our understanding of the pathogenesis, physiology, and ecology of the WNS-associated *Geomyces* sp. fungus. Diagnostic tools currently under development include polymerase chain reaction and fluorescent in situ hybridization assays for rapid and specific detection of the WNS-associated fungus. An infection trial is underway to identify mechanisms by which the *Geomyces* sp. fungus may be transmitted bat-to-bat and to determine whether the fungus is the sole causative agent of WNS. Also, an environmental survey is underway to characterize the distribution of the WNS-associated fungus in the eastern US and to determine the role that cave sediments may play in the WNS transmission cycle. Based on its current distribution, WNS threatens already endangered Indiana bats, Virginia big-eared bats, and associated ecosystems.

Clinch-Powell — The USGS is working in the Clinch and Powell Rivers in Virginia and Tennessee to establish a scientific framework to understand the effects of increased energy demand, changes in land use, and changes in climatic variability on biodiversity among specialized aquatic fauna. The Clinch and Powell Rivers flowing from southwestern Virginia through parts of East Tennessee support unique and nationally significant endemic and endangered populations of fresh-water mussels and other aquatic fauna. Surveys of mussel and fish community structure over past decades have shown a pattern of decline throughout the Powell River and on parts of the upper Clinch that have suggested a connection to changing land-use practices in these river basins—in particular to possible episodic or chronic effects of coal mining on water quality and hydrology. Localized losses in species richness and declines in population health, however, have not been linked exclusively to any one cause in these basins and may in fact be the result of a combination of stresses including coal mining, other energy extraction practices, agricultural practices, urban development, and increases in hydrologic extremes. The primary products are a series of interpretive and data summary products focusing on the Clinch River basin. USGS products in 2010 would include a network of sites established for monitoring status and trends in water quality, streamflow, geomorphology, and biological populations, data-series publication of GIS coverages of land-use and watershed properties, a baseline geomorphic characterization of channels and habitat for evaluation of status and trends.

Mapping and Prediction of Flood Hazards — Indiana and Wisconsin Water Science Centers (WSCs) worked with the FEMA and State agencies to provide timely flood-inundation maps and flood peak water-surface profiles for communities along streams that had extensive damages associated with heavy rains and extreme flooding in June 2008 in the Midwest. State of the art methods and equipment were used to survey and map the extent and depth of the flooding over approximately 80 miles of streams in the two states. The WSCs recomputed flood-frequency statistics for flooded streamgages. Flood-inundation maps, along with information on flood peaks and probabilities, provided critical information needed for the Federal, State, and local flood recovery efforts. Prior to this disaster, USGS had worked with FEMA Region 5 officials to develop flood delivery product templates to facilitate quicker responses for studying and mapping areas affected by large floods. For future floods, the maps may serve as a basis for predicting flood hazard areas, protecting critical infrastructure, and safe-guarding emergency response capabilities in communities upstream of real-time streamgages. Flood maps and

profiles are beneficial for FEMA for flood map validation as the National Flood Insurance Map Modification Program moves forward. Flood maps and profiles can be used to help expand flood warning and forecast products delivered by NWS/NOAA's Advanced Hydrologic Prediction Service.

In January 2009 a Midwest Area Flood Science and Response Initiative Team was formed with members from USGS Water Science Centers in Indiana, Wisconsin, Ohio, Illinois, Michigan, Kentucky, and North Carolina; USGS Upper Mississippi Environmental Science Center; USGS regional and headquarters offices; FEMA Region 5, and the National Weather Service headquarters and regional offices. The team's focus issues include:

- hydrologic monitoring networks support for flood science;
- flood science resource rapid response;
- post-flood documentation studies;
- flood inundation mapping;
- flood risk communication; and
- flood science.

Central Region

Overview — The USGS Central Region (CR) scientists support land and resource management decisionmakers by engaging in a broad array of scientific investigations including agricultural practices, wildfire science, invasive species forecasting and control, surface and ground water availability, carbon and alternative energy development, ecosystem-based landscape management and hazard mitigation. These investigations gather data and integrate information supporting development of predictive models and other land and resource management methods and techniques. Within this ecologically diverse Region, consisting of the 15 states between the Mississippi River and the western slope of the Rocky Mountains, are vast tracks of federally managed land rich with energy, timber and recreational resources; iconic national parks including Yellowstone, Rocky Mountain and White Sands; critical water resources such as the Ogallala aquifer and the headwaters of the Rio Grande, Colorado and Missouri Rivers; and fragile ecosystems stressed by changes in land use or climate such as Mississippi River Delta, Green River Basin and the Nebraska Sand Hills. In addition to being a major source of food production, the region has the potential to be a key component in the nation's quest for energy independence with potentially rich sources of alternative energy including solar, wind and bio-fuels as well as large reserves of carbon-based fuels. The Central Region is also home to the USGS science centers that provide the data critical to hazard mitigation and emergency response. Rapid urbanization in parts of the region have resulted in a diverse cultural landscape from Native American to the descendents of the original European settlers to the newer, primarily urban and suburban arrivals.

- 27 Science Centers with 2,700 employees; 975 on-site contractors
- 74 USGS Offices located in 88 cities and 21 field offices
- Regional office in Denver
- National Earthquake Information Center
- Earth Resources Observation Science Center
- National Water Quality Laboratory
- U.S. National Ice Core Laboratory

The Central Region consists of three geographic areas, North Central, Rocky Mountain, and South Central.

Partnerships — The CR has built partnerships with Federal, State and local agencies and Tribal governments, universities, non-governmental and international organizations, the private sector, and the military services including the U.S. Army Corps of Engineers. The Central Region is the primary USGS liaison with U.S. Northern Command (NORTHCOM) and North American Aerospace Defense Command (NORAD). Two full-time liaisons coordinate USGS's contribution to NORTHCOM and NORAD contingency response.

2010 Program Performance

Wind Energy – USGS, in collaboration with other federal agencies and the wind industry, implemented a scientific study in 2009 to examine the influence of wind generators on migratory birds during the breeding season. This has led to the discovery that certain bird species avoid nesting near wind generators, whereas other species appear unaffected. The study involves grassland birds, a group that includes many species declining in number. Scientific work is continuing to determine how many of those species are affected and the extent of the nesting area influenced by wind generators.

Ozarks Karst Study – The unique Karst topography created by water carving underground channels and caves in porous rock creates land use challenges because the same forces that produce caves, caverns and beautiful underground formations also make the land prone to sinkholes, subsidence and water contamination. It is estimate that Karst makes up 25 percent of the U.S. In 2008, the USGS initiated a project to develop a probabilistic model for identifying the major factors that determine the occurrence of karst features in the Ozarks that can be used to better inform resource management decision-making in karst-dominated landscapes. This work is being done in cooperation with the National Park Service and will be shared with other land use managers in the region. For instance, this model would predict locations prone to sinkholes and constructing roads or buildings over areas likely to collapse could be avoided. In 2009, the Ozarks Karst team continued to collect and derive topographic, geologic, and geochemical data in northern Arkansas. A method for analyzing topographic and geologic features was developed and tested. A multi-agency partnership was formed to collect high-resolution LiDAR data. A regional composite of 1:24,000-scale geologic map data was compiled. In addition, water quality data were collected from a large number of springs to assess the potential for karst terrain to facilitate rapid infiltration of surface water and resulting potential for contamination. In 2010, the team intends to continue to collect and derive topographic, geologic, and geochemical data and to develop innovative analytical techniques. This study complements a broader Federal, State and non-governmental Ozarks Highlands partnership focused on collaboratively addressing water quality and availability, recreational pursuits, riparian habitat and biological diversity.

Health and Environmental Impact of Coal Tar Sealcoat (Polycyclic aromatic hydrocarbon (PAH)) - In response to USGS findings that coal-tar sealcoat is a major source of urban PAH contamination, Austin, Texas, Washington, D.C., and Dane County, Wisconsin (Madison), have banned the use of coal-tar sealcoat. Several other jurisdictions have or are considering steps to reduce use of coal-tar sealcoat, including the New York Academy of Sciences for New York Harbor and the Chesapeake Bay Program. PAHs are an environmental concern because they are toxic to aquatic life and several are suspected carcinogens. In the study, dust collected from coal-tar seal coated parking lots in Central and Eastern cities contained concentrations of PAHs that were about 1,000 times greater than levels found in Western cities where asphalt-

based sealcoat is more commonly used. Two factors studied by USGS scientists – higher concentrations of PAHs in Central and Eastern lakes and chemical fingerprinting, which links the PAHs in pavement dust and lake sediment – indicate that use of coal-tar based sealcoat is an important contributor to PAH contamination of urban lakes. Three of the seven Central and Eastern lakes had PAH concentrations at levels expected to adversely affect aquatic life.

Missouri River Species Restoration - USGS is partnering with the USACE and the FWS on restoration of three endangered species in the Missouri River. The USGS is characterizing habitat needs and improving the understanding of ecological requirements for least tern, piping plover and pallid sturgeon in the highly engineered river system. Complementary efforts to better understand surficial geology, water flow, the role of sediment movement, and water quality will not only contribute to endangered species efforts but will also provide input to the upcoming Environmental Impact Statement evaluating potential actions for restoring the Missouri River ecosystem. In 2009 USGS signed a memorandum of understanding with the Corps as a full participating agency in these endeavor identified in the 2007 Water Resources Development Act.

Sustainable Energy Development — This effort represents the USGS partnership with other Department bureaus, State and local agencies, industry and private land owners in the Wyoming Landscape Conservation Initiative committed to maintaining healthy landscapes, sustaining wildlife and preserving recreational and grazing uses while developing natural gas energy in the Green River Basin. This project uses a holistic, landscape-level approach to natural resource management and restoration in areas undergoing development. The USGS provides the science foundation for land-use decisionmakers. In 2010, the scientific tools, models and protocols which were developed as part of the 2009 work will be applied in assisting land management agencies to determine best management practices to meet the needs of multiple stakeholders. Additionally, effectiveness monitoring approaches will be used to provide more scientifically based information for land management decision making and adaptive management applications.

Delineation of Brine Contamination In and Near the East Poplar Oil Field, Fort Peck Indian Reservation — Brine is a byproduct of crude oil production. Handling and disposing brine during the last 50 years in the East Poplar oil field has resulted in the contamination of the shallow Quaternary aquifers and the Poplar River. Previous investigations have documented and delineated a portion of the extent of brine contamination in the East Poplar oil field during the early 1990s. Ground water in the contaminated Quaternary aquifers flows toward the nearby City of Poplar, Montana, which relies on these shallow aquifers as its sole source of water. The objective of this project is to delineate brine contamination in the Quaternary aquifers in and near the East Poplar oil field. This project will provide, in 2009 and beyond, the Fort Peck Assiniboine and Sioux Tribes with an updated delineation of brine contamination in these shallow aquifers in and near the East Poplar oil field. The project will also enable the Tribes to determine more effective remediation of brine contamination within the oil field, and provide information the Tribes need to evaluate the threat to the well field for the City of Poplar's water supply. In 2007, USGS staff collected additional water-quality samples to verify water-quality conditions indicated by the electromagnetic survey. Three aquifer tests were conducted to determine hydraulic characteristics in an area near the City of Poplar. USGS staff also served as technical advisors for the Tribes during planning of a large remediation project by one of the oil companies.

Northern Cheyenne Ground Water — Coalbed methane (CBM) has a large potential for development in southeastern Montana. In order to release methane from the coalbeds, large

amounts of ground water must be withdrawn from the coalbeds. Development of coalbed methane on lands adjacent to the southern and southeastern boundaries of the Northern Cheyenne Reservation could have unwanted effects on valuable groundwater resources within the Reservation, such as depletion of the water resource and lowering of water levels over large areas. The coal-bearing formation targeted for methane development also supplies most of the domestic and livestock water used on the Reservation. USGS scientists are currently working with the Northern Cheyenne Tribe to evaluate the quantity of groundwater in coalbed aquifers in areas of the Reservation that are adjacent to non-Reservation lands having a high potential for development of coalbed methane. Knowledge of the present groundwater resources in coalbeds of the Reservation is needed by land and resource managers to help them determine if future off-Reservation coalbed methane development would have an effect on the availability and quality of drinking water and stockwater on the Reservation. The USGS Montana Water Science Center began studies in cooperation with the Northern Cheyenne Tribe in 2002. During 2007, the USGS and the Tribe monitored water levels in six observation wells and installed continuous water-level recorders in several of the wells. The USGS visited the wells quarterly and taught Tribal personnel how to service the recorders. In 2008, USGS staff began preparing a report to evaluate the quantity of groundwater in the coalbed aquifers. As a result of these efforts, the Northern Cheyenne Tribe will have additional data to manage their natural resources.

Western Region

Overview — The nine states comprising the Western Region contain some of the most diverse economic forces in the world, and some of the most remote, pristine landscapes in the Nation, rich in both renewable and non-renewable natural resources — minerals, geothermal energy, wind energy, oil and gas. Western Region has the longest coastline in the U.S., and underlying the greater part of the coastline are huge and potentially catastrophic earthquake-producing subduction zones.

In addition, the Western Region is home to numerous active volcanoes and is one of the world's most volcanically active regions. Most importantly for the Department of Interior, the West contains: 75 percent of current U.S. Federal lands, many of which hold potential for energy development; over two thirds of all federally listed threatened and endangered species; numerous Native American tribes and several Pacific Trust Territories, including Guam; many unique river systems, including some of the Nation's most intensively used rivers, and most of its remaining unaltered, unregulated rivers; a vast array of aquatic and terrestrial ecosystems, including many that are projected to be heavily impacted by future climate change; more than 50 million people, and eight of the Nation's ten fastest growing cities; approximately 2,500 USGS employees located in 22 major science centers and 60 field locations; volcano observatories in Hawaii, Alaska, California, and Washington; and the USGS Earthquake Hazard Program, the world's premiere earthquake science team.

The Western Region is comprised of 3 "geographic areas", Northwest, Pacific Southwest, and Alaska.

Partnerships — USGS Western Region has longstanding relationships with numerous Federal agencies such as U.S. Forest Service, USACE, EPA, NASA, Department of Energy (DOE) and Department of Defense (DOD). USGS also has strong partnerships with numerous Tribes, State and local governments, and major private partners such as Bonneville Power Authority, Western Area Power Authority, and others who manage hundreds of irrigation and power

districts in the arid West. In addition, like the rest of the USGS, Western Region delivers objective, credible science and technical support to all of Interior's bureaus, with especially strong partnerships with the NPS, BOR, BLM, and FWS.

2010 Program Performance

Columbia River Science and Partnerships — USGS science centers in multiple states and scientists from all scientific disciplines are actively engaged in Columbia River Basin studies, and throughout 2008 and 2009, have made important contributions to resolving the challenges that face those who inhabit, use, and have management responsibilities in the Basin. Traditional research, real-time monitoring, technology transfer, technical assistance, data management and integration, and development of predictive modeling capabilities are all currently underway in the Basin. USGS scientists were key contributors to the recently released "*Columbia River Basin State of the River Report*" (<http://yosemite.epa.gov/r10/ecocomm.nsf/Columbia/SoRR>), the first comprehensive look at toxic contamination throughout the Columbia River Basin. The report focuses on four widespread contaminants mercury, Dichloro-diphenyl-trichloroethane (DDT), Polychlorinated biphenyls (PCBs), and Polybrominated diphenyl ethers (PBDE) in the Basin, identifying the risks they pose to people, fish, and wildlife while also touching on the general lack of monitoring for toxics in the Basin. The report concludes with a number of initiatives that are intended to improve the understanding of the health of the Basin and strengthen coordination, including an expansion of existing toxics reduction activities throughout the Basin; identifying and characterizing the sources of toxics to the Basin; and developing a regional, multi-agency long-term monitoring and research program.

In addition to conducting cutting-edge, integrated science projects in the Columbia Basin, the USGS leads or participates in a large number of collaborative ecosystem-based efforts with an array of federal entities (including the NPS, FWS, USFS and BLM) and tribes charged with a variety of missions, trust responsibilities, and a tapestry of ownership in the Basin. For example, USGS executives and science staff are part of the Columbia River Basin Federal Caucus, a collaborative effort consisting of nine Federal agencies to better integrate, organize, and coordinate the Federal fish recovery and water quality efforts in the Columbia River Basin. USGS employees also coordinate and staff the Pacific Northwest Aquatic Monitoring Partnership (PNAMP), a forum for coordinating state, federal, and tribal aquatic habitat and salmonid monitoring programs. The Columbia River Toxics Reduction Working Group is composed of Federal agencies, states, tribes, and non-profit partners focused on preventing and reducing toxic concentrations and loads in the Columbia River. USGS scientists lead this effort and chair sub teams. Finally, the regionally-funded Columbia River Contaminants and Habitat Characterization project is a multidisciplinary effort to track the occurrence and effects of emerging contaminants in the aquatic environment and aquatic organisms of the Columbia River Basin.

The ShakeOut Earthquake Scenario — In 2007, the USGS began the Multi-Hazards Demonstration Project (MHDP), an inter-disciplinary science effort to demonstrate how hazards science can improve a community's resiliency to natural disasters such as earthquakes, tsunamis, wildfires, landslides, floods and coastal erosion. In one approach to doing this, USGS scientists generate a plausible hazard scenario, using long-term data sets, research findings, and professional expertise. Importantly, the MHDP team engages the user community in setting research goals and directs efforts towards research products that can be applied to loss reduction and improved resiliency. After the scenario is developed, the USGS and an array of Federal, State, municipal, and Non Governmental Organizations (NGO) partners plan and conduct a hazard response exercise designed to educate and involve agencies and the public.

This novel approach assures that the hazard scenario is based on sound science, reflects real-world possibilities, addresses a broad spectrum of potential outcomes and impacts, and is relevant to the user community.

The first public product of the MHDP was the ShakeOut Earthquake Scenario. It detailed the realistic outcomes of a hypothetical, but plausible, magnitude 7.8 earthquake on the San Andreas Fault in southern California. Over 300 scientist and experts from USGS and other organizations contributed to understanding the impacts of such a disaster, including the geotechnical, engineering, social, cultural, environmental, and economic consequences. The scenario advanced scientific understanding and exposed numerous vulnerabilities related to emergency response and lifeline continuity management. The magnitude 7.8 earthquake scenario served as a scientifically credible basis for the largest earthquake drill in United States history - "*The Great Southern California ShakeOut*" (www.shakeout.org). The November 13, 2008, series of events involved over 5,000 emergency responders, 280,000 local government officials, and over 5 million members of the community. The Great ShakeOut included presentations by the Secretary of Interior and the Governor of California, and participation by senior USGS leaders. This emergency preparedness drill - based on the science provided by USGS - was a watershed event in increasing public awareness and readiness of earthquake hazards in Southern California. The MHDP team and the USGS have received repeated recognition and rewards for their essential contribution to the ShakeOut. The MHDP team is currently working on the next hazard scenario, which will involve a series of severe winter storms along the West Coast.

Winter Storm Scenario — For 2009, the Multi-Hazards Demonstration Project is preparing for the next public project, a Winter Storm Scenario. Like the ShakeOut Earthquake Scenario (urbanearth.usgs.gov), the USGS is bringing together experts to examine in detail the possibility, cost and consequences of a winter storm disaster including floods, landslides, coastal erosion and inundation; debris flows; biologic consequences like extirpation of endangered species; physical damages like bridge scour, road closures, dam failure, property loss, and water system collapse. The project will begin with the design of large but scientifically plausible physical events followed by an expert analysis of the secondary hazards, and the physical, social, and economic consequences.

Alaska Native Health and Ecosystem Studies — The Alaska native community has an inseparable nexus to their surrounding natural resources that supports both nutritional and spiritual health. Alaska's fish, wildlife, plants, and waters are also critical subsistence resources for Alaskan Natives. No more clearly than in Alaska are public health threats affected by the relationship between people and their surrounding natural physical, chemical, and biological environment. Public health problems caused by environmental contamination (both natural and anthropogenic) and insect or wildlife transmission of emerging diseases are a growing concern, with some being directly related those resources being used by Alaskan Natives. These may include bio-accumulated, naturally occurring contaminants in the food chain, diseases transmitted by the bite of insects or animals, and environmental threats to public health from airborne hazards such as volcanic ash. The USGS is working closely with a number of Federal, State, and local native organizations in assessing the potential interconnections between naturally occurring minerals, ecosystem health, wildlife health, and human health.

In 2009, the USGS produced maps of arsenic in soil and water from regional databases and known cases of diabetes in and around native communities. These data were also related to arsenic obtained from drinking water samples from those same communities. This information is used to support organizations such as the Alaska Native Tribal Health Consortium, which is

interested in better understanding how climate change and Alaska's heavily mineralized environment (e.g. mercury, asbestos, arsenic) and wildlife patterns will relate to subsistence food safety and key health changes. The USGS has also recently established an Alaska Interagency Ecosystem Health Work Group to bring together and leverage the significant and diverse missions, skills, and capacities of the participants to gain a greater understanding of the relationships between ecosystems and human health. Membership includes Alaska Native Tribal Health Consortium, Alaska Departments of Environmental Conservation and Fish and Game, the Alaska Division of Public Health, Centers for Disease Control and Prevention (CDC), FWS, and EPA. The USGS will continue to work with the members of the working group to establish baselines for hazards (contaminants and environmental); identify pathways and sentinels and study to determine effects; and identify important data sets and mechanisms for exchange. In 2010, the USGS will also facilitate pilot projects that demonstrate the connections between the natural environment and human health issues, such as the assessment of mercury in salmon and northern pike from western Alaskan waters and the potential relationship to naturally occurring mercury in the local environment.

Mapping, Climate Change, and Landscape Vulnerability on the Navajo Nation — USGS scientists from the Flagstaff Science Center will continue in 2009 and 2010, to work with communities on the Navajo Nation to conduct geologic mapping and establish relations of land use and climate change to changes in the landscape. Data are compiled as digital maps in a Geographic Information System (GIS), using bedrock and surficial mapping as a foundation to document changes in land surface conditions. The Navajo Nation (roughly the size of West Virginia) has the largest land base and reservation population of all tribes in the United States. Sand dunes cover approximately one-third of the arid to semi-arid 65,000 km² Navajo Nation on the southern Colorado Plateau. Conventional geologic mapping from this study provides crucial information for planning urban development and infrastructure such as highways, buildings, bridges, and domestic septic and landfill systems. Surficial maps that show temporal changes also provide information on geologic hazards, such as sand and dust storms and flood vulnerability, to provide a better understanding of ecosystem responses to land use and global warming. Sand dune mobility brought on by drought, climate change, or land use practices, has serious consequences on human and animal populations, agriculture, grazing, and infrastructure. Dune mobility is inundating housing and causing transportation problems. It may also contribute to a loss of rare and endangered native plants and grazing land, and lower air quality from periodic dust storms. The USGS staff and their Navajo Nation partners are combining mapping efforts with remotely sensed data and meteorological data to provide information necessary to more effectively mitigate these impacts. Dust from sandstorms on the Navajo Nation may potentially affect snowmelt in the Colorado Rockies, because it lowers albedo (reflectance) and absorbs heat. Continuing severe drought conditions have produced diminishing soil moisture conditions during the past several years, leaving several areas without enough moisture to support stabilizing vegetation. Additional information on this project, which includes a significant traditional ecological knowledge component, is available on-line at <http://geomaps.wr.usgs.gov/navajo/>

Developing New River Ecosystems Models and Science: River Ecosystem and Modeling Science (REMS) — Competing demands for water supplies is one of the most challenging problems facing natural resource managers in the coming decades. New streamflow and habitat prediction models are needed to assist managers in the face of increasing complexity and uncertainty in water management decision-making throughout the Nation. Managers need to have tools available to help assess the implications of possible management options on streamflow, habitat, and biological populations and to incorporate ecosystem-level understanding into management of watersheds. The ultimate goal of the USGS REMS effort is

to advance the science and develop the next generation of tools needed to understand the hydrologic conditions necessary to support instream habitat requirements for river ecosystems. As a first step toward the larger goals, the Klamath REMS Pilot Study will focus on describing the 'environmental flows' and temperatures required to benefit the salmon run in this relatively large river basin. To this end, the Science Planning Team will endeavor to develop an approach (based on new tools) that will be transferable to other river basins. The Klamath River Basin has been selected as the site location for the pilot study to develop an approach for defining flows needed to benefit target fish species, and to take the first steps toward the long term goal of developing a new suite of enhanced models with national applicability. The Klamath Basin is the ideal location for this pilot project because it represents many of the water availability issues of concern across the Nation. Klamath is home to salmon, agriculture, dams, Tribal interests, and is already a scientific and management priority with ongoing modeling and process studies related to surface water, ground water, and biology. During 2008 the Science Planning Team developed a strategy for the effort, resulting in a workplan that describes in detail how the goals of the project will be achieved by 2011.

Great Basin Multidisciplinary Information for Adaptive Management —The Owyhee Uplands, which encompass portions of Idaho, Nevada, and Oregon, have remained relatively intact and isolated from the principle causes of habitat stress that influence other regions of the Great Basin. Because of this significance, the BLM has designated the Owyhee Uplands as a site for developing pilot strategies as part of their National Monitoring Strategy Program. The USGS will support this monitoring in 2009 and 2010, with improved understanding of agents, conditions, or other stimuli that stress ecosystem integrity; for example, exotic plant invasions. The USGS is also identifying indicators of habitat and bird population trends. Using site-specific information, data from remote sensing, and other geographically referenced data, the studies combine a wide array of information to identify primary environmental gradients structuring sagebrush habitats in the Owyhee Uplands. This information includes soils, landforms, bird distributions, plant community structure, and flowering patterns and other recurring phenomena associated with plant communities. The results will improve the understanding of primary patterns and processes that promote ecosystem integrity and influence resilience and resistance to external stressors. This understanding is an important contribution to monitoring and adaptive management for this region. Ultimately, the results will be useful in modeling climate-change scenarios for sagebrush and other dominant habitats in the Owyhee Uplands.

Puget Sound Integrated Landscape Monitoring — Deteriorating environmental quality of the waters of Puget Sound has raised alarms at State, local, private, and Federal levels. The USGS is working with many partners in the Sound to understand the effects that a changing landscape has had on the second largest estuary in the US. Determining the impacts of natural processes and human actions, predicting their effects, and developing models and tools to evaluate different actions as expressed through changes in the landscape are critical to ensuring a sustainable future for all, both economically and ecologically. A conceptual model of the landscape is being developed in 2010, to describe the components of the landscape (structure) and the interactions among those components (function). This conceptual model will also be used to identify monitoring needed to measure and evaluate potential indicators of landscape condition and change at scales necessary to inform management issues and practices. This area is now home to about four million people with population growing rapidly each year so it is critical to understand how the vital resource of Puget Sound can be sustained under this pressure.

Regional Realignment

The USGS Science Strategy Circular 1309, *U.S. Geological Survey Science in the Decade 2007-2017*, is based on input from diverse stakeholders regarding their science needs and on the results of a bureau-level National Research Council review of USGS roles and responsibilities. This science strategy identifies needs for structural change in implementation strategies — an examination of the best organizational structure both to continue to meet our science responsibilities and to more effectively conduct the ecosystem-based science required to meet the challenges of the 21st Century.

A long-term evaluation had been underway to assess our traditional organizational structure, which was primarily discipline-based. After careful evaluation, in 2008 the USGS regional structure was modified to shift from a team of Regional Directors and discipline-specific Regional Executives to Regional Directors with three executives overseeing multiple disciplines within large geographic areas. The three existing regions — Central, Eastern, and Western — were maintained and three geographic areas within each region were created to enhance the multi-discipline science. This was done in order to facilitate cross-discipline science, allow closer collaboration with our customers, and provide a simplified coordination process via a single USGS point of contact for all science disciplines. During 2009, recruitments were completed for all Regional Director and Regional Executive positions, and the regional and area offices continue to work on becoming fully staffed and operational.

A key aspect of implementing our Science Strategy will be creating and sustaining a work environment and culture that is more conducive to collaborative, interdisciplinary scientific research. The realignment of the Regional Executives was one step toward building our capacity for interdisciplinary science. Another part of our commitment toward achieving the goals of our Science Strategy is to implement a common bureau science planning process. The Regional Executives and the discipline Chief Scientists have been charged with developing and refining a bureau science planning model that takes advantage of our new regional management structure and enhances our ability to achieve the Science Strategy goals.

The regions and associated geographic areas are led by members of the Senior Executive Service who have responsibility for all the science centers in their region and areas and for implementing multi-disciplinary work and delivering high-quality integrated science as well as being the primary USGS representative to all customers. These executives are also responsible for providing technical quality control and quality assurance for all science activities.

Priority Ecosystems

Priority Ecosystems Science in Biological Research & Monitoring — One of the major components of the Ecosystem Program is the Priority Ecosystem Science (PES). Research in PES is aimed at improving the understanding of the rates, causes, and consequences of natural and human-induced processes that shape and change the landscape over time and to provide comprehensive information needed to understand the environmental, resource, and economic consequences of landscape change. Through PES, the USGS provides integrated science support to better understand the interactive nature of resources and the environment. Land- and resource-management agencies require integrated scientific information and understanding to circumvent potential problems and implement needed improvements. USGS scientific information is provided within the adaptive management framework as improved scientific understanding can be incorporated into the planning and management of each area. Scientific

information is used to ensure that future plans have realistic expectations for restoration, structures under construction are optimally managed, monitoring will yield the information desired, and managers have the tools to predict outcomes of possible restoration scenarios. PES supports ongoing studies in the Greater Everglades, Chesapeake Bay, San Francisco Bay, the Mojave Desert, the Platte River, and the Greater Yellowstone area.

2010 Program Performance

Restoring the Greater Everglades and Coastal Ecosystems — Marjory Stoneman Douglas wrote in her 1947 book on *The River of Grass* “*There are no other Everglades in the world. ... They are, they have always been, one of the unique regions of the earth, remote, never wholly known.*” Today’s Greater Everglades is highly degraded and declining. Restoring the Nation’s Greater Everglades and adjacent coastal ecosystems in south Florida, over half of which is under the stewardship of the Department, is the largest environmental restoration project ever attempted in the United States. Sustainable restoration of this valuable natural resource requires a fundamental understanding of the ecosystem and the underlying causes of ecosystem change.

USGS research and monitoring helps provide this fundamental understanding of the Greater Everglades ecosystems. Much of USGS science focuses on coupling its research and monitoring with modeling to aid in understanding historical changes and assist in predicting future ecosystem changes as a response to restoration, urbanization and climate change/sea level rise. USGS research focuses on ecosystem history, water quality and contaminants, surface and groundwater flows, and species response to hydroperiod dynamics. A major thrust of the USGS continues to be the development of new and improved models, including hydrologic models, ecological models, landscape models and water quality/contaminant models. These models and associated decision support tools are essential for planning, evaluating and forecasting alternatives for restoration and Strategic Habitat Conservation (SHC). To help address emerging issues and concerns about climate change and sea level rise relevant to restoring greater South Florida, the USGS recently initiated and redirected several projects. A USGS/Massachusetts Institute of Technology (MIT) project in partnership with FWS, is focusing on linking predictions on climate change, future urbanization patterns and predicted pressures on FWS trust lands and species. On another project, in partnership with USACE and Everglades National Park, the USGS is using surface water and groundwater hydrologic models and ecological models to address the interplay between the timing and amount of restored freshwater flow to the Everglades relevant to various sea level rise predictions. The basic premise is that restored freshwater flow to the Greater Everglades will delay the rate at which saltwater will intrude into groundwater supplies while also helping to recover the resilience of the coastal freshwater and estuarine ecosystems to climate change perturbations. A 2008, USGS study in the Ten Thousand Island National Refuge area of southwest Florida coupled a hydrologic model, which included water salinity and water temperature, with a manatee model to aid in predicting future response of manatees (and similar estuarine species) to restoration efforts. This model is being expanded to incorporate sea level rise predictions in evaluating future responses of manatees to change. USGS has a network of coastal and freshwater hydrologic monitoring stations throughout the coastal areas of Florida Bay and southwest Florida. The recently established Everglades Depth Estimation Network (EDEN), a central network designed and operated by USGS to provide a real world validation tool for hydrologic models in the freshwater ecosystems, is being expanded in 2009, to include the estuarine and coastal systems. Water depth greatly influences ecological response to hydroperiod in freshwater ecosystems, and, hence, is required for developing hydrology-driven wildlife and plant community models. In estuarine ecosystems, water depth and salinity are major drivers.

Extending USGS EDEN network into the estuarine ecosystem and USGS extensive coastal monitoring network provide the opportunity for developing a depth/salinity network for estuarine systems. This freshwater/estuarine/coastal EDEN network will provide a solid foundation for measuring and predicting the significance of restored freshwater flow on impacts of landward migration of salt water as sea level rises. USGS paleoecological (recent history) research was recently used with hydrologic models to clearly show that current estuarine and coastal ecosystems were historically much fresher with minor fluctuations in salinity, and that the major cause for the increased salinity was a reduction in freshwater flows. This coupled paleoecological and hydrological model is being used to better understand and predict expected changes relevant to sea level rise. Previous USGS research noted that the mercury and sulfur hotspot had migrated from the central Greater Everglades to the northern portion of Everglades National Park. In 2008, USGS field research confirmed via sediment and water sampling that this 'migration' is a recent event providing the opportunity for resource managers to look for options for reducing or eliminating this impact through restoration.

San Francisco Bay Priority Ecosystem Science— The San Francisco Estuary is an ecosystem undergoing an aggressive and expensive restoration. Like other urban estuaries, this system has a history of anthropogenic manipulations that have degraded the ecosystem. Half of the estuary's historic freshwater flow is exported, sewage from over two million people and chemical and biological (exotic species) contaminants are discharged each day into the system, and less than 10 percent of its original tidal wetland and riparian habitat remain. This study has looked at the ecosystems response to these multiple stresses over the last 40 years. In 2009, California is addressing how the ecosystem is currently responding to restoration, and how the interaction of current stressors with future changes such as population growth and climate change will affect water quantity and quality and restoration actions. Both field studies and linked numerical models from this work supply scientific guidance to current and future resource and restoration managers.

USGS Provides Science for Restoration of the Nation's Largest Estuary: the Chesapeake Bay — The restoration of the Chesapeake Bay, is continually challenged by the population increase in its 64,000 square mile watershed and potential impacts of climate change. Since the mid-1980s, the Chesapeake Bay Program (CBP), a multi-agency partnership has worked to improve water quality, increase habitat, and restore living resources in the Bay. However, the lack of significant improvement in the Bay ecosystem and the discovery of "intersex" characteristics in fish within the Bay watershed illustrates that more effective implementation and assessment of ecosystem management actions are needed. To meet these challenges, the USGS has implemented aspects of its Chesapeake Bay Science Plan, which covers 2007-2012, to provide integrated science for effective ecosystem conservation and restoration. Results from 2009 will include:

- The USGS is partnering with Natural Resources Conservation Service (NRCS) and EPA to apply the newly developed Chesapeake Online Adaptive Support Toolkit (COAST) decision-support system to identify priority watersheds to enhance conservation practices using funds from the 2008 USDA Farm Bill. The USGS is also working with EPA to apply COAST to identify areas to focus Stimulus Bill funding to improve green infrastructure.
- A sediment model of the Chesapeake Bay watershed, which is the first regional sediment SPARROW model for the Nation, is being released that will help target the locations and types of sediment management actions.
- The USGS worked with the CBP office to develop new techniques to analyze land-cover change for the Chesapeake Bay watershed. However, 2009 Geographic Monitoring and

Analysis Program funds have been reduced to continue development of a model to forecast the effects of land change on ecosystem conditions.

- The USGS is analyzing emerging contaminants in both water and fish during 2009-2010 as part of its fish-health assessments to identify causes of fish kills and intersex conditions in the watershed.

In 2010, the USGS is planning to conduct field investigations that are needed to better define the factors affecting water quality, explain ecosystem change and its relation to management actions, determine the causes of poor fish health and improve COAST to more effectively implement and assess ecosystem management actions.

The Mojave Desert Ecosystem — The Mojave Desert Ecosystem is a landscape of contrasts and challenges spread across southern Nevada, western Arizona, southwestern Utah, and southeastern California. Encompassing six military bases, four national park units, and considerable BLM and other Federal lands, the Mojave Desert is home to a rapidly growing population of well over a million people. Human activities, such as animal grazing, off-road vehicle use, construction, mining, urban expansion, waste disposal, recreational uses, water withdrawal, and natural processes influenced by man, such as fire and invasive species, have increased the vulnerability of the desert environment to soil erosion and ultimately habitat degradation. The Mojave Desert is also an area expected to be rapidly developed for solar and wind energy, which pose new impacts to the ecosystem that may extend beyond the region and have human health effects. This interdisciplinary project continues to work closely with land management entities in the Mojave Desert, mainly through the Desert Managers Group which includes NPS, BLM, FWS, DOD, State and many other groups creating a knowledge base to:

- describe the vulnerability of the land to erosion, invasion by noxious weeds, climatic variability and other disturbances, especially those related to energy development,
- identify the mechanisms that determine resistance and resilience to disturbance,
- determine the potential for recovery of degraded land so that managers can better target management activities, and
- develop monitoring techniques.

In 2010, the USGS will continue:

- detailed studies of how plants and fauna interact and respond to climate and landscape heterogeneity and water availability,
- development of tools for analyzing these processes at a landscape and regional scale, and
- assist managers in developing monitoring programs to assess and predict landscape level disturbances, cumulative effects, resilience to disturbance, and effectiveness of mitigation activities.

Platte River Ecosystem Resources and Management — The Central Platte River Valley provides habitat for the annual migration of over one-half million sandhill cranes, several million waterfowl, and for endangered species, including the whooping crane, piping plover, and least tern. Changes in water and land use have transformed the river channel, altered the structure of riparian habitats, and allowed for the introduction and spread of invasive species. In 2006, the Department and the States of Colorado, Nebraska, and Wyoming all signed off on a proposed Platte River Recovery Implementation Program to improve habitat for the endangered species. The USGS collaborates with State, Federal, and local partners to develop successful adaptive management strategies and the USGS research is being used to guide the development of a

new 5-year management plan for the crane population. In 2009 and 2010, the USGS will continue to operate hydrologic monitoring stations along the river, monitor cranes and migratory waterfowl, expand technological studies to better link surface and ground water levels, and investigate the effects of invasive species. USGS is studying least tern and piping plover nesting ecology of sandpits and sandbars for the Platte River Recovery Implementation Plan. USGS scientists from several disciplines are studying climatic linkages of waterfowl pathogens, such as Avian Flu and Legionella. In addition, the USGS is collaborating with the University of Nebraska and Stanford University to develop magnetic resonance scanning as a technique for characterizing aquifers in the Platte River valley. Other related studies are examining the effect of sediment movement on hydrologic flows, vegetation and channel morphology.

Greater Yellowstone Ecosystem: Snake River Project — The Snake River Priority Ecosystem Study is part of the Greater Yellowstone area. The area is home to relatively intact species assemblages that represent world-class wildlife, botanical, and geologic resources. This area includes multiple states and mixed jurisdictions of Federal, State and private lands with competing uses that include urbanization, mineral development, recreational and grazing use and timber harvesting. The initiation of USGS research and the formation of the science advisory panel have prompted the BOR to examine modification of river flows to more closely mimic natural seasonal water flows thereby providing an opportunity to adaptively manage the system. Currently, four years of riparian vegetation research and three years of geomorphological research have been completed (2005–2008). In 2008, an additional 150 radio tags and several hundred passive integrator transponder tags were implanted in Snake River cutthroat trout to track seasonal movements of cutthroat trout throughout the study area. The first paper from the riparian study was submitted and accepted for publication. Additional work on tributary riparian habitats was initiated in 2008 as a graduate project and will be complete in 2009. The geomorphic studies were finished in 2008 and two papers have been completed, one has been published and the other submitted for publication. The final geomorphic work will be completed this year. A LiDAR study component was initiated in late 2007 and this data has been analyzed and is now being used by the riparian and geomorphic groups to better understand the effects of the changing flow regimes on sand bar substrates, channel formation and colonization of cottonwoods. Knowledge gained through ongoing studies enabled the production of maps of the distribution of floodplains and terraces of the river, the development of maps and figures detailing how the river has changed since the completion of the dam, reports on occurrence and spatial data on invasive and sensitive plant species, and spatially geo-referenced study plots for future monitoring as part of our riparian work. The initial fisheries work indicates that spawning is taking place in the Park area and that fish are moving tens of kilometers during periods of high flows in the summer time, possibly in response to the altered flows. In 2009, fisheries and riparian work will continue and the initial Structural-Equation Modeling will begin for geomorphology/riparian work. In 2010, the USGS is cosponsoring a workshop to build a larger Yellowstone Ecosystem initiative with Yellowstone National Park and other partners in the ecosystem directing the effort with a climate change focus.

Department Crosscuts

As the Department's science bureau, the USGS conducts research that is foundational to numerous intradepartmental and interagency crosscutting activities. These crosscutting activities range from environmental issues such as the Everglades restoration and coral reef protection in the Pacific Islands to environmental and climactic change issues being studied under the Global Change rubric. The following are crosscutting activities in which the USGS plays a prominent role.

(Dollars in Millions)

	2007 Enacted	2008 Enacted	2009 Enacted	2010 President's Request
Great Lakes Restoration	16.3	14.8	15.8	15.8
Columbia River Basin Salmon Recovery	3.0	2.7	3.0	2.6
Coral Reef Protection	2.5	1.7	1.7	1.7
Global Change	26.6	26.6	40.6	58.2
Greater Everglades Ecosystem Restoration	6.9	6.8	6.9	6.9
Invasive Species	11.3	11.3	11.2	11.2
Klamath River Basin	2.7	2.7	2.8	2.8

Great Lakes Restoration — The mission of the Great Lakes Science Center (GLSC) is to improve the understanding of National Ecosystems and resources through interdisciplinary assessment for restoring, enhancing, managing, and protecting the living resources and their habitats in the Great Lakes basin ecosystem. The Great Lakes support a \$7.0 billion annual fishery plus considerable additional dollars for tourism and recreation. The GLSC is in a strategic position to address Great Lakes restoration issues with biological stations located throughout the basin. Research programs, including deepwater science, invasive species, restoration ecology, and wetlands and coastal habitat, provide critical scientific information for the management of these resources.

The GLSC leads the long-term program of deepwater research for assessing status and trends of Great Lakes fish populations and management of associated databases. The GLSC works closely with the Great Lakes Fishery Commission, FWS, seven state fishery agencies, Ontario of Ministry Resources, and tribal entities in collaborations to provide necessary information to manage the important fishery and restore native fisheries. USGS scientists in collaboration with multiple partner groups are also conducting invasive species studies including control of invasives, identifying key natural habitats at risk over a large geographic scale, and methods that help restore native populations. In addition, scientists are examining the role of invasive species in food web disruption and fish community changes and measuring the amount and flow of nutrients and energy through the food web across seasons and habitats.

For more information about the Great Lakes Restoration in 2010, see Section C, Key Initiatives.

Columbia River Basin Salmon Recovery — The USGS collaborates with many partners on efforts to restore salmon populations in the Columbia River Basin. The USGS works with FWS, USBR, and BLM to address research needs on Interior lands and projects. Partners external to the Department of Interior include the Bonneville Power Administration, U.S. Army Corps of Engineers, and NOAA Fisheries, U.S. Forest Service, Washington and Oregon state government agencies, the Grand Ronde Tribe, the Yakama Nation, and several citizen advisory groups. In 2007, the USGS determined that survival of juvenile salmon passing through modified spillways at McNary Dam was equal to or better than passage over unmodified spillways, which means that structural modifications at other dams may provide a means to maintain or improve passage of fish while reducing the volume of water needed to safely allow passage. On the Toutle River, a sediment retention structure built after the eruption of Mount St. Helens, was determined to be a total barrier to upstream migrating salmon. In the Wind River, studies showed that introduced Chinook salmon do not have a negative impact on native steelhead and that summer flows influence the upstream extent of spawning by Chinook salmon, which in turn influences the distribution of juvenile Chinook salmon the following year. The USGS monitored fish migrations in the Big White Salmon and Methow rivers as part of ongoing investigations of barrier removals. In the Yakima River basin, a decision support tool

was developed to assist with managing river flows to maximize benefits to fish, agriculture, and municipalities.

In 2009 and 2010, the USGS will continue working with managers to restore Columbia Basin salmon. Studies will focus on long-term effects of barrier removal as a means of rebuilding salmon populations, including removal of Condit Dam on the Big White Salmon River and irrigation dam removals on the Methow River. The USGS will continue to assess the survival of juvenile salmon passing dams to identify the impacts of water management and determine the efficacy of modifications to fish passage structures at dams on the Lower Snake and Columbia Rivers. The USGS will also investigate the impact of American shad, a fish not native to the Columbia River, on salmon restoration efforts.

Coral Reef Protection — Coral reefs worldwide are in decline. The Department alone has responsibility for more than 3.5 million acres of submerged habitat. In addition to shallow reef habitat, Interior also has responsibility for ocean areas where deep reef habitat exists. USGS research is informing States and Territories in the development of Local Action Strategies in response to Coral Reef Task Force resolutions to address coral reef degradation, conservation, and restoration in State and Federal waters (e.g., Hawaii, Florida, and the Caribbean). The USGS research is also providing information on reef health and status to resource managers and the scientific community to enable them to develop management strategies to address climate change effects on coral communities. USGS is providing information to MMS on the structure, diversity and extent of deep reefs under Department responsibility. Resource managers with the NPS, FWS, MMS, NOAA, and coastal States have called upon USGS to help them understand the processes involved in reef decline so that local-scale stressors can be mitigated or removed, and reef recovery encouraged. USGS products are being and will continue to be used by members of the Coral Reef Task Force as they implement the various Local Action Strategies and the coral reef community as a whole.

In 2009 and 2010, USGS research on shallow and deep reefs will include: understanding conditions needed for productive and healthy reef communities; information to support strategies needed to conserve and restore reef resources in a changing climate; understanding terrestrial impacts to reef health in support of U.S. Coral Reef Task Force resolutions; assessing impacts of disease on corals and the recovery trajectory to a healthy and resilient state; and evaluating how nature and human activities in marine parks and refuges and on the Outer Continental Shelf influence reef integrity and biodiversity.

Global Change — The USGS supports multidisciplinary studies of past environmental and climatic changes (climate history); process studies that explore the sensitivity of the Earth's surface, the hydrologic cycle, and ecosystems to climate variability and change; and forecasting of potential future changes and their effects on landscapes and ecosystems (particularly on public lands). USGS Global Change Research activities strive to achieve a whole-system understanding of the interrelationships among Earth surface processes, ecological systems, and human activities. Activities of this cross-discipline science program focus on documenting, analyzing, and modeling the character of past and present environments and the geological, biological, hydrological, and geochemical processes involved in environmental change so that future environmental changes and impacts can be anticipated. To accomplish these goals, the USGS draws on its extensive land, water, and ecological monitoring networks, its remote sensing and mapping capabilities, and its basic process-oriented research. The integrated combination of these studies provides long-term perspectives needed by natural resource managers, communities, and policymakers to anticipate and adapt to climate change and variability within a science-based framework.

In 2009, following the recommendations articulated by the Department Climate Change Task Force, the USGS is providing leadership for more effective coordination of climate effects monitoring across the Department and developing new intensive research regarding processes related to climate change impacts in climate-sensitive parts of the Nation, including the Yukon Basin and North Slope of Alaska. USGS is developing a new strategy for development of locally and regionally relevant science applications for resource management decision making, and the architecture for a global change information management system in order to provide better and more efficient access to science information by managers and policymakers throughout Interior. A new organizational structure was approved in the 2009 budget to consolidate primary climate change efforts.

For more information about Global Change in 2010, see Section C, Key Initiatives.

Restoring the Nation's Greater Everglades and Coastal Ecosystems — The Everglades and adjacent coastal ecosystems in South Florida comprise the largest environmental restoration project ever attempted in the United States. USGS science is an important part of the restoration effort. For more information about this initiative, see Priority Ecosystems on page G-14 above.

Invasive Species — The USGS plays a significant role in implementing the national Invasive Species Management Plan, developed by the National Invasive Species Council, as called for in the Presidential Executive Order on invasive species. To meet the goals of the plan, the USGS provides management-oriented research and delivers information needed to prevent, detect, control, and eradicate invasive species and to restore impaired ecosystems. USGS researchers are leading or facilitating efforts to integrate the capabilities of USGS and partners, including Federal and State resource agencies, universities, and the National Biological Information Infrastructure Invasive Species Information Node, to help provide the information, methods, technologies, tools, and technical assistance needed for effective responses to terrestrial and aquatic invaders threatening the U.S. ecosystems and native species. In 2010, USGS will address invasive species issues by developing models for predicting the probable spread and impacts of invaders, conducting research to document and monitor the introduction and spread of invasive species, studying the ecology of invaders and factors in the resistance of habitats to invasion, providing methods and information to assess and manage risks, and developing methods to prevent and control invasive species and minimize their environmental impacts. USGS researchers will also continue their efforts to develop an early detection and rapid assessment framework and incorporate pilot studies into a coordinated national early detection system.

Klamath River Basin — The Departments of the Interior, Commerce, and Agriculture are conducting a variety of projects in support of natural resource management in the Klamath River Basin. USGS scientists collaborate with many Federal, State, tribal, and local partners to address priority environmental, economic, and statutory needs in the basin. Recent USGS science has primarily focused on the key information needs of USBR and FWS on issues related to Endangered Species Act consultation, tribal trust, and water availability. In addition to providing key information for managers and stakeholders and future resource allocations in the basin, USGS data was also used in integrated studies to understand and predict endangered fish survival and migration behaviors in response to changing environmental conditions.

In 2007 and 2008, several USGS publications provided significant new information relevant to partners. A detailed analysis of key environmental influences on water-quality conditions in Upper Klamath Lake was performed and related to probable population consequences to endangered suckers. Federal managers are currently using this information in the reconsultation of Biological Opinions for shortnose and Lost River suckers. Results provide a more detailed understanding of the physical processes controlling internal loading of phosphorus in the lake have been instrumental in assisting managers in the development of strategies to effectively cope with lake nutrient dynamics, algal blooms, water-quality conditions, and related biological effects. Another article describing the near-shore habitats of juvenile suckers is significant with respect to lake-level management and habitat restoration projects. Finally, in response to water managers' needs, the USGS work in hydrology of the Klamath Basin serves as the lynchpin for ongoing ground-water modeling and efforts to develop a reliable quantitative tool for optimally managing seasonal use of water in the upper basin and stream flows in the lower Klamath River.

In 2009 and 2010, the USGS will continue its research and monitoring of fish-habitat interactions and hydrological relationships to better understand and adaptively manage ongoing wetland restoration activities and other resource management actions. In particular, the USGS will investigate habitat usage by juvenile suckers in the newly restored Williamson River Delta. Other biological efforts will continue to emphasize status and trends of endangered suckers in Upper Klamath Lake. Information needs associated with the possible reintroduction and recovery of salmon in the Klamath Basin will include the conduct of coordinated studies addressing the physiology and condition of key species, migrations and habitat characteristics within the context of a new landscape initiative to improve watershed ecosystem modeling and decision support technologies.

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Geographic Research, Investigations, and Remote Sensing

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-) ^{a/}	Program Changes (+/-)	Budget Request	
Land Remote Sensing (\$000)	61,457	61,718	+339	0	62,057	+339
<i>FTE</i>	148	139	0	0	139	0
Geographic Analysis and Monitoring (\$000)	16,266	10,598	+237	+300	11,135	+537
<i>FTE</i>	105	53	0	+1	54	+1
National Geospatial Program	0	0	+70,748	0	70,748	+70,748
<i>FTE</i>	0	0	+295	0	+295	+295
Total Requirements (\$000)	77,723	72,316	+71,324	+300	143,940	+71,624
Total FTE	253	192	+295	+1	488	+296

^{a/} The USGS proposes to move the National Geospatial Program from the Enterprise Information Activity to the Geography Activity. The adjustment includes +\$69,816 and +295 FTE for this restructure. See Section F for more details.

Activity Summary

The 2010 budget request for the Geographic Research, Investigations, and Remote Sensing Activity (Geography) is \$143,940,000 and 488 FTE, which is a net program change of +\$300,000 and +1 FTE from the 2009 Enacted level. Additional information on program changes is provided in each subactivity section and in the Key Increases section beginning on page C-1.

Geography is a multidisciplinary science that emphasizes space and place. It offers great potential to integrate important environmental and societal processes to facilitate our understanding of how human well-being and environmental quality can be improved and maintained. Moreover, it has the potential to identify spatial variation in these characteristics and qualities and to facilitate a more "place-specific" solution to environmental problems, including reduction of risk and options for greater adaptation to an uncertain future, including those related to global climate change.

The USGS confronts some of the most pressing natural resource and environmental issues facing our Nation, such as energy development, climate change, hazards, and resource management. Observing the Earth with remote sensing satellites, USGS geographers monitor and analyze changes on the land, study connections between people and the land, and provide society with relevant science information to inform public decisions. The surface of the Earth is changing rapidly, at local, regional, national, even global scales, with significant repercussions for people, the economy, and the environment. Some changes have natural causes, such as volcanic eruptions or drought, while other changes on the land, such as resource extraction, agricultural practices, and urban growth, are human-induced processes. There are other types of changes that are a combination of natural and human-induced factors for example, landslides and floods are fundamentally natural processes that are often intensified or accelerated by human land use practices. Land cover on the Earth's surface—the pattern of natural vegetation, agriculture, and urban areas—is the product of both natural processes and human influences. Land cover represents an unbiased signature of environmental conditions. Improved understanding about the consequences of landscape change assists decision makers in the fields of land use planning, land management, and natural resource conservation. The

need for better information about land surface change is especially evident for changes brought about by wildfire, agricultural production, urbanization, forest logging, climate change and other factors operating at broad regional scales. USGS Geography research also includes linking satellite-based results to those observed from field-based monitoring programs, such as those generated by other USGS programs (stream gauge monitoring network, Breeding Bird Survey, National Water-Quality Assessment program) and other agency programs (the Environmental Protection Agency's Environmental Monitoring and Assessment Program). Creating these linkages provides for a powerful way to monitor important changes on the landscape that relate to a wide range of environmental characteristics valued by society.

The goal of the USGS is to improve people's ability to prosper by either affecting how the land will change (positive) or by becoming more adaptive to change (forecasting). This provides decision makers and the public a combination of data and readily available tools (e.g., Web based) to improve and sustain environmental quality and public safety in an ever-changing world. These data and tools will result in an unprecedented ability to design landscapes that are resilient and adaptive. Geography works toward becoming a global leader in the science of:

- Integrated vulnerability and risk assessment that incorporate the natural, social, and economic sciences,
- Scenario-based, alternative futures tools to reduce environmental and hazard risks and to facilitate adaptation to an every-changing world at landscape scales,
- Land observations and monitoring via remote sensing, and
- Maintaining USGS' role as the civilian mapping agency for the Federal government.

The USGS Geography Activity is uniquely suited for modeling land change, given its diverse expertise set and ability to analyze and integrate both biophysical and socioeconomic processes affecting landscape change. Geography is developing a framework for modeling land change across regional and continental extents, constructing multiple scenario-based models at these scales, and applying the models to answer key scientific questions including the potential effects of land-use change on climate, biodiversity, carbon dynamics, and water quality.

Focus areas of ongoing Geography research in global change include:

- **Remote Sensing Phenological Research** — The USGS has a well established history of global change research related to phenological studies. Geography researchers have produced the first (since 1996) and most extensive (1989-2007) satellite-derived phenology database in existence. They have also conducted research on the relationships between phenology and land use/land cover change, hydrology and drought.
- **Monitoring Regional Carbon Cycling** — Geography researchers utilize remote sensing data to quantify ecosystem performance and determine changes through time. They have collaborated with the AmeriFlux and FluxNet tower operators and the North American Carbon Project to monitor carbon cycling and the impact of management decisions and climate variability on net ecosystem exchange.
- **Land Cover Change** — Geography monitors land use and land cover change at national to global scales, documenting the geographic variability of change and defining the environmental, social, technological, and political drivers of change, as well as assessing the impacts of these changes. Current land cover monitoring activities include the National Land Cover Database (NLCD) and the land cover Status and Trends projects. These projects supply data for Geography's modeling activities in

areas such as the Great Plains, Southeast US and the Chesapeake Bay watershed, providing scenario-based forecasts of future land use and land cover. These models contribute to simulations of land cover change effects on regional weather and climate variability, the links between land cover change and temperature anomalies, and changes in surface albedo (reflectance) that could affect the exchange of energy between the land and atmosphere.

- **Decision Support** — Geography continues to bridge the gap between researchers and decision makers by creating products to address the needs of policy and decision makers, such as the Rapid Land Cover Mapper, the Land Cover Analysis Tool, the National Integrated Drought Information System, and the Famine Early Warning Systems Network. Geography is also developing a methodology for estimating the rate of carbon sequestration at different abatement costs, or prices, which will allow resource managers to conduct cost-benefit assessments of sequestration activities.
- **Hazards** — Geography is conducting research to assess the impacts of sea-level rise and changes in storm regimes on coastal communities, such as coastal erosion rates in Alaska and the impacts of tsunamis in the Pacific Northwest.

Geography's objectives align with the Department's goal to improve the understanding of national ecosystems and resources. Geography supports USGS strategic objectives by making high-quality remotely sensed geospatial data widely and inexpensively available without restrictions to a global community of international, Federal civil, defense, Non-governmental organizations, State, local, academic, commercial, and individual users. Geography also supports USGS strategic objectives by efforts that further the understanding of the Nation's environmental, natural resource, and economic challenges through scientific assessments that provide a national and global perspective on land surface change.

Just as the USGS' Science Strategy encompasses a broad range of national concerns that directly lend themselves to the mission of the Nation's natural resources research bureau, so too does the USGS manage the Nation's land imagery in support of a broad range of national and international purposes. Since the early days of spaceflight, the USGS has maintained the land imagery archive of the United States at its Center for Earth Resources Observation and Science, which contains nearly 100 years of satellite and aerial photographs of the land surfaces of the Earth. These archives are indispensable to USGS science and other national and international science investigations. Key among these imagery holdings is the archive of the Landsat program, the Nation's principal land-imaging satellite since 1972. Landsat provides the longest, most continuous land surface imagery of the entire Earth, a record unparalleled among the space and science programs and there are 45 throughout the world.

Program Evaluations

In 2009, the National Academy of Science and the National Science Foundation will complete a review of Geography's Strategic Directions for the Geographical Sciences in the Next Decade. The review will summarize research progress to date and outline future challenges. A report on the findings is expected to be completed in 2009.

Workforce Planning

In 2009 and 2010, the USGS will continue to enhance its workforce plan to build and maintain an internal capacity of staff with skills related to:

Geographic Research, Investigations, and Remote Sensing

- geographic research, analysis and modeling,
- application of economic theory to determine societal benefits
- systems engineering,
- project management,
- geospatial data management and integrations, and
- remote sensing.

Geography maintains workforce flexibility through the use of various employment and contract options, such as permanent and non-permanent employees, contractors, student appointments, post-doctoral science program, and partnerships. In addition, Geography continues to implement various workforce management strategies such as the utilization of voluntary separation incentive payments and voluntary early retirement authority (VSIP/VERA) authorities; training and development; and targeted recruitment to achieve workforce goals.

In 2009, the National Geospatial Technical Operations Center (NGTOC) began implementation of its organizational re-engineering by accomplishing the following goals: (1) hired critical technical staff to fill gaps in expertise created through attrition and retirement; (2) hired senior managers to oversee operations and research and development; (3) implemented both a VSIP/VERA and Career Development Program for cartographic technicians to continue to align workforce skills with requirements for current and future work; (4) stood up a new organizational structure designed to maximize efficiency between the Denver and Rolla NGTOC sites; and (5) awarded a 5-year on-site technical support contract. During 2010, the NGTOC will continue to implement the staffing strategy outlined in the organizational re-engineering staffing plan. In addition, a new focus will be placed on re-engineering specific business processes and practices.

Subactivity Overview

The USGS Geography Activity is staffed by 296 FTE and approximately 650 contractors to carry out its activities within the following three budget subactivities:

The **Land Remote Sensing (LRS)** subactivity ensures continuous availability of Earth observations and other remotely sensed imagery for use by the Nation. LRS activities include acquiring, archiving, disseminating, and promoting the application of remotely sensed data of the Earth's land surface. LRS operates the Earth-observing satellites (Landsats 5 and 7) and acquires additional data through a multimission ground station. LRS also procures commercial data from both aircraft and spacecraft operators and maintains a comprehensive archive of Earth observation data at the USGS Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD. Data from this archive are distributed to Business Partner retailers and customers. LRS manages the National Civil Applications Program, including the Global Fiducials Library, rapid exploitation applications, and source management for classified and unclassified data. It also promotes the application of remotely sensed information and advances the state of remote sensing technology. Data acquired and managed by LRS are vital to applications such as support for national defense; global agricultural crop monitoring; monitoring and assessing the impacts of natural disasters; aiding in the management of water, biological, energy, and mineral resources; and analyzing the impacts of climatic and other global changes.

The **Geographic Analysis and Monitoring (GAM)** subactivity contributes to an understanding of changes occurring on Earth's land surface and the consequences of these changes, human and environmental. GAM provides the analysis and applications needed to address natural and human-induced changes on the landscape. Activities conducted in this program include land cover applications, global change research, ecosystems research, and producing a series of status and trends reports that document a national assessment of land surface change. Regarding science impact within GAM, it is a nascent, cross-discipline effort to increase the use and value of USGS science in making informed decisions at Interior, at other Federal, State, and local agencies, and by citizens. The effort encompasses developing, testing, evaluating, and applying improved methods and processes to enhance linkages between science and decisionmaking.

The **National Geospatial Program (NGP)** subactivity creates and maintains *The National Map*, collects and integrates base national geospatial datasets, coordinates data discovery and access, and ensures consistent and current data are available for the Nation. Through the Federal Geographic Data Committee, the USGS promotes and promulgates consistent geospatial data and metadata standards, enhances the National Spatial Data Infrastructure, and adoption of cross-government best business practices for geospatial resources, policies, standards, and technology.

This budget reflects a technical adjustment moving the NGP from the Enterprise Information Activity to the Geography Activity in order to align the USGS' geographic-based programs. This results in:

- Integration of NGP activities into a single organization, mutually reinforcing geographic research and applications in the products produced by the NGP;
- Integration of geographic data from *in situ*, aerial, and space-based remote sensing platforms and implementation of a comprehensive strategy for timely and efficient data acquisition and dissemination;
- Ability to leverage existing state-of-the-art data management, archive and dissemination capabilities at EROS; and
- Development of NGP products that are responsive to data needs related to global change, ecological conditions, resource management, natural hazards, and other USGS scientific research.

In 2010, the USGS proposes to move the National Geospatial Program to the Geographic Research, Investigations, and Remote Sensing Activity. See Section F for more details.

Performance Improvement

Completed program assessments concluded that the USGS needed to take steps to continue to focus on land cover mapping and eco-region assessments in support of Department goals and to focus its activities of Land Remote Sensing to make remote sensing imagery and data more useful land managers. In an effort to improve in these areas, the USGS completed the transition of the NLCD from a research endeavor into an operational effort. The USGS also worked with the National Aeronautics and Space Administration and land observation data users to develop a plan to achieve technical, financial, and managerial stability for land surface observations. The USGS is working to establish an operational land imaging capability within the Department.

As part of the improvement effort, the USGS also focused geographic research on high priority areas such as landscape status and trends; causes and consequence of landscape change; vulnerability and risk analysis, and vulnerability and risk reduction. The USGS used this information to create the NLCD to promote the use of land cover trends data and ecosystem services information by decision makers. To continuously improve program performance, the USGS continues to educate resource managers on the need to include ecosystem services such as water purification and carbon sequestration in resource and environmental decisionmaking.

Activity: Geographic Research, Investigations, and Remote Sensing

Subactivity: Land Remote Sensing

Subactivity	2008 Actual	2009 Enacted	2010			Change from 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Land Remote Sensing (\$000)	61,457	61,718	+339	0	62,057	+339
<i>Total FTE</i>	<i>148</i>	<i>139</i>	<i>0</i>	<i>0</i>	<i>139</i>	<i>0</i>

Summary of 2010 Program Changes for Land Remote Sensing

The 2010 budget request for the Land Remote Sensing (LRS) Subactivity is \$62,057,000 and 139 FTE. There are no program changes requested for LRS in 2010.

Program Overview

The Nation's economic and environmental vitality and security interests rely on continual observations of the Earth's land surface to understand changes on the landscape at local, regional and global scales. Improving our ability to monitor, analyze and permanently record these changes promotes continued economic expansion, environmental awareness, and the advancement of scientific knowledge to support policy officials and decisionmakers in fulfilling their public service responsibilities. Through the passage of the Land Remote Sensing Policy Act of 1992 (P.L. 102-555), Congress endorsed the need for continuous monitoring of the Earth and maintaining a readily available record of information displaying the status of its resources and environment. LRS is meeting this need by ensuring continuous availability of moderate resolution and other remotely sensed imagery for the Nation.

The Land Remote Sensing Program:

- Operates Landsat 5 and 7 satellites, collecting valuable imagery of the Earth's land surface for users around the world;
- Develops the ground system to acquire, process, archive, and distribute imagery for the next Landsat 8 mission, in partnership with NASA;
- Manages the world's largest civilian archive of remotely sensed data, providing a comprehensive record of landscape dynamics;
- Analyzes and develops applications for using remotely sensed data in research areas, such as drought monitoring, forest health and wildfire risk assessment, and carbon cycle of vegetation; and
- Manages the premier civil program to assist agencies in utilizing classified remote sensing systems and data to address environmental, socioeconomic, hazards, and other geospatial science issues.

Further guidance is provided by the U.S. National Space Policy (NSPD 49), dated August 31, 2006, which states: "The Secretary of the Interior, through the Director of the USGS, shall collect, archive, process, and distribute land surface data to the United States Government and other users and determine operational requirements for land surface data." In addition, the Department established a permanent Government archive, the National Satellite Land Remote

Geographic Research, Investigations, and Remote Sensing

Sensing Data Archive (NSLRSDA), containing satellite remote sensing data of the Earth's land surface—and makes these data easily accessible to users.

The primary objectives of the LRS are to:

- Collect, process, archive, and distribute scientifically and operationally relevant global land and near-land observations;
- Ensure that these data are permanently maintained and easily accessible to the Nation;
- Conduct and sponsor research in land remote sensing applications to collect, archive, and distribute data, and investigate new remote sensing technologies; and
- Provide civilian agencies with the means to utilize classified assets.

These objectives support the Department's strategic goal of protecting the Nation's natural resources by ensuring a comprehensive record of land surface data is available for environmental and economic decision making. LRS supports the mission of the USGS by providing high-quality remotely sensed data for understanding global changes of the Earth's landscape.

LRS will continue efforts for a comprehensive evaluation of the societal and economic benefits of moderate-resolution land imaging data and to the extent that resources are available, begin steps towards implementing agreements to acquire new sources of moderate-resolution data to augment the existing Landsat data.

2010 Program Performance

LRS includes the following components:

Remote Sensing Missions

(Estimates for 2008, \$39.5 million; 2009, \$40.2 million; 2010, \$40.2 million)

LRS is responsible for the operations and maintenance of the Landsat satellites and acquires remotely sensed land data from government, commercial, and international assets in support of the Department and the global Earth science community. The activities funded within this component include:

- Operation of Landsats 5 and 7 satellites, which includes flight operations, orbital maintenance, and management of all ground data reception, processing, archiving, product generation, and distribution.
- Coordination of mission requirements for users, including international cooperators;
- Maintenance of ground receiving stations, and implements new technologies that support ground data reception and processing in preparation for long-term archiving; and
- Support of ground systems development for the Landsat 8 satellite mission.

Landsat 5 and 7 satellites — The Landsat Program is a series of Earth-observing satellite missions jointly managed by the USGS and the National Aeronautics and Space Administration (NASA). NASA has developed and launched the Landsat satellites. Once launched, the USGS assumes responsibility for operation of the spacecraft, as well as the operations, maintenance, and management of ground data reception, processing, archiving, and product distribution systems.

More than three decades worth of Landsat data is used by government, commercial, industrial, civilian, military, and educational communities throughout the United States and worldwide. These data support a wide range of applications in areas such as global change research, agriculture, forestry, geology, resource management, geography, mapping, water quality, and oceanography. No other current or planned remote sensing system, public or private, fills the role of Landsat in global change research or in civil and commercial applications. The Landsat series of satellites have provided imagery of the Earth's surface for over 37 years, making these data the most consistent, reliable documentation of global land surface change ever assembled. No other satellite system has such an unprecedented history of collecting data and monitoring changes of the Earth's landmasses. Additional information on Landsat satellites can be found at: <http://landsat.usgs.gov/>.

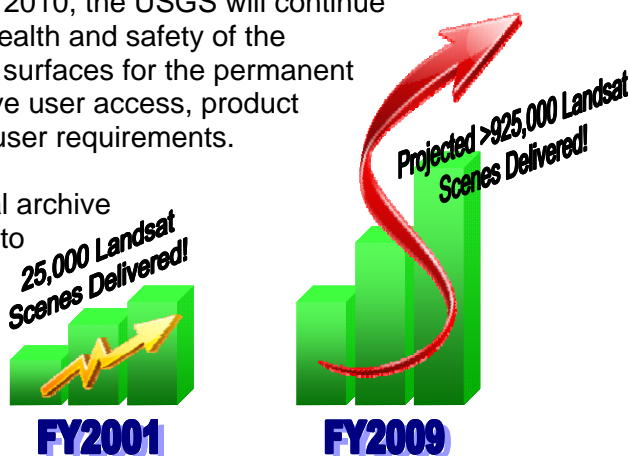
Landsat 5 Celebrates 25 Years of Earth Observations

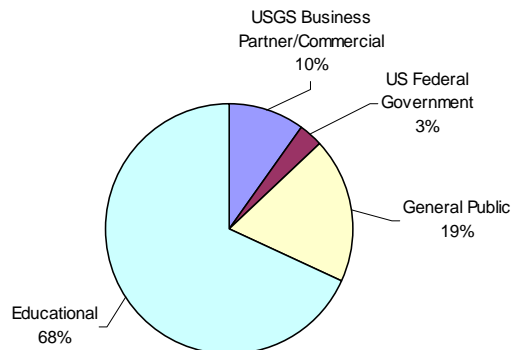
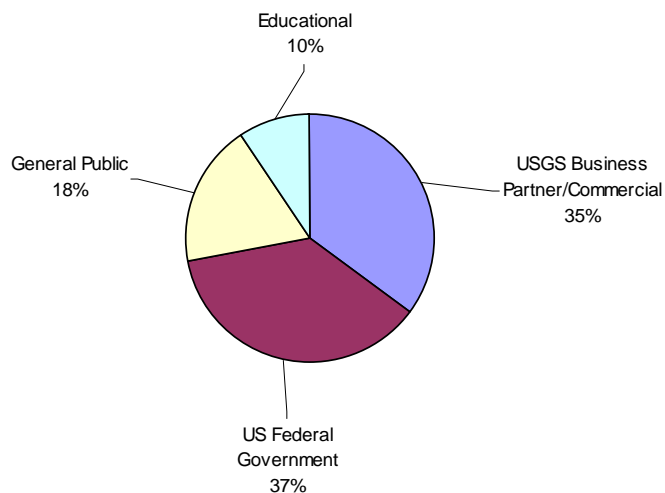
Well beyond its expected 3-year design life, Landsat 5 celebrated, on March 1, 2009, 25 years of collecting images of planet Earth's landmasses. It has produced a catalog of over 700,000 images reflecting a 'photo album' of major events in the Earth's history. This satellite has charted urban growth in Las Vegas, monitored fire scars in Yellowstone Nation Park, and tracked the retreat of a Greenland glacier. Landsat 5 images have appeared in scientific journals and will more likely to do so, now that the data are free of charge or copyright.

The uses of these images have exceeded our expectations, cell phone companies who were not in existence when the satellite was launched – rely on Landsat images to determine the best locations for cell towers. Landsat images are also used in flight simulator training of pilots. Landsat is no longer a research program, but is a fundamental part of our Nation's infrastructure – the Landsat image catalog provides the backbone of Google Earth.

On April 15, 2009, Landsat 7 reached its 10th anniversary. Launched in 1999, this satellite has outlived its 5-year design life. The Landsat 7 archive is a growing catalog with more than 900,000 images of the globe. During 2009 and 2010, the USGS will continue operation of Landsat 5 and 7, maintaining the health and safety of the satellites and collecting data of the Earth's land surfaces for the permanent archive. The USGS will also continue to improve user access, product generation, and calibration of the data to meet user requirements.

In 2008, the USGS opened the Landsat national archive to users around the world. Users are now able to select a Landsat scene from the archive, have it automatically processed to a standard product, and download the data at no charge. Prior to making Landsat data available over the Internet, the highest number of scenes sold totaled 19,000 in a year, in 2008 the total scenes downloaded was 86,351. In October 2008 users downloaded over 60,000 scenes. Nearly 500,000 scenes have been downloaded during the first half of 2009, demonstrating not only the demand for Landsat data, but also the utility and interest from users worldwide. Previously, the cost to purchase a Landsat scene was unaffordable to many users. The charts below show how the user categories have changed with the tremendous growth in users of Landsat data.





The graphic shows how the types of users have changed from before Landsat data were made available over the Internet (**top graphic**) and after (**lower graphic**).

Landsat Data Continuity Mission (LDCM) — The LDCM, also known as Landsat 8, is planned as a 5-year mission and will include enough consumables for 10 years of operation. The USGS and NASA share responsibilities for the implementation of LDCM. NASA is developing the flight systems including the spacecraft, the instrumentation, the mission-operations element, the mission launch, and will perform on-orbit checkout. The USGS is developing the ground system that will acquire, process, archive, and disseminate products from the Operational Land Imager (OLI) instrument to the user community. Following launch in December 2012 and on-orbit checkout, NASA will transfer ownership of the satellite to the USGS. The USGS will then be responsible for the flight operation and orbital maintenance of the Landsat 8 satellite.



Several options were investigated for the LDCM, starting as a commercial data-buy, then a government-commercial partnership and a U.S. government-international partnership. Finally, due to the urgency to maintain continuity of Landsat data the decision was made to develop a

separate free-flyer satellite with an OLI sensor. Additional information on this mission can be found at: http://landsat.usgs.gov/documents/lbcm_factsheet.pdf.

In 2009, the USGS is completing design activities and beginning systems development for the ground system including computer software coding, hardware procurement and installation for launch critical elements. In addition, the USGS and NASA will conduct major ground system and mission level reviews. NASA has recently listed the USGS ground system as high risk to the mission; scope and budget require reconciliation and modifications to the ground system will be necessary in order to receive and process data from the Thermal Infrared Sensor (TIRS). Also, development of the Mission Operation Element, the systems that will command and control the spacecraft, have reached critical point requiring that a contract for a Flight Operations Team (FOT) to be awarded. During 2010, efforts will continue to focus on system development and testing in preparation for the December 2012 launch. The data processing and archive element and the flight operations segment must undergo a series of comprehensive testing in order to ensure that all ground systems are ready before launch.

In 2008, the USGS:

- Completed the Ground System Preliminary Design Reviews for the collection activity planning element; infrastructure element; the user portal element; and the storage and archive element.
- Continued to research an automated cloud cover assessment algorithm.
- Held the two meetings of the Landsat Science Team to discuss progress and issues of Landsat missions, data applications, data continuity, and the thermal sensor.
- Supported NASA's major milestone reviews for:
 - the Spacecraft System Requirements Review (SRR) for the development of the spacecraft bus;
 - the OLI Preliminary and Critical Design Reviews (PDR and CDR) for the development of the sensor; and
 - the TIRS System Definition Review to define requirements for the instrument.

Long-Term Data Preservation and Access

(Estimates for 2008, \$7.5 million; 2009, \$7.0 million; 2010, \$7.2 million)

The Earth is changing in ways that are not fully understood. It will never be possible to comprehend the meaning of these changes without a clear and consistent record of observable surface phenomena. LRS has the responsibility to preserve, provide access to, and distribute products from the long-term archive of aerial and satellite data sets. The archives at the USGS EROS Center provide a comprehensive, permanent, and impartial record of the Earth's land surface acquired over several decades.

The Land Remote Sensing Policy Act of 1992 directed the DOI to establish a permanent Government archive (NSLRSDA) containing satellite remote sensing data of the Earth's land surface, and to make them available for study. The USGS is a world leader for archiving remotely sensed data, and responsible for making these data available and easily accessible to users. Today, the archive contains over 107,000 rolls of aerial and satellite imagery containing in excess of 13 million frames. It also contains additional aerial and satellite data sets, totaling over 4,000 terabytes stored in robotic mass storage systems.

The archive holdings provide a wealth of information used for environmental research, land and resource management, natural hazard analysis, and homeland security. Earth-observation records including aerial photographs as far back as the 1930s and satellite images from the 1960s offer a 75-year history of changes on the landscape. This vast reservoir of data provides objective reference points, essential in documenting land use and land cover change and in understanding climate change. There is a worldwide community of users throughout Federal, State and local, and tribal governments, academic institutions, and private enterprise. The core satellite data holdings include: Multispectral Scanner (MSS) and Thematic Mapper (TM) image data (1972 to present) from Landsats 1-5 and Landsat 7; Advanced Very High Resolution Radiometer (AVHRR) data (1979 to present) over the Earth's land surface from NOAA weather satellites; and more than 880,000 declassified intelligence satellite photographs (1959-1980). These archival data form a baseline chronology of environmental change on the Earth, both natural and human-induced, providing an invaluable tool for scientific assessment and prediction. Through access to archive holdings, scientists, resource managers, and decision-makers can learn from the past to decide for the future.

The USGS estimates an exponential growth in archival volume of satellite data to over 5 petabytes by 2013. In 2009 and 2010, the project continues to maintain, preserve and provide ready access to historical remote sensing film and digital databases and archives. Planned activities include data organization, ingest, metadata generation, data set appraisals and assessments, dispositions including transfer to the National Archives and Records Administration (NARA) and preservation activities, such as data set transcriptions and media migrations for collections.

USGS activities in 2009 and 2010 include:

- Operate and maintain systems to process and ingest satellite imagery for the historical record,
- Support archiving initiatives to partner with NARA,
- Manage, operate, and maintain photographic and digital archives, and ensure long-term preservation of archival holdings,
- Appraise and dispose of the historical collections; add new collections in the archive that are aligned to program objectives and the USGS mission,
- Improve easier, faster public access to archive holdings through continued digitizing of USGS historical film collections; create and place browse images online and create single-frame coordinate metadata (to better assist customers in acquiring data and imagery tailored to their needs),
- Web enable historical data sets for no charge electronic distribution,
- Enhance Earth Explorer and GloVis capabilities to enhance public access to the historical archive,
- Provide for effective and efficient user and customer services for all the data sets currently in the archive.

The USGS and NASA are partnering on the creation of the Global Land Survey 2005 (GLS2005). The GLS2005 data set will include a collection of 9500 medium-resolution images, primarily Landsat, collected between 2004 and 2007, covering the entire Earth's landmasses.

The GLS2005 represents the next survey in the series of global land surveys for 1975, 1990, and 2000. GLS2005 is expected to be complete in 2009, providing scientists and other users with the latest global land survey of the Earth. GLS2005 along with the previous data sets provide scientists with an objective visual record of land changes and the impacts on the global economy and environment. These data sets are essential to a multitude of environmental monitoring programs such as the North American Carbon Project, the Forest Resources Assessment program, the Monsoon Asia Integrated Regional Study, the Northern Eurasia Earth Science Partnership Initiative and more. Preliminary efforts are underway for the creation of a 2010 data set, see http://landsat.usgs.gov/science_GLS2005.php.

"Landsat's nearly four decades of accumulated Earth imagery data will provide an historical record that, combined with continuous updates, will make it possible to interpret and anticipate changes to the Earth's surface with far greater certainty than ever before."

José Achache, Director
Group on Earth Observations Secretariat
November 2008

In 2008, the USGS maintained and provided users with ready access to historical film, digital databases, and other remote sensing data for scientific and operational applications.

Remote Sensing Research and Applications

(Estimates for 2008, \$7.6 million; 2009, \$7.5 million; 2010, \$7.7 million)

LRS conducts and sponsors research in remotely sensed land data collection, access, distribution, and applications. Scientists and engineers sponsored by the program are investigating new types of satellite systems and sensors, studying promising new data sources, developing new data acquisition programs and sources, and assessing the potential for new data applications. The program is seeking new ways to make remotely sensed data products more accessible, and to expand and enhance the overall use of remotely sensed data and remote sensing technology. Additional information on LRS research can be found at: <http://remotesensing.usgs.gov/researchapps.php>.

The USGS is currently working to expand the availability and consistency of Light Detection and Ranging (LiDAR) data to address some of the Nation's most pressing climate, infrastructure and environmental issues. A USGS LiDAR Advisory Committee was established to look cross-disciplinary at LiDAR activities and, in cooperation with Federal, State and other stakeholders, to begin designing a potential national LiDAR program. A consistent, standardized LiDAR collection on a national basis will allow for large-scale scientific analyses that are difficult, if not impossible, to perform by stitching together disparate LiDAR projects. Also, the creation of a National LiDAR Dataset would enable researchers who may not have the financial resources or technical expertise to collect LiDAR over their region of interest. Planned near-term efforts include outlining a national LiDAR program to help address pressing societal concerns related to energy, climate change, hazards, and the environment, and to use LiDAR technology to enhance ongoing science and operational programs.

The USGS, as an authoritative source of aerial photography and satellite-based imagery, is researching the application and use of Unmanned Aircraft Systems (UAS) for monitoring and collecting scientific data. An important focus of this new office will be to leverage the commitment that the defense and intelligence communities have made in supporting UAS research. Working in partnership with many other Federal agencies, academia, and industry groups, LRS will utilize research of the defense and intelligence communities to promote UAS technology for civil, domestic applications. In dangerous and remote areas, such as polar-

regions, volcanic islands, and expansive deserts, remote-controlled unmanned aircraft can provide more detailed and timely data about the status of natural resources and environmental conditions than would be feasible or cost effective by other means.

Remote sensing data is used by the USGS Biology discipline to understand the habitat fragmentation associated with domestic energy exploration in the intermountain west and Rocky Mountain region. In 2009, LRS is evaluating data from various remote-sensing platforms and computer software that can be used to map the infrastructure, such as distribution of roads, well pads, holding ponds, pipelines, etc. associated with energy development, as well as monitor changes. This work will continue in 2010.

In the past decade, conifer forests of Colorado and many western States have experienced widespread mortality from epidemic population outbreaks of insects, such as the Mountain Pine Beetle. This has increased the risk of wildland fire and other associated hazards, affecting many key ecosystem services and socio-economic values. LRS is using advanced remote sensing techniques at various scales to quantify forest mortality in Grand County, the epicenter of Colorado's outbreak and major source of the State's water supply. Data are being collected and analyzed from the Civil Air Patrol's hyperspectral high-resolution sensor to delineate several distinct stages of conifer mortality and the QuickBird satellite to assess vegetation cover and conifer condition. This information was used to provide emergency response teams with updated USGS topographic maps during wildfire events. Landsat data are being used to produce a moderate-resolution conifer condition assessment spanning Grand County and a complete Statewide assessment. The USGS is collaborating with U.S. Forest Service and Colorado State Forestry Division on these assessments that will enable us to quantify forest conditions and associated fire hazard, critical for resource managers, emergency responders, and scientists. This work will also continue in 2010. Additional information can be found at: http://rmgsc.cr.usgs.gov/rmgsc/sci_nathaz.shtml

The Geospatial Multi-Agency Coordination Group (GeoMAC) is an Internet-based mapping application originally designed for fire managers to access online maps of current fire locations and perimeters. With the growing concern of western wildland fires in the summer of 2000, this application has also become available to the public. Over the past 10 years, the average number of acres of forest and rangeland impacted yearly by wildland fire has grown to over 7 million acres. GeoMAC averages 50-million requests yearly. In 2010, LRS will continue to address requests. In 2008, nearly 6,000 fire perimeters were loaded into the application and made available for download from a web connection. Additional information can be found at: <http://www.geomac.gov/main.html>.

National Civil Applications Project (NCAP)

(Estimates for 2008, \$6.9 million; 2009, \$7.0 million; 2010, \$7.0 million)

The NCAP serves USGS science programs and other Federal civil agencies by providing for the acquisition, dissemination, archive, and exploitation of classified remote sensing systems and data to address land and resource management, environmental, socioeconomic, hazards, disasters, and other geospatial scientific analysis and policy issues. In addition, the NCAP provides support for the Civil Applications Committee (CAC), a Presidential-chartered interagency committee that provides coordination and oversight of Federal civil use of classified collections.

LRS currently funds two secure facilities, in Reston and Denver, which support the complex infrastructure of security precautions and information technology (hardware, software, networks,

etc.) necessary to enable the dual use of classified systems and capabilities. The NCAP activity serves as a key point of entry for the civil community to gain access to the significant resources the Intelligence Community has dedicated in areas such as: technology transfer and awareness of advanced image processing and analysis techniques, sensor research, and applications research.

In 2009 and 2010, the NCAP will continue to play a proactive and relevant role in addressing geospatial requirements associated with Federal lands management and preparation for, mitigation of, response to and recovery from hazards and other emergencies. NCAP also supports the preservation of a long-term record of classified earth observations, which are useful for scientific evaluation of global dynamics, such as climate variability and change. Through NCAP, LRS provides decision-makers with the best available, scientifically sound information based on the awareness, utilization and synthesis of all classified, open source, and governmental remotely sensed data.

Program Performance Overview

The following highlights important performance measures for the Land Remote Sensing Subactivity:

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of data accessible: X% of satellite data available from archive within 24 hours of capture (LRS)	C	97.2%	98.7%	95% (285/300)	95% (285/300)	95% (285/300)	95% (285/300)	100% (300/300)	+5%	100% (300/300)
Comment	Measures the percent of scenes captured and made available to users within 24 hours (numerator is the number of scenes available (300 in 2010) and denominator is the number of scenes collected (300) every 24 hours.									
Total Actual/Projected Cost (\$000)		43,725	40,159	40,962	40,962	40,962	40,159	40,159	0	40,159
Actual/Projected Cost per scene (whole dollars)		14.64	14.64	14.64	14.64	14.64	14.64	14.64	0	14.64
Efficiency and Other Output Measures										
Comment	Based on history, the USGS expects to continue managing gigabytes at about the 2008 level through 2013.									
# of terabytes collected annually (LRS)	A	438.8	537.9	96	278	535.2	270	270	0	270
# of terabytes managed and distributed cumulatively (LRS)	C	2,887.4	3,425.3	4,255.9	3,556.6	3,840.6	4,300	4,600	+300	5,400
# of systematic analyses and investigations completed (LRS)	A	14	16	12	12	23	12	12	0	12
Total Actual/Projected Cost for Analyses(\$000)		7,549	8,711	8,318	2,532	5,980	3,120	3,120	0	3,120
Actual/Projected Cost per Analysis (whole dollars)		539,202	544,452	693,149	211,000	260,000	260,000	260,000	0	260,000
# of formal workshops or training provided to customers (LRS)	A	5	2	12	3	18	15	13	-2	15
Comment	Decrease results from changes to base funding.									

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Total Actual/Projected Cost for Workshop(\$000)		1,412	683	4,573	123	7,58	632	547	-85	632
Actual/Projected Cost per Workshop (whole dollars)		282,378	341,718	381,119	41,000	42,100	42,100	42,100	0	42,100

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Activity: Geographic Research, Investigations, and Remote Sensing

Subactivity: Geographic Analysis and Monitoring

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Geographic Analysis and Monitoring (\$000)	16,266	10,598	+237	+300	11,135	+537
<i>Total FTE</i>	<i>105</i>	<i>53</i>	<i>0</i>	<i>+1</i>	<i>54</i>	<i>+1</i>

Summary of 2010 Program Changes for Geographic Analysis and Monitoring

Request Component	(\$000)	FTE
• New Energy Frontier - Biofuels	+300	+1
TOTAL Program Changes	+300	+1

Justification of 2010 Program Changes

The 2010 budget request for the Geographic Analysis and Monitoring (GAM) Subactivity is \$11,135,000 and 54 FTE, a net program change of +\$300,000 and +1 FTE from the 2009 Enacted level.

New Energy Frontier — Biofuels (+300,000 / +1 FTE)

Program changes associated with the New Energy Frontier — Biofuels initiative are described in section C, Key Increases.

Program Overview

The Earth's surface is rapidly changing, at local, regional, national, and global scales, with significant repercussions for citizens, the economy, and the environment. Some of these changes are due to natural causes, such as volcanic eruptions, earthquakes, or drought, while other changes on the land, such as mining and forestry operations, agricultural practices, and urban growth, are human-induced processes. There are also changes that are a combination of natural and human-induced factors, for instance, landslides and floods are fundamentally natural processes that are often intensified and accelerated by human land use practices. The GAM focuses on the entirety of Landscape Change processes by creating datasets of the changes taking place; researching the impacts of the identified changes and developing tools

Geographic Research, Investigations, and Remote Sensing

and models that allow resource managers to adapt to changing conditions and make knowledgeable decisions on resource use and allocation. Results of GAM research are important components in reducing the detrimental impacts of human economic development and plans for avoiding, or alleviating the impacts of hazard events.

Approximately, one-half of GAM's resources are devoted to maintaining a land change monitoring system that characterizes and quantifies land surface characteristics and provides a framework for understanding change patterns and processes from local to global scales. The National Land Cover Database (NLCD) and the Ecosystems Mapping project form the core of this monitoring system. The remainder of GAM's resources are used to fund land change science projects that seek to:

- Understand the environmental consequences of land change and its impacts on the people, environment, economy, and resources of the nation.
- Improve the scientific basis for vulnerability and risk assessments, as well as disaster mitigation, response, and recovery activities.
- Develop credible and accessible geographic research, tools, and methods supporting resource allocation and decisionmaking.

Program researchers use earth observation data supplied by remote sensing platforms, environmental data gathered in the field, and socio-economic data to quantify the rates of landscape change, identify key driving forces, and forecast future trends of landscape change. Results of these studies are utilized by resource managers to plan future activities and responses to possible events that may result in loss of life, economic value, or degrade environmental resources. Studies are conducted within a geographic context at a range of spatial and temporal scales to provide a comprehensive, interdisciplinary perspective. This perspective is necessary to understand the threats impacting our nation's quality of life, such as climate change, natural disasters, infectious diseases, and suburban sprawl.

The science conducted by GAM plays a vital role in several important USGS activities such as the Multi-Hazards Demonstration Project (MHDP) in southern California and the Integrated Landscape Monitoring (ILM) project, which is focused on four sites, the Great Basin, Puget Sound, Prairie Potholes, and Lower Mississippi Valley. The goal of GAM in these initiatives is to utilize the most relevant data and geographic techniques to assess some of the most pressing issues facing resource and disaster managers in our nation. In the MHDP, GAM is applying its expertise in assessing disaster response plans and identifying the possible economic damages and casualties resulting from a serious earthquake event. This work is being coordinated with local governments on how to limit these consequences through comprehensive land use zoning scenarios and building standards.

The USGS ILM project has harnessed the talents of scientists from all USGS disciplines to better understand and respond to ecosystem change. Monitoring change at the landscape level provides a window for viewing ecosystem responses that cannot be detected at the small site scale. In addition, understanding the processes that drive complex factors shaping landscapes requires sophisticated modeling and monitoring. For each pilot area a model of the landscape is developed to understand the key factors affecting the structure and condition of the landscape system and explore what conservation, restoration and remediation activities could be implemented to protect and improve the integrity and ecosystem functioning of the landscape. These models will be used to identify monitoring needs and the required science needed to support these efforts. GAM research in the ILM projects involves using remotely sensed images

to identify vegetation types for habitat assessments, modeling hydrologic processes, and assessing the impacts of urbanization on water quality.

2010 Program Performance

GAM includes the following components:

Land Change Monitoring

(Estimates for 2008, \$8.0 million; 2009, \$3.3 million; 2010, \$3.6 million)

Land Change Monitoring projects involve developing geospatial data sets needed to evaluate landscape conditions, changes, and trends over time. This includes land cover (the National Land Cover Database), land-use, and other biophysical characterizations (vegetation condition, soils, climate, etc). It also includes major human and natural factors of change, incorporating but not limited to human infrastructure (roads), and socio-economic factors. This area also includes modeling, assessing and valuing ecosystem services such as water filtration and carbon sequestration. The results of Land Change Monitoring projects are critical to the work of the remaining three components of GAM. The USGS will continue this work in 2010.

The National Land Cover Database (NLCD) — Land cover information is required in a broad spectrum of scientific, economic and governmental applications including assessing ecosystem status and health, understanding spatial patterns of biodiversity and developing land management policies. The USGS has taken the lead in developing the NLCD which has been used in thousands of applications in the private, public, and academic sectors. This database is a critical component of many regional and environmental assessments, including the Heinz Center's *State of the Nation's Ecosystems* and EPA's *Report on the Environment*. These assessments were the first attempts to analyze environmental conditions for the entire country. NLCD 2001 (the 2001 refers to the year which most of the Landsat imagery was captured) is an effort to modernize the Nation's land cover information. NLCD information is essential for addressing a wide variety of issues, such as assessing ecosystem status and health, understanding spatial patterns of biodiversity, understanding climate change, and developing land management policy. All NLCD products are Web enabled for download at the Multi-Resolution Landscape Characteristics consortium Website at <http://www.mrlc.gov>.

In 2010, the USGS will continue to lead in the development of the NLCD to provide information that addresses ecosystem status and health assessment, spatial patterns of biodiversity, climate change, and developing land management policy

Land cover change information spanning the decade between the NLCD 2001 and the original NLCD from 1992 will be published in 2009 to inform users on the amount and type of land cover change. Also, prototyping research and development for a next generation NLCD based on a nominal year of 2006 Landsat imagery will be completed. In 2009, full scale production of the NLCD 2006 will be underway, approximately 40 percent of the conterminous United States will be completed and by 2010, 60 percent will be complete. This will encompass the completion of four thematic layers including land cover, percent imperviousness, percent tree canopy and change vector analysis.

In 2008, the USGS, working in conjunction with the interagency Multi-Resolution Land Characteristics (MRLC) Consortium, completed the 2001 National Land Cover Database (NLCD 2001) for Alaska earlier this year. The completion of NLCD 2001 for Alaska represents the first time 30-meter cell land cover has been produced for the State and is part of MRLC's effort to

produce land cover products (<http://www.mrlc.gov>) for all 50 U.S. States and Puerto Rico. NLCD 2001 products include land cover identified for all 30-meter cells across the State, and percent urban imperviousness and tree canopy for select 30-meter cells across the State. The land cover product contains 19 land cover classes in Alaska, with results revealing the three most common classes across the State (in terms of area covered) include Shrub/scrub at 21.2 percent of total area, Dwarf scrub at 17.2 percent of total area and Evergreen forest at 15.5 percent of total area. An accuracy assessment of the data is currently underway and will be completed later this year. Plans for future work will focus on assessing land cover change.

Ecosystems Mapping — In 2010, the USGS will continue to lead an effort commissioned by the Group on Earth Observations to classify and map global ecosystems in a standardized, robust, and practical manner, at scales appropriate for use by land managers. The Global Ecosystems Data Access System is available to users at <http://rmgsc.cr.usgs.gov/ecosystems/data.shtml>. This map tool allows users to perform customized viewing, data selection and download capability for several of the ecosystem data layers. Included is the effort to map standardized, meso-scale ecosystems for the United States, and represents a massive biophysical stratification of the contiguous United States. This work has produced standardized geospatial ecosystem models, enabling the use of ecosystem occurrences as a robust spatial unit of analysis for assessing climate change impacts on ecosystems. Spatial data on ecosystem distributions is useful for a variety of other applications, including conservation planning, resource management, and analyses on the economic value of ecosystem benefits.

National Geospatial Ecosystem Modeling — In 2010, the USGS will continue to provide both Federal and State land management agencies a standardized spatial framework for assessing and monitoring ecosystem services. Ecosystems provide a framework for understanding the Earth's physical and biological processes that make life possible for all organisms, including humans. A comprehensive national ecosystem model enables the economic and societal valuation of key ecosystem services like water production and quality, carbon sequestration, biodiversity, soil fertility, and flood control. Quantifying the value of these services is increasingly becoming important to land management agencies, especially for the Bureau of Land Management and U.S. Forest Service (USFS). GAM has produced unique ecosystem footprints, which have been aggregated and labeled using an existing ecological systems classification. In 2009, the USGS is collaborating with the Environmental Protection Agency (EPA) to produce a National Atlas of Ecosystem Services, which will incorporate the ecosystem model, as well as other datasets. This National Ecosystems Model will provide an invaluable tool to multiple agencies for use in resource management and conservation applications.

Consequences of Landscape Change

(Estimates for 2008, \$4.0 million; 2009, \$2.7 million; 2010, \$3.0 million)

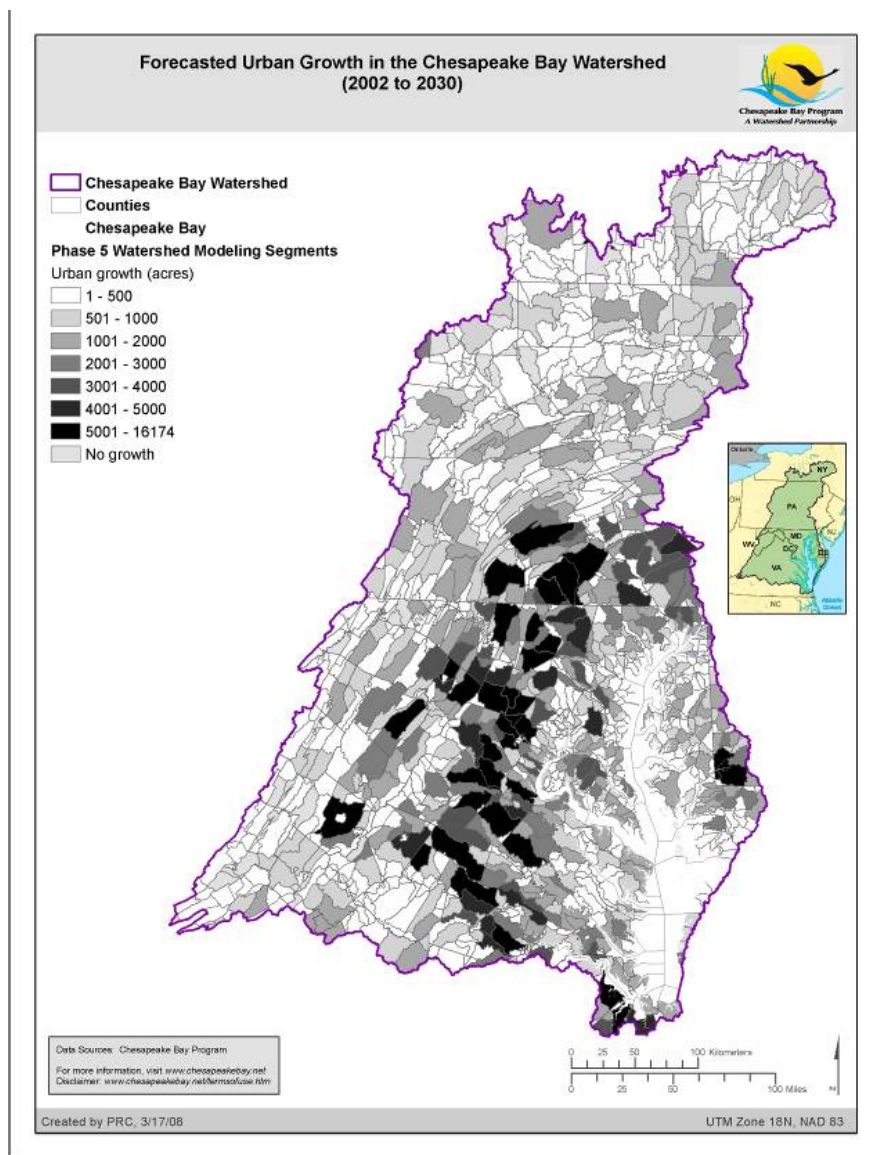
Consequences of Landscape Change includes studies and scientific investigations linking patterns and rates of landscape and land-surface changes to fundamental ecological, biological, physical, chemical, and hydrologic processes and factors. For example, a study linking observations of landscape pattern and change to breeding bird populations is considered a study of consequences. The work also involves use and enhancement of a process model of these linkages. These studies also look at thresholds and tipping points of land surface changes and fundamental ecological processes and services. They result in models, spatial metrics and indicators, and assessment tools that can be used to evaluate the consequences of landscape change at a number of spatial and temporal scales. The USGS will continue this work in 2010.

The Road Indicator Project (TRIP) — Roads are an important indicator of human influences on the environment, contributing to the degradation of ecological and watershed conditions, while simultaneously providing access to natural resources. TRIP project, in cooperation with the Bureau of Land Management, the National Park Service, USFS, and the Colorado Division of Wildlife, has completed three years of simultaneous monitoring of traffic on public land and movements of elk on both public and private land of the Gunnison River Valley. More than 40,000 GPS elk locations (this is one of the largest elk studies ever conducted) and 75,000 vehicle counts are now assembled for targeted analysis of the influence that traffic exerts on elk movements. Preliminary examination of the data shows that increased traffic levels just before rifle hunting season are quickly followed by movement of elk from public to private land. The USGS will continue TRIP activities in 2010.

Chesapeake Bay Land Change Model (CBLCM) is a major activity in the Land Use and Land Cover Change in the Chesapeake Bay Watershed: Causes and Consequences project.

This project is part of the multi-agency Chesapeake Bay Program that focuses on the causes and consequences of land use change to the watershed's water quality and wildlife habitat. The scientific information it produces is critical to ensuring that the money spent on Bay restoration efforts is focused in areas and on projects where it will have the greatest benefit to the Chesapeake Bay. The project includes comprehensive assessments of land use change and its causes from 1984 to 2006 for the entire Bay watershed and compares these trends to trends in water quality; includes the development of

analytical tools to empower citizens with information to assess and monitor watershed condition; and develops alternative future land use scenarios to engage the public and inform local and



regional planners of the potential impacts of land use policies and urban growth trends on the Chesapeake Bay.

The USGS, working in conjunction with the multi-organizational Chesapeake Bay Program completed the development of the (CBLCM) and has applied it to forecasting urban growth within the Bay watershed under a variety of landscape trend scenarios. The CBLCM combines economic, demographic, infrastructure, and physical characteristics of the Bay to generate spatially-explicit forecasts of urban growth and associated sewer outflows/septic loads, and proportions of farm and forested land conversions. These outputs are critical inputs to water quality models that forecast nutrient loads to the Bay. The USGS is in the final stages of developing a Website and wiki environment that can be used as a model development, communication, dissemination, and learning tool.

The Shenandoah and Best Management Practices (BMPs) — BMPs' accomplishments are part of the Land Cover Dynamics and Environmental Processes project that develops, evaluates, and applies landscape process understanding to improve the hydrologic and biologic science used in decisionmaking at Federal, State, and local government levels. The multiple project objectives include developing field data collection and remote sensing methods, creating well-calibrated multi-temporal and multi-resolution databases, and understanding how the relationships among land cover and hydrologic/biologic processes change at different spatial and temporal scales.

- ***Looking for Climate Change in the Shenandoah National Park*** — The USGS is using remote sensing in Shenandoah National Park to detect possible climate change impacts on forest health. Installation of a network of meteorological data collection stations has been completed. Data are being correlated with the multi-decadal record of Earth observations to detect forest changes caused by climate as opposed to other natural and manmade disturbances in the Park. A new Webpage (<http://lcat.usgs.gov/shenandoah/>), featured by local news is providing the public with real-time information on weather conditions and valuable information about the research to understand the influence of climate change on the timing of biological events, such as annual plant flowering and seasonal bird migration.
- ***Mitigating the Negative Impacts of Land Use Change*** — As a component of adaptive management research, the USGS is studying BMPs. BMPs are specific structures and actions designed to mitigate, or lessen, the negative environmental effects of land use change by controlling sediment, nutrients and other pollutants that result from urban and suburban development. A geographic database was developed to map and interpret the use of different BMPs in relation to land cover change in the Clarksburg Special Protection Area in Montgomery County, Maryland. The USGS is part of a multi-organization partnership looking at the application of BMPs in a rapidly developing suburban area. Data on BMPs was integrated with climate, and receiving stream physical, biologic, and chemical data to identify patterns of land use change. The integrated data improved communication among stakeholders, provided a platform to guide upcoming targeted data collection, and informed decisionmakers on mitigation planning and remediation actions and their potential impacts on ecosystem health.

Studies and Method Development

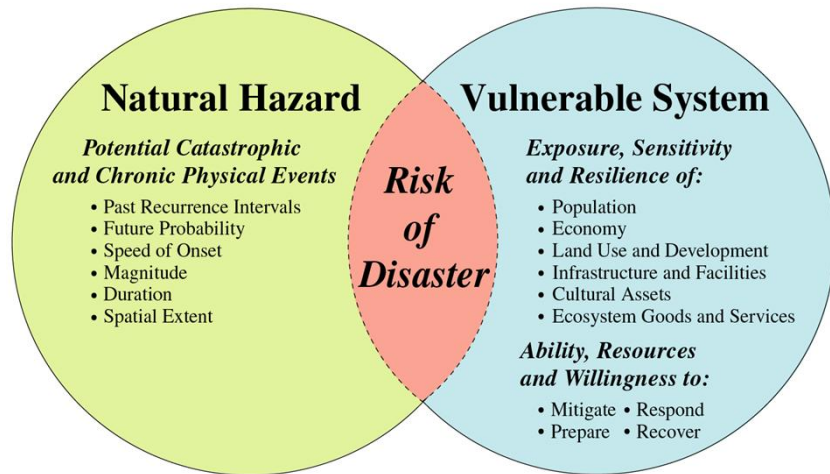
(Estimates for 2008, \$3.1 million; 2009, \$3.0 million; 2010, \$3.0 million)

These scientific investigations utilize consequence study results (e.g., models), sensitivity analyses, distributions of people, key landscape features and processes, and the probability of specific disturbance factors occurring, to evaluate vulnerability and risk. These projects include case studies, interpretative assessments of vulnerability and risks, and method and tool development. They involve natural hazard vulnerability and risk assessments, as well as those related to climate change scenarios, ecological goods and services, and socio-economic conditions. These may include science impact studies involving stakeholders and other clients (e.g., collaborative processes). The USGS will continue this work in 2010.

Assessing Societal Vulnerability to Natural Hazards — Reducing potential losses from natural hazards in coastal communities is one of the critical issues of the 21st century. To reduce potential losses, public and private decisionmakers must understand the hazards in their communities and their vulnerability to these hazards. In 2009 and continuing in 2010, the USGS is helping local and State practitioners by augmenting its traditional expertise in natural hazards with improved capacity to assess vulnerability, defined here as the exposure, sensitivity, and resilience of a community. Recent USGS research efforts have focused on assessing the vulnerability of coastal communities to catastrophic tsunamis and providing training opportunities to assess pre-event vulnerability and post-disaster recovery. This combination of efforts

shifts discussions of risk from simple inventories of exposed assets to community-wide understanding of system resilience.

Two USGS Scientific Investigation Reports detailing variations in community exposure and sensitivity to tsunamis in Oregon and Washington were released in 2008. In addition, technical briefings of these reports will continue to be given to local, State, and Federal partners.



Risk is function of natural hazards and vulnerable human-environmental systems

Developing Tools to Support DecisionMaking

(Estimates for 2008, \$1.2 million; 2009, \$1.5 million; 2010, \$1.5 million)

These are studies and scientific investigations that take advantage of the other three components above (Landscape Monitoring, Consequences, and Studies and Methods) in conducting pilot studies to evaluate concepts such as alternative landscape futures and other risk communication and decision support approaches. This includes research into forecasting capabilities and systems that utilize real-time and near-real time data. Examples of modeling efforts include natural hazards, climate change, urbanization, energy development, invasive

species, and other natural and anthropogenic factors. The USGS will continue this work in 2010.

Web-based Geospatial Decision Support Tools Empower Users — Decisionmakers at all levels are challenged not by the lack of information, but by the absence of effective tools to synthesize the large volume of data available and utilize it to inform decisionmaking. Examples of decisionmaking issues include natural hazard mitigation, homeland security, emergency response, economic and community development, water supply, and health and safety services. The Land Cover Analysis Tool (LCAT), the South Florida Ecosystem Portfolio Model (EPM), and the Chesapeake Online Adaptive Support Toolkit (COAST) are now available for application. LCAT allows users to display and download data from the National Land Cover Database (<http://lcat.usgs.gov>). EPM allows users to evaluate hypothetical future land use and land cover patterns in terms of habitat availability, indicators of ecological health, water quality criteria, land price changes, and effects of climate change and sea level rise on water quality and the severity of coastal storms (<http://lcat.usgs.gov/sflorida/sflorida.html>). COAST is an integrated framework of information and provides Web-based tools that allows for an adaptive-management approach to coordinate, implement, and assess management actions to restore and protect the Chesapeake Bay and its watershed. COAST is helping to support the Chesapeake Action Plan, which is promoting an adaptive-management process to enhance management, coordination, and accountability of Chesapeake Bay Program partner activities (<http://chesapeake.usgs.gov/coast/index.html>). The USGS will continue this work in 2010.

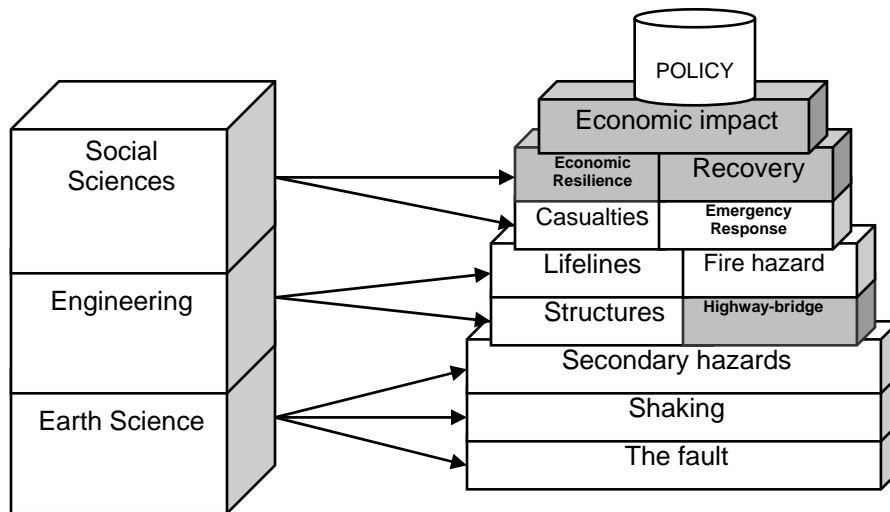
These and other tools are products of the Web-based Geospatial Decision Support Tools project that is focused on developing accessible, manageable and understandable Web-based data and tools and applying them to a variety of critical issues facing Federal, State, and local government partners.

South Florida Ecosystem Portfolio Model — Resource managers, land use planners, and decision makers in South Florida require user-friendly easily-accessible tools that evaluate the many consequences of land use decisions. Informed land use decision-making involves maintaining a balance between many competing factors, including the pressure to expand urban and suburban development, human quality-of-life, and ecosystem health. The current South Florida Ecosystem Portfolio Model (EPM) prototype has two major components: (1) an ecological value model based on a set of ecological criteria relevant to National Park Service and US Fish & Wildlife Service resource management and species protection mandates; and (2) a real estate market-based spatially-explicit land price model sensitive to changes in land use patterns. Future work will involve the development of a third major component: (3) a set of human well-being metrics sensitive to land use/cover changes that collectively measure changes in community quality-of-life, community risk profiles, and economic indicators. The current prototype is implemented for Miami-Dade County, with the protection of ecological values in the agricultural and managed lands between the Everglades and Biscayne National Parks as the focus. The Web-delivered prototype was demonstrated at a workshop held at Everglades National Park in July of 2008. This Web-based EPM will contribute to improved public understanding and awareness of the complex ecological, environmental, and socioeconomic consequences at stake in land use decisions in South Florida.

Geography contribution to Multi-Hazards Demonstration Project, ShakeOut Scenario — The ShakeOut earthquake scenario in Southern California was a successful execution of interdisciplinary research and coordination with unprecedented Stakeholder involvement. The magnitude 7.8 earthquake scenario provided the foundational materials for the Golden Guardian 2008 emergency response and recovery exercises and the ShakeOut drill involving over 5,000

emergency responders and disaster recovery agents, and over 5.5 million citizens. Fire following, water service disruption, and economic impact results stimulated interagency and inter-utility assessments and problem solving. GAM contributed spatial, quantitative, and integrated analyses, accessed expert opinion, managed contracts, conducted workshops, produced reports, and cooperated with exercise planners on the following topics: highway-bridge damage and traffic and commuter impacts; port operation and lifeline service disruption; regional economic impact; economic resilience; disaster recovery, two community focus studies, and lessons learned.

The following graphic depicts building the ShakeOut earthquake scenario from an earth science foundation with interdisciplinary research. The gray boxes highlight GAM's contribution to this effort.



Geographic Research, Investigations, and Remote Sensing

Program Performance Overview

The following highlights important performance measures for the Geographic Analysis and Monitoring Subactivity:

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
% of US surface area with contemporary land cover data needed for major environmental monitoring and assessment programs (SP) (GAM)	C	65%	94%	95% (286/300)	100% (300/300)	99.3% (298/300)	40% (120/300)	100% (463/463)	+60%	40% (120/300)
Comment	In 2009, USGS will begin the next generation land cover dataset. Efforts in 2010 will focus on completing the 2006 NLCD product for the conterminous U.S. only. Data for AK, HI, and Puerto Rico will be included in the next NLDC updated product of 2011.									
Efficiency and Other Output Measures										
# of terabytes collected annually (GAM)	A	438.8	537.9	96	278	535.2	270	270	0	270
# of terabytes managed and distributed cumulatively (GAM)	C	2,887.4	3,425.3	4,255.9	3,556.6	3,840.6	4,300	4,600	+300	5,400
# of systematic analyses and investigations completed (GAM)	A	69	63	55	59	70	53	53	0	53
Total Actual/Projected Cost for Analyses(\$000)		14,824	14,521	16,782	12,449	18,200	13,780	13,780	0	13,780
Actual/Projected Cost per Analysis (whole dollars)		214,846	230,488	305,121	211,000	260,000	260,000	260,000	0	260,000
# of formal workshops or training provided to customers (GAM)	A	12	8	16	5	31	15	12	-3	15
Comment	Change results from changes to base funding.									
Total Actual/Projected Cost for Workshop (\$000)		101	56	227	205	1,305	632	505	-127	632
Actual/Projected Cost per Workshop (whole dollars)		8,445	7,041	14,128	41,000	42,100	42,100	42,100	0	42,100

Activity: Geographic Research, Investigations, and Remote Sensing

Subactivity: National Geospatial Program

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-) ^{a/}	Program Changes (+/-)	Budget Request	
National Geospatial Program (\$000)	0	0	+70,748	0	70,748	+70,748
<i>Total FTE</i>	0	0	+295	0	295	+295

^{a/} The USGS proposes to move the National Geospatial Program from the Enterprise Information Activity to the Geography Activity. The adjustment includes +\$69,816 and +295 FTE for this restructure. See Section F for more details.

The 2010 budget request for the National Geospatial Program (NGP) Subactivity is \$70,748,000 and 295 FTE. There are no program changes requested for NGP in 2010.

Program Overview

The NGP collects and integrates base national geospatial datasets, maintains standards, coordinates data discovery and access, and ensures consistent and current data are available for the Nation. The NGP meets geospatial needs of Department bureaus by making basic and advanced products and services available over the Web and through the USGS Store. Two of NGP's primary products are *The National Map* and The National Atlas, which present current, accurate, and consistent geospatial data and map services online. These products contain data and information describing the landscape of the U.S. and locational features that can be fused or integrated and displayed online or in a traditional map format. *The National Map* represents the starting point—the basic framework—from which land and resource decisions and economic and environmental policies can be made.

Partnerships Through the National Spatial Data Infrastructure (NSDI)

In 2008, the NGP developed partnerships through its NSDI Liaison Network to acquire, maintain, and steward geospatial data for *The National Map* at a cost of \$5.6 million. By acting as a coordinator with other agencies, the USGS has leveraged the \$5.6 million investment to a total value of about \$35 million. After quality assurance and control, the data will be made publicly available online for government and private use. The USGS is continuing this effort in 2009 and 2010.

Decisionmakers at all levels of government, including land and resource managers, emergency responders, homeland security personnel, scientists in a variety of disciplines, and citizens rely on geospatial information. Through Emergency Operations, the USGS provides coordination and support to geospatial information activities associated with homeland security, homeland defense, emergency response for natural and human-made disasters, law enforcement, and the intelligence communities. Research in the Center of Excellence for Geographic Information Science (CEGIS) and a robust State-based Partnership liaison network are also essential contributors to the success of NGP.

The Federal Geographic Data Committee (FGDC) Office of the Secretariat (OS) of the USGS provides executive support to the FGDC. The FGDC promotes and promulgates consistent data and metadata standards, system interoperability, and cross-government best business practices for geospatial resources, policies, standards, and technology. The Committee is charged with facilitating the continued building of the National Spatial Data Infrastructure (NSDI). The Office of the Secretariat (FGDC-OS) coordinates, develops and manages the geospatial data clearinghouse, providing discovery of and collective access to geospatial data.

NGP long-term goal 1, Leadership: Provide leadership and guidance for key stakeholders to assure base thematic data is planned and collected in the most efficient and effective ways and to benefit the broadest user community. This is accomplished through developing policy, developing key standards and data models, coordinating and facilitating a governance structure, negotiating collaborative agreements with partners, developing a national geospatial enterprise architecture, establishing achievable priorities, and providing a forum for technology transfer and best practices.

NGP long-term goal 2, Operations: Implement key components of the NSDI. This is accomplished through hosting spatial datasets, Web sites, knowledge base, and tools for discovery and access; providing data integration and quality assurance of spatial data; staffing enterprise architecture, governance body, and spatial operations; conducting and sponsoring research for geospatial information science; providing contract management for operations; conducting training, education, and consultation; adopting a posture of being the data producer of last resort; and making map products accessible.

The NGP strives to improve the understanding of natural ecosystems and resources through integrated interdisciplinary assessment. The program supports USGS strategic objectives by providing an integrated approach to national geospatial coordination and standards, effective leadership and collaboration with the larger geospatial community, and tools for the discovery, access and sharing of geospatial resources.

In 2010, the USGS proposes to move NGP to the Geography discipline. NGP is divided into six components: *The National Map*, The National Atlas, Emergency Operations, CEGIS, Partnership Implementation, and FGDC-OS.

For details on performance measures, see the table at the end of this section.

2010 Program Performance

NGP includes the following components:

The National Map

(Estimates for 2008, \$41.9 million; 2009, \$42.4 million; 2010, \$42.9 million)

The National Map is the cornerstone of NGP. It provides base geospatial data to the Nation through a portfolio of products and services that focus on eight data themes: elevation, geographic names, hydrography, land cover, orthoimagery, boundaries, structures, and transportation. A consistent database, combining Federal, State, and local information, provides a seamless, up-to-date mapping framework for multiple needs, including updating and maintaining the Nation's topographic maps. In conjunction with *The National Map*, Geospatial One-Stop (GOS) provides access to and discovery of geospatial data to meet the science, land,

and resource management needs to State, Federal, local, industry, and public users. The National Geospatial Technical Operations Center (NGTOC) serves as a national capability of the production activities and technical services necessary to create *The National Map*.

Geospatial Data Themes of *The National Map*

Through the Department, the USGS is the Federal agency with the Office of Management and Budget (OMB) Circular A-16 framework data layer responsibilities for seven framework data layers, including digital orthoimagery, terrestrial elevation, hydrography, watershed boundaries, and geographic names. The NGP carries out responsibilities for these 5 layers through *The National Map*. Another framework data layer that USGS has responsibility for - Land Cover - is managed under Land Remote Sensing. The 5 data themes are considered National Map priority data themes. Other geospatial data themes which are OMB Circular A-16 responsibilities for other agencies and are included as map layers in *The National Map* are transportation, man-made structures, and boundaries. The USGS coordinates acquiring and integrating geospatial data from a variety of sources and provides access to the resulting seamless nationwide coverage of geospatial data.

The USGS manages data themes that are available through *The National Map*, plus the development of topographic maps from *National Map* data. As a geospatial data broker, facilitator, and integrator of geographic knowledge, the USGS coordinates the requirements of many State, Federal, and local constituents, cooperators, and partners to set priorities for orthoimagery, elevation, hydrography/watershed boundaries, and geographic names data. Based on customer needs, the USGS is expanding and improving high-resolution geospatial data coverage. The bureau is also increasing the coverage of transportation and boundary data layers from the Census Bureau, along with a database for man-made structures from Federal, State, and local government agencies.

Orthoimagery — Digital orthoimagery is an essential base layer in geospatial databases in nearly all levels of government. The USGS ensures that the orthoimagery in *The National Map* is up-to-date and serves as a primary component of its graphic program in support of the new E-Topographic Map. The orthoimagery program also supports a variety of applications: natural hazards and emergency response activities; science investigations; geographic analysis; land use planning; National Environmental Policy Act's environmental impact statements and assessments; and commercial applications.

In its Federal leadership role, the USGS acquires, provides quality assurance, maintains, archives and distributes terabytes of public domain orthoimagery data. All NGP funds for orthoimagery are leveraged with partners, either through agreements on their projects or via contracts administered by the USGS Geospatial Products and Services Contract.

The USGS collaborates with other government agencies at the Federal, State and regional levels to acquire orthoimagery, at resolutions ranging from 1-meter to 6-inches, in order to fulfill their missions. The bureau is one of the founding members of the National Digital Orthoimagery Program, a consortium of Federal and State agencies allied with the purpose of developing and maintaining national orthoimagery coverage in the public domain through the establishment of partnerships with Federal, State, local, tribal, and private organizations.

For the Nation's urban areas, the NPG partners closely with the National Geospatial-Intelligence Agency (NGA) orthoimagery for 1-foot or better resolution orthoimagery over 133 of the Nation's most populous and administratively important urban areas. The 133 Urban Area program acquires very high-resolution data in support of homeland security, public safety, emergency response, and other applications with a 2- to 4-year update cycle. The program relies heavily on State, regional, and local government participation and has averaged a 1:6 return on investment over the course of its six year history.

National Elevation Dataset (NED) — *The National Map's* elevation data theme is focused on data acquisition and quality assurance activities, supporting emergency response activities, and other priority Department programs. As a multi-resolution, seamless dataset, NED is the best terrestrial elevation data of the U.S. All NED elevation data are offered to the public at no charge and are public domain data. The NED is updated on a quarterly basis as new source data become available, improving overall accuracy.

Elevation data support modeling of drainage networks and geometric correction of remotely sensed data and are critical to various decision support systems (e.g., flood mitigation and response, wildfire behavior prediction). The growing demand for higher-resolution (3 meter or finer) elevation data over populated areas and flood plains drives current USGS investments in detailed elevation data and technologies such as light detection and ranging (LiDAR) and Interferometric synthetic aperture radar (IfSAR).

The elevation project acquires the best available data in cooperation with Federal, State, local, and private sector partners, via agreements to partner on others' projects or USGS-lead contracts. An NGTOC quality assurance program guarantees that all new elevation data meets USGS quality specifications, and the data are archived and disseminated to the public via *The National Map* and GeoSpatial One-Stop Web portal.

National Hydrography Dataset (NHD) and Watershed Boundaries — The NHD provides a complete nationwide data coverage, eliminating duplication of effort, improving the sharing of scientific data, and standardizing the technology to greatly reduce the cost of science. NHD is a USGS-led multi-agency project designed to build and maintain a comprehensive geospatial dataset of the Nation's surface water to provide state-of-the-art analysis in water science.

Accessible via *The National Map* and GOS, NHD contains comprehensive and detailed data about America's surface waters. The NHD assigns unique identifiers for each surface water feature, enabling all agencies to reference their water-related data to a common map base. The dataset is used by many agency scientists: USGS scientists in the bureau's StreamStats and SPARROW nutrient modeling projects; U.S. Forest Service in its Natural Resource Information System water module; Environmental Protection Agency as part of its Watershed Assessment, Tracking & Environmental Results system; Census Bureau in its map modernization activities; Department of Homeland Security in its ICWater program to assess risks in the Nation's surface water; and numerous State agencies for meeting reporting requirements of the Federal Water Pollution Control Act.

In 2010, the Watershed Boundaries dataset will have matured to the point where it will be maintained and its maintenance responsibilities will reside in NGP. The NHD activities will incorporate maintenance of the Watershed Boundaries dataset.

In 2010, the USGS plans to accomplish these NHD tasks:

- Achieve enhanced integration with the National Elevation Dataset for one-third of the U.S.
- Implement active data stewardship programs for 45 States.
- Complete the data integrity improvement program for all of the U.S.
- Improve basic data content for 25 percent of the U.S. and special data content (streamgages and dams) for all of the U.S.
- Integrate the Watershed Boundary Dataset with the NHD and assure spatial integration for 25 percent of the U.S.
- Develop “local resolution” NHD with ten State partners.
- Provide capabilities to expand the applicability of the data in science and resource management.

The USGS long-range strategy for NHD calls for:

- Achieving enhanced integration with all National Map themes.
- Making further progress to integrate with other hydrographic datasets (National Wetlands Inventory, Digital Flood Insurance Rate Maps).
- Continuing development of “local resolution” data to meet ongoing need for enhanced data.
- Continuing data content improvements to expand functionality (water diversions and metropolitan storm water systems).
- Continuing growth and development of the data stewardship program.
- Improving information accessibility using ontology and other methods.

Geographic Names — The USGS Geographic Names Project is comprised of two functions: providing the Secretariat and staff for the United States Board on Geographic Names (BGN); and managing the Geographic Names information System (GNIS). The BGN is an interagency body consisting of representatives from various Federal departments and agencies, and is empowered by Public Law to issue standard geographic names for use on all material (maps, documents, reports, data files) published by the Federal Government and its contractors. Geographic names are a critical and important reference component for scientific investigations and emergency response, as well as for land and resource management operations throughout the Federal Government. A large number of local, State, and Tribal agencies adhere to the guidelines and policies of the BGN and participate actively in the standardization effort.

The BGN is also authorized to disseminate the official names and locative attributes of all cultural (“administrative”) features, including schools, hospitals, and such emergency preparedness locations as police and fire stations.

The GNIS is the authoritative database for all geographic names, all of which must conform to the BGN’s principles, policies, and procedures. In addition to data developed from decisions made by the BGN, GNIS contains data received through partnerships

with Federal agencies, State Names Authorities, State Geographic Information Systems (GIS) offices, and Tribal authorities. GNIS serves as the names layer of *The National Map*, and is a major component of GOS. GNIS data elements are cited in the Department of Homeland Security (DHS) Geospatial Data Model and the draft FGDC Address Standard.

In 2010, the USGS will continue to provide the BGN Secretariat national leadership responsibilities. The bureau will continue to develop State stewardships as the model for geographic names harmonization across Federal, State, local and commercial products. With the integration of GNIS and USGS Best Practices Vector Database, the USGS will complete the coalescence of data acquisition efforts, ensuring that BGN principles and policies are adhered to by partners/stewards through education. The bureau will continue to develop joint maintenance toolsets.

Secondary Data Themes (Transportation, Man-Made Structures, and Boundaries):

These are geospatial data themes that USGS does not have a direct Federal responsibility for maintaining, but they remain important layers in *The National Map*.

Transportation — Transportation data are critical to most geospatial applications involving routing and navigation, disaster planning and response, traffic safety improvement, congestion mitigation, mapping, recreation and environmental planning. The USGS involvement in transportation data development has been to address gaps in geospatial data update and management of public domain transportation data at a national level.

In 2010, the USGS will continue to support the acquisition, integration and maintenance of high resolution transportation data, including roads, railroads, trails, and airports. The USGS will continue to build on pilots to update and improve base roads data developed with States through the Census Bureau's MAF/TIGER Accuracy Improvement Project and *The National Map*. In addition, the USGS will work with other Federal agencies and with States to explore the potential for public/private partnership for the continued development and improvement of transportation data in the public domain.

Man-Made Structures — The structures data theme is comprised of buildings, industrial areas, facilities, and other features important to planners, land managers, utility companies, and the general public for a broad range of analyses and applications. This theme is the key concern for the locations of critical structures that are of vital interest to emergency responders.

In 2010, the USGS will continue to leverage data development by NGA, DHS and the States to complete additional National coverage of base data content in the public domain, but to also implement continuous updates through collaborative data maintenance through the States.

Boundaries — The boundary data theme depicts administrative and jurisdictional information critical to a broad range of applications, including those requiring legal and ownership information. The boundary theme primarily relies on data from the Census Bureau, along with some Federal boundaries provided by other agencies.

In 2010, the USGS efforts will be limited to processing updates from the Census Bureau.

Topographic Maps

The USGS produced its first topographic map in 1879, the same year it was established. Today, more than 100 years and millions of map copies later, topographic mapping is still a core mission of the USGS. The topographic map remains an indispensable tool for government, science, industry, land management planning, and leisure. The best known USGS topographic maps are those of the 7.5-minute, 1:24,000-scale quadrangle series. A scale of 1:24,000 allows considerable detail to be shown. At this scale, it takes about 57,000 maps to cover the conterminous 48 States, Hawaii, and territories. The USGS completed this primary topographic map series in 1991. All of these maps are now for sale to the public in paper format. While these maps are considered by many to be a national treasure, the average primary series topographic map is more than 29 years old. Frequent changes on the landscape mean that many of these maps are no longer accurate and complete.

Much has changed since early topographers first traveled the unsettled West and carefully plotted the first USGS maps by hand. The art and science of mapping may have never undergone more profound change than in the last 30 years. New technologies such as remote sensing and Global Positioning Systems are altering the production and use of traditional maps. The face of mapping has changed: digital data for computerized mapping, GIS analysis, and Web-based data exchange and fusion. New applications emerge every day with each technological advance. At their most basic, digital data applications make it possible to display maps on a home personal computer. At their most advanced, analytical applications stretch the definition of cartography and enter the realm of geography and other sciences.

In 2001, the USGS published a new vision for mapping the Nation in the 21st Century, and began development of *The National Map*. The objective of *The National Map* is to ensure current, consistent, seamless, and integrated geospatial data for the Nation through Federal, State, local and other partnerships. The vision calls for topographic maps to be produced as an output of *The National Map*. In 2008, a USGS report, "The National Map 2.0 Tactical Plan: Toward The (Integrated) National Map," resulted in an accelerated goal to develop the new topographic map as a primary digital product of the program. A recent National Map Customer Requirements Study confirmed the need for up-to-date topographic maps and provided information about the priorities regarding currentness, accuracy and content.

To address these challenges, the USGS and partners in the public, private, and academic sectors have been researching methods for producing electronic maps. An initial focus in 2007 and 2008 was on production of image maps, using data contained in *The National Map*, along the Gulf and East Coasts. This effort was undertaken to support hurricane-related emergency response, while at the same time using the process to refine and advance the map products and methods. The image map is a first step toward the ultimate goal of national coverage of a topographic digital map product.

Starting in 2009, the next generation USGS topographic map will be a digital product made from *The National Map* data. The initial version of the "Electronic Topographic Map" will include orthoimagery with roads and geographic names, and ultimately transition to a digital topographic map that includes data available from *The National Map* — orthoimagery, elevation, hydrography, boundaries, transportation, geographic names, structures, and land cover. In 2010, the USGS will add quality checked and integrated hydrography and elevation to the

content produced in 2009. The addition of integrated hydrography and elevation data to the map followed significant research and development into cost-effective integration techniques.

In 2010, the USGS will achieve these targets for topographic maps:

- Produce “electronic topographic maps” in targeted areas of interest where there are suitable data (goal is to make 18,300 new ‘electronic topographic maps” and about 18,300 scanned historic maps for the same quadrangles)
- Continue collaboration and development work towards fully automating topographic map production
- Continue to conduct customer research and analysis, data integration, and ongoing investigations to support the needs of the USGS topographic map user community
- Enhance the new “electronic topographic map” with additional features and user utility

Data Access

The USGS ensures that public domain geospatial data associated with the eight major themes and map products prepared from these data are freely accessible 24x7 to the public and available to partners. Access activities include coordinating the integration of national geospatial databases held by the USGS, and other Federal, State, and local agencies. Access activities include those to integrated national databases held by the USGS and a catalog of Web mapping services made available by partners. For national databases, the USGS focuses on providing around-the-clock, free, or low-cost access to its geospatial data holdings. Users can browse, select, and retrieve geographic data and information for their area of interest.

In 2010, the USGS will upgrade systems to enhance access to *The National Map* databases for a wide variety of customers within the geospatial user community including GIS professionals, emergency operations first responders, other Federal agencies and the general public.

Geospatial Data Archive

The USGS provides for long term archive and retrieval of its geospatial data and metadata at its EROS Center in Sioux Falls, South Dakota. Procedures are developed to maintain original data sets such as high-resolution orthoimagery quadrangles, digital raster graphics, digital line graphs, and digital elevation information. The USGS makes current and historical information available online in time frames that allow them to be used in emergency response activities as well as ensuring long-term preservation.

In 2010, the USGS will continue to maintain the archive of materials and support the growth of the archive as new NGP geospatial data are acquired. The USGS estimates an exponential growth in archival volume with planned growth to 250 Terabytes by the end of 2010. Planned activities include data organization, ingest, metadata generation, data set appraisals and assessments, dispositions including transfer to the National Archive and Records Administration (NARA) and preservation activities such as data set transcriptions and media migrations for offsite storage and protection.

Geospatial One-Stop

Under OMB's EGov initiatives, the USGS instituted and manages the GOS Web portal. The portal, located at <http://www.geodata.gov>, serves as the government's gateway for the discovery and access to the Nation's distributed geospatial resources from thousands of organizations across the country. These data sets, developed by local, Tribal, State, and Federal governmental organizations, academia and the private sector, as well as Internet mapping services, models, applications, and place based publications, can all be organized, discovered and accessed through the GOS portal.

In 2010, the USGS will continue to enhance work flows between GOS and *The National Map* to incorporate data and services from Federal, State, local and Tribal sources; improve search to enhance the discovery of Agency "authoritative" data services; and support new International Organization for Standardization (ISO) and OGC standards.

The USGS will take steps to better integrate the new National Map base map services into the GOS portal as part of its scheduled 2.4 release and provide a GOS search in the new National Map Viewer. The project will also develop a new search wizard which will support the Geospatial Lines of Business efforts for new geospatial grants and contracts language. Another key focus will be assisting the implementation of search interfaces to the GOS catalog from outside of the portal utilizing capability established in 2009.

National Geospatial Technical Operations Center

The NGTOC provides geospatial technical expertise to develop *The National Map*, National Atlas of the United States[®], and implementation of key components of the NSDI. In 2010, the NGTOC will continue to implement the staffing strategy outlined in the organizational re-engineering staffing plan. In addition, a new focus will be placed on re-engineering specific business processes and practices.

National Atlas of the United States of America

(Estimates for 2008, \$2.6 million; 2009, \$2.6 million; 2010, \$2.6 million)

The National Atlas features products and services designed to make geographic information more useful to a broad audience. For the public, the Atlas produces wall maps; polished page-size maps; multimedia articles on the Nation's natural and socioeconomic resources; dynamic maps that illustrate change over time; and an innovative and award-winning interactive map maker that includes more than 2,500 discreet map layers. For professional users, the National Atlas provides accurate, integrated geospatial data; full documentation for these data; and Web map services.

In 2010, the USGS will develop innovative products and services that meet public need for Federal geographic information in useful forms. The bureau will introduce a series of multimedia articles designed for use by educators and by individuals to improve map reading skills and their knowledge of America's physical geography. Another set of articles will provide maps and information on 100 wetlands across the country. Software developments will include an Atlas content management system; a revamped Map Maker with a second graphical user interface for more advanced users; an entirely new set of Web map services for hundreds of National Atlas data sets; and an entirely new program that will allow USGS customers to compare data collected over time, year by year. The bureau will edge align and harmonize its 1:1,000,000-scale cartographic frameworks with those from Canada and Mexico to produce a

North American Atlas to complement the one that the USGS maintains at ten million scale. These data will also be delivered to the Global Map Secretariat.

Center of Excellence for Geographic Information Science (Estimates for 2008, \$2.0 million; 2009, \$2.0 million; 2010, \$2.0 million)

The USGS established CEGIS in February 2006 to conduct, sponsor, and collaborate in the research and innovative solutions required by *The National Map*, NSDI, and the emerging GeoSpatial Web.

The focus of CEGIS is implementing recommendations from the National Research Council publication, "A Research Agenda for Geographic Information Science at the United States Geological Survey," and staffing through post doctoral positions and academic contracts to begin the research needed to support *The National Map*. The CEGIS has active research projects in the following areas recommended by NRC: Design of an Electronic Topographic Map, User-Centered Design for Web-Map Interfaces, Developing an Ontology for *The National Map*, Automated Data Integration, Generalization, and Multi-Resolution Raster Data. Results include algorithms and procedures for generalization of NHD from 1:24,000-scale to a user selected smaller scale, for example, 1:100,000. For the Data Integration project, CEGIS results indicate that an accuracy of 6.2 m root-mean-square-error between a vector transportation dataset and a high resolution (0.3 to 1.0 m) orthographic image is perceived as integrated. An automatic method to warp a vector transportation dataset to fit an orthographic image has also been developed. For the Ontology project, a Specialists Meeting of 30 researchers was conducted in January 2009 and the results are in preparation for publication and prototype implementation with data from *The National Map*. For the Multi-Resolution Raster Data project, CEGIS is implementing transformation of high resolution scanned historical topographic maps to the U.S. National Grid on a parallel computing cluster to reduce processing time and increase throughput for the generation of the new USGS electronic topographic map product.

Emergency Operations (Estimates for 2008, \$3.4 million; 2009, \$3.4 million; 2010, \$3.5 million)

The focus of Emergency Operations is for the USGS to provide coordination and support to geospatial information activities associated with homeland security, homeland defense, emergency response for natural and human-made disasters, law enforcement, and the intelligence communities. A secondary role is to facilitate, where appropriate, the scientific analysis needs of these communities with other USGS science disciplines.

Emergency Operations promotes the adoption of USGS programs as the underpinning for Federal mapping activities and those of other public and private sector organizations with homeland security, homeland defense, law enforcement, and emergency management mission responsibilities. Emergency Operations supports a vision of comprehensive integration of *The National Map* and USGS science activities as a key component of a National Geospatial Architecture and NSDI.

Planned 2010 activities include partnership development, liaison and coordination, information requirements definition, inter-bureau and discipline coordination, geospatial applications development and support, support for USGS continuity of government and continuity of operations responsibilities, national security special events support, emergency response support, custom and special product generation, and provisioning of sensitive, proprietary, and classified information. These activities enable cross-purposing of government assets to improve

the value of data and services to citizens. Key Federal partners and stakeholders include the Department, DHS, United States Marshals Service, NGA, and United States Northern Command.

Partnership Implementation

(Estimates for 2008, \$13.3 million; 2009, \$13.6 million; 2010, \$13.9 million)

The NGP partnership network cultivates and maintains long-term relationships with partners and develops agreements for *The National Map*, GOS, and other projects that advance NSDI. The partnership network is comprised of headquarters and regionally-based liaisons who coordinate with other Federal agencies and national organizations, and USGS Geospatial Liaisons who are distributed throughout the Nation to work with geospatial communities in the States.

Partnerships are the foundation of USGS geospatial programs because they leverage funding across organizations to provide cost savings and reduce redundancy in geospatial data acquisition and stewardship.

In 2010, the partnership network and its agreements will continue to grow. Previous years' FGDC CAP grants will be completed and results shared with the geospatial community. Further, additional emphasis will be given in 2010 to strengthen Federal agency-to-agency partnerships and coordination for *The National Map* and NSDI, and to improving partnership communications materials.

Federal Geographic Data Committee Office of the Secretariat

(Estimates for 2008, \$5.6 million; 2009, \$5.7 million; 2010, \$5.7 million)

The FGDC-OS of the USGS provides executive support to the FGDC. The FGDC promotes and promulgates consistent data and metadata standards, system interoperability, and cross-government best business practices for geospatial resources, policies, standards, and technology. The Committee is charged with facilitating the building of the NSDI and the FGDC-OS coordinates, develops and manages the geospatial data clearinghouse, accessible through the GOS Web portal, providing discovery of and collective access to geospatial data.

Federal Geographic Data Committee Executive Support

The FGDC is an interagency committee that promotes the coordinated development, use, sharing, and dissemination of geospatial data on a national basis. This nationwide geospatial data publishing effort is known as NSDI. It is a physical, organizational, and virtual network designed to enable the development and sharing of this nation's digital geographic information resources. The FGDC activities are administered through FGDC-OS.

The OMB established FGDC in 1990 and rechartered the Committee in its August 2002 revision of Circular A-16, "Coordination of Geographic Information and Related Spatial Data Activities." The FGDC is a 31 member interagency committee composed of representatives from the Executive Office of the President, and Cabinet level and independent Federal agencies. The Secretary of the Department of the Interior chairs FGDC, with the Deputy Director for OMB as Vice-Chair. Numerous stakeholder organizations participate in FGDC activities representing the interests of State and local government, industry, and professional organizations.

The FGDC-OS provides leadership, support, outreach, technical expertise, and subject matter expertise to the multiple tiers of the FGDC which span all sectors of the geospatial industry. This includes the Executive Committee, the Steering Committee, the Coordination Group, the

National Geospatial Advisory Committee and numerous Thematic Subcommittees and cross-cutting Working Groups, such as Clearinghouse, Enterprise Architecture, Metadata, and Standards. The FGDC-OS plays a cornerstone role in the cross-coordination of efforts between the various committee activities and facilitates the identification of national geospatial issues and coordination opportunities. It manages and maintains the FGDC Web site and all associated content, documents, news releases, and committee, subcommittee, and work group pages.

In 2010, the USGS will support FGDC as directed in OMB Circular A-16; manage coordination activities; participate in Federal, State, and international geospatial standards, coordination, and infrastructure development committees and consortia; coordinate the development of FGDC geospatial standards; develop training and outreach materials; and manage the NSDI Cooperative Agreements Program (CAP) and 50 States Initiative. The FGDC-OS provides leadership and support for the Geospatial Line of Business, and provides support for the NGAC and serves as its Designated Federal Official. The NGAC was established under the FACA, which provides a forum to convey views representative of partners and stakeholders in the geospatial community outside of, but in coordination with, the Federal community.

Geospatial Line of Business

The Geospatial Line of Business (GeoLoB) was initiated by OMB in 2006 as a project of the President's EGov management objectives. The goal of GeoLoB is to develop a more strategic, coordinated, and leveraged approach to producing, maintaining, and using geospatial data and services across the Federal government. The vision is to serve vital national interests and the core missions of Federal agencies and their partners through the effective and efficient provision of geospatial data and services.

Fifty States Initiative

One of the goals of the USGS is to engage all levels of geospatial data and information providers and practitioners in the creation of NSDI. The task of involving all State, county, and community governments as well as academia, non-government organizations (NGO), and industry is enormous and well beyond the capability of FGDC as originally configured. As such the 50 States Initiative is designed to involve all States in the task by asking them to take the leadership in engaging all geospatial users and providers within their respective States in the endeavor.

The initiative seeks to develop and implement Statewide strategic and business plans that will facilitate the coordination of programs, policies, technologies, and resources that enable the coordination, collection, documentation, discovery, distribution, exchange and maintenance of geospatial information in support of NSDI. The FGDC-OS works closely with the National States Geographic Information Council (NSGIC) to advance this initiative.

National Spatial Data Infrastructure Cooperative Agreements Project

Since 1994, the NSDI Cooperative Agreements Project (CAP) continues to play a substantial role in promoting and disseminating the tenets of NSDI to thousands of NSDI advocates and practitioners. Essentially the program develops incentives for agencies and organizations to participate. To date, NSDI CAP awards have created collaborations at all levels of government, developed an understanding of geospatial information in organizations and disciplines new to NSDI, provided seed money to enable geospatial organizations to participate in the national

effort to implement NSDI, promoted the development of standardized metadata in hundreds of organizations, and funded numerous implementations of Open Geospatial Consortium (OGC) Web Mapping Services and Web Feature Services.

National Geospatial Advisory Committee

The goal of FGDC is to facilitate collaboration among Federal geospatial user and provider partners. Every effort has been made to engage States, counties, communities; NGOs, academia, and industry in FGDC activities, but to date only the Federal partners have had a vote at the table. In order to engage partners at all levels in the decisionmaking and to build a truly national infrastructure, FGDC will define a new governance structure.

The National Geospatial Advisory Committee (NGAC) was created to advise the Federal government on the management of Federal geospatial programs, the development of NSDI, and the implementation of OMB Circular A-16. The NGAC is sponsored by the Department under Federal Advisory Committee Act (FACA). It provides advice and recommendations to FGDC, through the FGDC Chair (the Secretary of the Interior or designee), on behalf of FGDC member agencies.

Geospatial Data Clearinghouse

The FGDC-OS coordinates the sharing of geographic data, maps, and online services through an online portal (Geodata.gov) that searches metadata held within the NSDI Clearinghouse Network to enable users to identify and analyze available geospatial data. While the portal is managed as part of Geospatial One-Stop, the underlying clearinghouse network and supported search capabilities are managed, monitored, enhanced, and developed by FGDC-OS.

International Activities

The FGDC facilitates the building of the NSDI while also promoting the creation of spatial data infrastructures (SDI) globally. This support occurs mainly through conference attendance, outreach, and participation in international geospatial bodies and events. The conferences provide opportunities for geospatial experts and policymakers at local, regional, and global levels to interact for the purpose of determining how SDI developments can help address important worldwide needs.

Geospatial Standards Development

The FGDC-OS develops geospatial data standards for implementing the NSDI, in consultation and cooperation with State, local, and Tribal governments, the private sector and academic community, and, to the extent feasible, the international community. It develops geospatial data standards only when no equivalent voluntary consensus standards exist, in accordance with OMB Circular A-119. The FGDC-OS leads the FGDC Standards Working Group and promotes and coordinates FGDC standards activities. It maintains membership in the International Committee for Information Technology Standards Technical Committee L1 on Geographic Information and serves as a conduit to the broader Federal community.

Performance Overview

The following table highlights important performance measures for the National Geospatial Program Subactivity.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
% of surface area of the conterminous U.S. for which high-resolution geospatial datasets are cataloged, managed, and available through <i>The National Map (SP) (NGP)</i>	C	UNK	UNK	99.71% (698/700)	100% (700/700)	99.86% (699/700)	99.86% (699/700)	100% (700/700)	0	100% (700/700)
Comment	The National Geospatial Program continues to maintain the geospatial data layers over the conterminous US. There are 7 data layers to maintain.									
% of total cost FSA and USGS saved through partnering with other entities for imagery acquisition of 1-meter NAIP orthoimagery (NGP)	A	44% (3.23/7.35)	41% (4.43/10.8)	32% (2.3/7.2)	36% (5.0/14.0)	27%	36% (5.0/14.0)	40% (5.6/14)	+4%	40% (5.6/14)
% of data acquisition costs for <i>The National Map</i> funded by partners (NGP)	C	47%	74%	59.3% (11.9/20)	60% (12/20)	71% (14/20)	60% (12/20)	71% (14/20)	+11%	71% (14/20)
Comment	Numerator is the total funds contributed by partners; the denominator is the total funds used to purchase data. The USGS expects partner funding to remain at the 2008 level.									

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of customers that identify or indicate (via a survey) that USGS NGP Outreach materials and activities (information and publications, conferences, training and workshops) met their needs/requirements (NGP)	C	UNK	UNK	UNK	Baseline	20%	20%	30%	+10%	75%
Comment	In 2008, this measure was baselined to determine the number of customers. The percent of customers is expected to increase in 2010 based on 2009 results.									
% of time that USGS managed geospatial data and information dissemination systems (i.e., Geospatial One-Stop Portal, The National Map, NSDI Clearinghouses) are accessible online to customers (NGP)	C	UNK	UNK	UNK	Baseline	97%	97%	98%	+1%	99%
Comment	NGP will monitor, log, and summarize the NGP geospatial data dissemination IT systems' accessibility times. The time will be the average for these systems divided by 24x7x365. The systems' availability will be reliant on the Department's Enterprise Services Network. In 2008, the USGS baselined the number to enable the bureau to establish a realistic projection of the online availability of USGS databases and applications such as The National Map. There were several DOI Enterprise Services Network system outages across the country during August and September 2008.									
% of GIO partners reporting satisfaction with partnership agreements (NGP)	C	UNK	UNK	UNK	Baseline	75%	75%	80%	+5%	90%
Square miles of the US with updated high resolution elevation data	A					93,153	58,000	58,000	0	50,000
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget. Not a cumulative measure.									
Square miles of the US with high resolution, leaf off, <1m imagery data	A					79,751	75,000	200,000	*+125,000	75,000

Geographic Research, Investigations, and Remote Sensing

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget. * Increase due to Nat'l Geospatial Intelligence Agency Border Program. Not a cumulative measure.									
% of total cost of geospatial data and geospatial services saved through Geospatial Line of Business Joint Business Case (NGP)		UNK	UNK	UNK	UNK	UNK	Baseline	TBD	TBD	TBD
Comment	The OMB Geospatial Line of business is a cross-government project that is standardizing and consolidating geospatial data and services across the Federal government. The Geospatial SmartBuy Agreement, issued by the General Services Administration on March 6, 2009, will be awarded and contracts available in mid-May 2009. 2009 is the baseline year.									
Efficiency and Other Output Measures										
# of gigabytes collected annually (NGP)	A	6,023	76,550	94,802	24,344	133,452	144,707	129,000	-15,707	129,000
# of gigabytes managed and distributed cumulatively (NGP)	C	108,035	187,842	278,646	249,679	410,713	555,420	684,420	+129,000	1,071,420
# of formal workshops or training provided to customers (NGP)	A	29	51	122	17	96	52	52	0	60
# of data standards used in implementing <i>The National Map</i> (NGP)	A	22	22	22	22	22	22	22	0	22

Geologic Hazards, Resources, and Processes

Subactivity/Program	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Geologic Hazard Assessments (\$000)	85,651	90,585	+1,178	-500	91,263	+678
<i>FTE</i>	<i>425</i>	<i>419</i>	<i>0</i>	<i>0</i>	<i>419</i>	<i>0</i>
Geologic Landscape and Coastal Assessments (\$000)	80,614	72,381	+1,095	+875	74,351	+1,970
<i>FTE</i>	<i>422</i>	<i>345</i>	<i>0</i>	<i>0</i>	<i>345</i>	<i>0</i>
Geologic Resource Assessments (\$000)	77,211	79,176	+1,741	+450	81,367	+2,191
<i>FTE</i>	<i>482</i>	<i>475</i>	<i>0</i>	<i>+1</i>	<i>476</i>	<i>+1</i>
Total Requirements (\$000)	243,476	242,142	+4,014	+825	246,981	+4,839
Total FTE	1,329	1,239	0	+1	1,240	+1

Activity Summary

The 2010 budget request for the Geologic Hazards, Resources, and Processes Activity (Geology Discipline) is \$246,981,000 and 1,240 FTE, which is a net program change of +\$825,000 and +1 FTE from the 2009 Enacted level. Additional information on program changes is provided in each subactivity section and in the Key Increases section beginning on page C-1.

The budget request includes proposed increases of (1) +\$375,000 to the Coastal and Marine Geology Program (CMGP) for funds for geologic characterization to provide the information framework for offshore wind-energy development; (2) +\$1.0 million to the CMGP to analyze and synthesize data collected during two previous seafloor mapping cruises in the Arctic and to work with the Department of State led Interagency Task Force on the Extended Continental Shelf (ECS); (3) +\$100,000 for the Minerals Resources Program (MRP) for support of the biofuels portion of the New Energy Frontier initiative; (4) +\$1.0 million to the Energy Resources Program (ERP) to work will highlight geothermal energy resources located on public lands, particularly working in conjunction with the Bureau of Land Management (BLM) and U.S. Forest Service (USFS).

The budget request includes proposed decreases of (1) -\$500,000 from the Earthquakes Hazards Program (EHP) to eliminate unrequested congressional funding for a one time purchase of seismological equipment at the Arkansas Seismological Observatory; (2) -\$500,000 from the CMGP to eliminate unrequested congressional funding for the State-led California State Waters sea-floor mapping program in cooperation with other Federal agencies; and (3) -\$650,000 from the Minerals Resources Program (MRP) to eliminate unrequested congressional funding for a mineral resource assessment of Federal lands in Nye County, Nevada.

The Geology Discipline provides Earth science information needs for a wide variety of partners and customers, including Federal, State, and local agencies, non-government organizations, industry, and academia. This information is used by the USGS and its partners, cooperators, and customers in evaluating resource potential, defining and mitigating risks associated with

Geologic Hazards, Resources, and Processes

natural hazards, and characterizing the potential impact of natural geologic processes on human activity, health, the economy, and the environment.

The mission of the Geology Discipline contributes to the achievement of providing for responsible resource protection and use and serving communities by providing information to improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment; to improve the understanding of energy and mineral resources to promote responsible use and sustain the Nation's dynamic economy, and to improve understanding, prediction, warning and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property. All Geology programs have a 5-Year Plan that supports the USGS Science Strategy and are reviewed every 5 years.

Since 1996, the Geology Discipline has been a leader in conducting a discipline-wide competitive project proposal process using a prototype of the BASIS+ system now in use across the bureau. Geology issues an annual call for project proposals called the Geology Annual Science Plan, which contains scientific and funding guidance for all projects. The plan uses the Geology Science Strategy and Program 5-Year Plans for its organizing framework. Scientists are required to submit annual project work plans into the BASIS+ system for program review. The system is used to examine strengths and weaknesses in staff, scientific methodology, progress on goals, budgetary structure, use of funds and capital investments, and formulate final funding allocations. Reviews are conducted by scientific peers and include external scientific or stakeholder review.

Other Program Reviews

The American Association for the Advancement of Science (AAAS) report, "*Review and Guidance to the United States Geological Survey -- National Cooperative Geologic Mapping Program*" (2006), recommended that the USGS "set standards for data collection, preservation, and exchange." We have incorporated this recommendation into our program and are working on several standards, including the release in January 2009 of the Federal Geographic Data Committee (FGDC) approved Map Symbol Standard that contains a detailed set of technical instructions and guidance on how this complex standard should be implemented. The standard has since been adopted by Environmental Systems Research Institute (ESRI), an industry leader in geographic information system technology.

The EHP is reviewed annually by the Scientific Earthquake Studies Advisory Committee, which was established by Congress in the 2000 reauthorization of the four-agency National Earthquake Hazards Reduction Program (NEHRP) to provide oversight and guidance to USGS earthquake activities. In response to committee recommendations, the USGS has invested more heavily in the Advanced National Seismic System (ANSS), nurtured and expanded multi-hazards demonstration projects in southern California and the Pacific Northwest, and developed a plan for the future USGS role in geodetic research and monitoring of earthquakes.

In the review of the Volcano Hazards Program (VHP) conducted by the AAAS in 2007, the panel strongly endorsed the National Volcano Early Warning System (NVEWS) effort, and proposed that the VHP work more closely with State and local partners in developing risk-focused products that deal with future eruption scenarios. The NVEWS plan is being used as the blueprint for modernizing the volcano monitoring system as part of the American Recovery and Reinvestment Act. In 2008, the USGS significantly strengthened existing partnerships with

universities and state agencies and added a new partnership with universities at the Hawaiian Volcano Observatory.

Using guidance developed by the National Academy Committee on Critical Minerals published in 2008, the MRP has identified 16 mineral commodities as the focus of research preparing for the next National Mineral Resource Assessment.

Workforce Planning

The Geology Discipline implemented a workforce planning strategy in 2005 aligned with the USGS science goals and tied to Government Performance and Results Act (GPRA) goals. The plan identifies areas in which the USGS needs to build internal capacity, contract with the private sector, and partner with other organizations; forecast future critical skill needs and identify mechanisms for recruiting, developing, and retaining a diverse workforce with those critical skills; align individual employee performance and rewards with organizational performance; and make effective use of technology. The Regions are leading an effort during 2009 to update the workforce strategy. The Geology Discipline is working with regional line management, to support its efforts to continue to rebalance and renew the skill mix to gain functional and position flexibilities.

Subactivity Overview

The Geologic Hazards, Resources, and Processes Activity is comprised of three subactivities:

Geologic Hazard Assessments programs operate monitoring networks, provide hazard warnings, assessments, and evaluation of impacts, and work with emergency managers and decisionmakers to develop response strategies and mitigate damage and loss. Programs include EHP, VHP, Landslide Hazards Program (LHP), Global Seismographic Network (GSN), and Geomagnetism.

EHP decreases in 2010 include -\$500,000 for a one time purchase of seismological equipment at the Arkansas Seismological Observatory. Details for this program changes are included in the individual program sections which follow this activity summary.

Geologic Landscape and Coastal Assessments programs focus on understanding geologic processes at or near the Earth's surface. Knowledge and models derived from these studies enable more effective, adaptive, and efficient resource and environmental management decisions. Programs include CMGP and National Cooperative Geologic Mapping Program (NCGMP).

The 2010 budget includes increases within the CMGP of \$375,000 for geologic characterization to provide the information framework for offshore wind-energy development and \$1.0 million to analyze and synthesize data collected during two previous seafloor mapping cruises in the Arctic and to work with the Department of State led Interagency Task Force on the Extended Continental Shelf (ECS) and a decrease of \$500,000 to eliminate unrequested congressional funding for the State-led California State Waters sea-floor mapping program in cooperation with other federal agencies. Details for these program changes are included in the individual program sections that follow this activity summary.

Geologic Resource Assessments programs assess the availability and quality of the Nation's mineral and energy resources, including the economic and environmental effects of resource

Geologic Hazards, Resources, and Processes

extraction and use. Programs include the MRP and the ERP. The MRP is the Federal provider of scientific information for objective resource assessments and research results on mineral potential, production, consumption, and environmental effects, and also provides comprehensive baseline data in the fields of geochemistry, geophysics, and mineral deposits. The 2010 budget includes increases of \$100,000 for the MRP for support of the biofuels portion of the New Energy Frontier initiative and an increase of \$1.0 million to the Energy Resources Program to work will highlight geothermal energy resources located on public lands, working in conjunction with BLM and USDA-FS. Decreases include \$650,000 from the MRP to eliminate a mineral resource assessment of Federal lands in Nye County, Nevada. Details for these program changes are included in the individual program sections that follow this activity summary.

Performance Improvement

In the area of Geologic Hazards, the USGS coordinates with other federal agencies to avoid the duplication of efforts. The USGS works with Federal partners to ensure complementary roles and responsibilities in the delivery of geologic hazard information including information for flash floods and debris flows in Southern California in areas burned by wildfires. In particular, the USGS assists the Federal Emergency Management Agency (FEMA) to develop tools which include USGS geologic hazard information to help improve FEMA loss estimation capabilities. Also, the USGS works with Federal, State, and local partners to improve hazard assessment and response for multiple hazards, including volcano and tsunami hazards. The USGS will continue to invest in technologies that help to integrate these efforts.

Completed program assessments indicate that the USGS needs to have information delivery meet user needs and that the program should improve performance measures to meet long-term goals. In response to the assessments, the USGS works with external partners to align program performance with measures and goals in the Energy Resources 5-year plan, including those related to geothermal and hydrates. In addition, the Energy Resources website continues to monitor data delivery from the redesigned website and will implement new functionalities to help users to find energy related data and information more easily.

The USGS continues to improve accessibility and application of mineral resources information. The evaluation of the utilization of electronic forms for collection of mineral production and consumption data have been used to develop strategies for improving user familiarity and increasing utilization rates for the collection of mineral data. In an effort to support long term land use in Alaska and policy concerning critical materials, stakeholder meetings were to identify priority frontier lands in Alaska and to seek advice on highest priority critical minerals. The findings of these meetings were synthesized to develop research strategies for providing essential data and information in these geographical areas. In addition, the USGS will conduct a soil geochemical survey in an effort to support long-term land use and economic policy decisions.

The USGS continues to increase the availability and consistency of geologic maps through development of data collection and management standards and training and information exchange tools. The USGS has implemented the findings from an American Association for the Advancement of Science (AAAS) review by identifying, advertising, and filling high-priority positions nationwide to replace expertise depleted by retirements and buyouts. In an effort to increase the integration of geologic mapping efforts with State geological surveys, a revised State Geologic Survey Mapping Component (STATEMAP) Request For Proposal (RFP) has been released which will improve alignment between State and USGS geologic mapping

projects in support of Federal initiatives. The USGS will also continue to explore future technologies that will help promote the creation and adoption of content standards for geologic maps.

The USGS is increasing the coordination of coastal mapping activities across the Federal, State, and local governments. As a result, the USGS engaged regional management in development of project plans/objectives for several priority coastal activities that support the Ocean Research Priorities Plan (ORPP). In addition, the USGS & NOAA have developed shared objectives addressing the ORPP related to coastal inundation in the northern Gulf of Mexico and beach closings in the Great Lakes. The USGS, NOAA (National Oceanic and Atmospheric Administration), & Department of State have also developed an interagency strategic plan for Extended Continental Shelf Mapping. A NOAA/USGS effort will map the Arctic in cooperation with the Canadians.

In an effort to develop performance measures for enhancements in the provision of coastal and ocean mapping information across Federal and non-federal agencies, Federal agencies developed a draft strategic plan. The plan will deliver data, program plans, and derived products through Geospatial One-Stop (GOS) resulting in thousands of newly available records. The USGS will use objectives and performance measures for ORPP to determine effectiveness of the USGS coastal ecosystem studies with regional alliances. Also, the USGS will work with other Federal agencies in the study design, review, and implementation of interagency objectives and performance measures for ORPP priority studies. This will help to make enhancements in delivery and availability of coastal and ocean mapping information from Federal agencies and their partners.

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Activity: Geologic Hazards, Resources and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Earthquake Hazards

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Earthquake Hazards (\$000)	53,653	55,760	+761	-500	56,021	+261
<i>Total FTE</i>	<i>237</i>	<i>234</i>	<i>0</i>	<i>0</i>	<i>234</i>	<i>0</i>

Summary of 2010 Program Changes for Earthquake Hazards Program

Request Component	(\$000)	FTE
• Arkansas Seismological Observatory	-500	0
TOTAL Program Changes	-500	0

Justification of 2010 Program Changes

The 2010 budget request for the Earthquake Hazards Program is \$56,021,000 and 234 FTE, a net program change of -\$500,000 and 0 FTE from the 2009 Enacted level.

Arkansas Seismological Observatory (-\$500,000 / 0 FTE)

The reduction eliminates unrequested congressional funding that does not address the highest priority science needs. This will keep the core program intact while allowing the USGS to make the best use of available resources. These funds are being used to for a one time purchase of seismological equipment at the Arkansas Seismological Observatory. This activity will be discontinued in 2010.

Program Overview

The EHP provides the scientific information and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes and earthquake-induced tsunamis, landslides and liquefaction. Products of this program include timely notifications of earthquake locations, size, and potential impacts; regional and national assessments of earthquake hazards; and public outreach to communicate advances in understanding earthquakes, their effects, and the degree to which they can be predicted.

"Here in Southern California, we rely on real-time USGS earthquake data for emergency response, loss estimation, and aftershock probabilities."

Ellis Stanley
 Manager, City of Los Angeles
 Emergency Preparedness
 Department
 November 2008.

Geologic Hazard Assessments

Of all natural hazards facing the United States, earthquakes have the greatest potential for inflicting catastrophic casualties, damage, economic loss, and disruption. Damaging earthquakes are infrequent, but their consequences can be immense. According to recent studies, a major earthquake in an urbanized region of the United States could cause several thousand deaths and a quarter trillion dollars in losses, impacting the national economy. Although the risk from earthquakes is high in California, many other parts of the country are also at risk, including the Mississippi River valley, Pacific Northwest, Intermountain West, Alaska, Hawaii, and parts of the eastern seaboard. Over 75 million people, including 46 million outside California, live in metropolitan areas with significant earthquake risk.

As required under the Disaster Relief Act of 1974 (P.L. 92–288), the USGS has the delegated Federal responsibility for monitoring and notification of seismic activity in the United States. The USGS is the only U.S. agency that routinely and continuously reports on current domestic and worldwide earthquake activity. Through the ANSS, the USGS and its State and university partners provide seismic monitoring coverage for the Nation. The EHP is the applied earth science component of the four-agency NEHRP, most recently re-authorized by the Earthquake Hazards Reduction Authorization Act of 2004 (P.L. 108–360). Through NEHRP, the USGS partners with lead agency National Institute of Standards and Technology (NIST), the FEMA, and the National Science Foundation (NSF).

Partnerships are crucial to the program's success. Approximately 25 percent of the total EHP budget is directed toward research grants and cooperative agreements with universities, State agencies, and private technical firms to support research and monitoring activities. This external funding is highly leveraged by funds from other Federal agencies, States, and the private sector.

Overall direction for the EHP is established by a 5-Year Plan that results from internal and external inputs. These inputs include the USGS and Interior strategic plans, results of periodic reviews by the congressionally established external Scientific Earthquake Studies Advisory Committee, workshops with stakeholders on specific topics, and the advice of senior scientists both within and outside the USGS. The program is a critical component of the national hazards, risk and resilience assessment activity called for in the new USGS Science Strategy document, *Facing Tomorrow's Challenges*. The program's activities are identified in the National Science and Technology Council's planning documents, including the Subcommittee on Disaster Reduction's (SDR) *Grand Challenges for Disaster Reduction* (2005), an earthquake-specific implementation plan (2008), and the joint SDR/U.S. Group on Earth Observations document, *Improved Observations for Disaster Reduction: Near-Term Opportunity Plan* (2006). The specific activities being taken by the EHP undergo both management and scientific review of project concepts and of final project proposals when submitted for initial funding using a program council responsive to regional and topical needs. Additionally, periodic reviews are conducted on progress of multiyear projects and peer review of reported project results when completed.

2009 Enacted and 2010 Program Performance

The EHP includes the following three program components: Assessment and Characterization of Earthquake Hazards, Monitoring and Reporting Earthquake Activity and Crustal Deformation, and Conducting Research into Earthquake Causes and Effects. The program's strategic plan also identifies a fourth component—earthquake safety policy—that features activities embedded in each of the other program components and reflects the overall NEHRP mission to translate

improvements in understanding into loss-reduction results. At the 2010 funding level, program accomplishments will include the following:

Assessment and Characterization of Earthquake Hazards

(Estimates for 2008, \$21.5 million; 2009, \$22.8 million; 2010, \$23.1 million)

The USGS contributes to earthquake hazard mitigation strategies by (1) developing seismic hazard maps that describe the likelihood of and potential effects of earthquakes throughout the Nation, especially in high-risk urban areas, and (2) making this knowledge available to others so that it can be used to reduce the impact of potentially damaging earthquakes. Federal, State, and local government agencies, architects and engineers, insurance companies and other private businesses, land-use planners, emergency response officials, and the general public rely on the USGS for earthquake hazard information to refine building codes, develop land-use strategies, safeguard lifelines and critical facilities, develop emergency response plans, and take other precautionary actions to reduce losses from future earthquakes.

The USGS national seismic hazard maps are used to develop new, unified model building codes for the United States. These digital maps integrate a wide range of geological and geophysical information to provide estimates of the maximum severity of ground shaking that a given location is expected to experience during the next 50, 100, and 250 years. Periodic review and updating of the seismic hazard maps to incorporate new information are among the highest priorities for the EHP. The USGS works closely with earthquake researchers, engineers, and State and local government representatives across the Nation to ensure that the maps represent the most current and accurate information available.

The scale of the national seismic hazard maps precludes taking into account local variations in the size and duration of seismic shaking caused by small-scale geologic structures and soil conditions. For high-to-moderate risk urban areas, the USGS is generating more detailed products that make it possible for local officials to make informed zoning and building code decisions. Modeling of ground motion is provided for engineering applications. In conjunction with release of these targeted products, the USGS conducts workshops to assure the proper transfer of knowledge and to help design effective mitigation strategies.

Example projects in assessment and characterization include:

National Seismic Hazard Maps — In 2008, the USGS released the next-generation national seismic hazard maps following an extensive review process. The maps will be considered for the 2009 version of the NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures. The new maps replace those from 2002, and will be considered for inclusion in the 2012 version of the International Building Code. These maps were developed using the best available science based on internal USGS studies as well as information available from government agencies, academic institutions, and industry. During 2008, the USGS also produced a set of engineering design maps that are derived from the new hazard maps for use in construction engineering standards for existing buildings developed by the American Society of Civil Engineers, and ultimately the International Building Code. In 2009, the USGS is producing a variety of other products derived from the seismic hazard maps, for use by engineers, city planners and other end-users. These include uniform hazard spectra for a broad range of structures, maps that portray the degree of certainty and resolution of seismic hazard estimates nationwide, and information on the earthquakes most likely to cause strong shaking at a given site of interest. In 2010, the USGS scientists will undertake targeted

Geologic Hazard Assessments

research directed toward improvements in the next generation of national seismic hazard maps.

Hazard Maps for Urban Areas — During 2009, the USGS is focusing on efforts on collaborative urban seismic hazard mapping projects in the high-risk St. Louis urban area and the Tri-State (Evansville) area of Indiana, Kentucky, and Illinois. In both these efforts, the USGS serves primarily as a coordinator, with most of the technical work being done by local partners. Partners in the St. Louis project include the University of Missouri at Rolla, Missouri Department of Natural Resources, and the Missouri State Geological Survey. Those for the Tri-State (Evansville) project include the State geological surveys of Indiana, Kentucky, and Illinois, the Southwest Indiana Disaster Resistant Community Corporation, Association of Central United States Earthquake Consortium (CUSEC), State Geological Surveys, and Purdue University.

Monitoring and Reporting Earthquake Activity and Crustal Deformation

(Estimates for 2008, \$21.5 million; 2009, \$22.3 million; 2010, \$22.1 million)

The ANSS effort is focused on expanding and improving the performance and integration of national, regional, and urban seismic monitoring networks in the United States. The system consists of a national ANSS Backbone network, the National Earthquake Information Center (NEIC), 15 partner-operated regional networks in areas of moderate-to-high seismic activity, and the National Strong Motion Project for monitoring structures.

The NEIC provides information on potentially damaging earthquakes to the National Command Center; the White House; the Departments of Defense, Homeland Security (including FEMA), Transportation, Energy, and the Interior; State offices for disaster services; numerous public and private infrastructure management centers (e.g., railroads and pipelines); the news media, and the public. Rapid earthquake notifications are delivered by e-mail and text message to over 100,000 users, and a suite of earthquake information products such as ShakeMap, Did You Feel It maps, and technical data are available on the program's Web site, which receives more than two million hits every day. The USGS also provides near-real-time data to the National Oceanic and Atmospheric Administration (NOAA) tsunami warning centers, supporting tsunami monitoring in the Pacific Rim and disaster alerting in Alaska, Hawaii, Washington, California, and U.S. territories in the western Pacific.

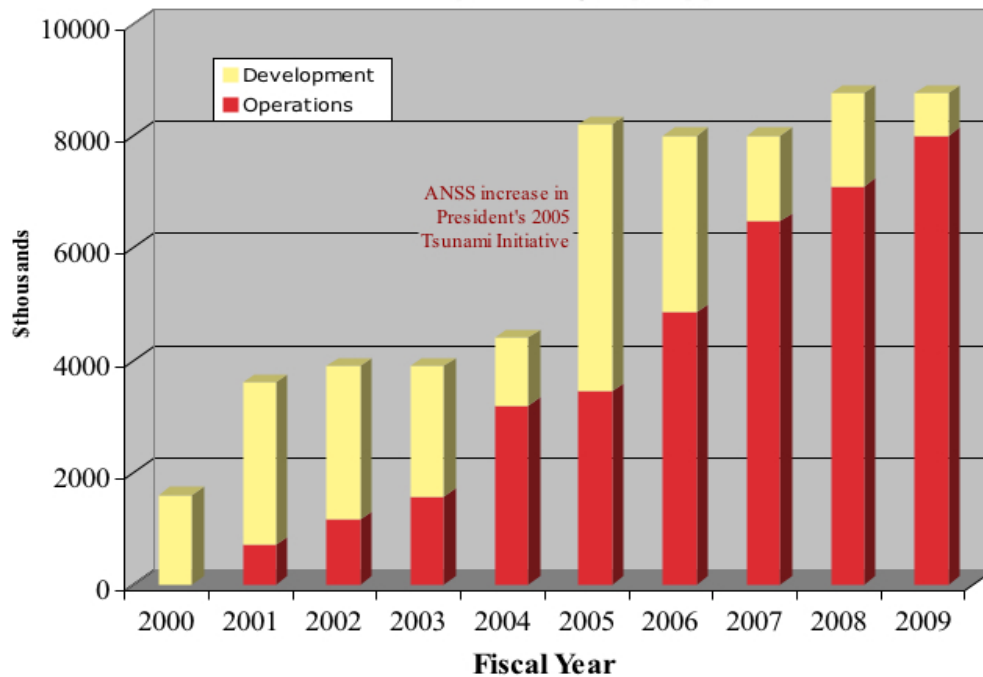
Begun in 2000, ANSS implementation efforts have focused primarily on the installation of new urban recording stations in five high-risk metropolitan areas: Los Angeles, CA; Salt Lake City, UT; San Francisco, CA; Seattle, WA; and Anchorage, AK. Increased seismic monitoring capability in urban regions has two major benefits: (1) it provides rapid assessments of the distribution and severity of strong ground shaking just after an earthquake—information conveyed graphically via ShakeMap, which provides situational awareness for emergency response officials to help determine the scope and scale of the crisis they face, and (2) it provides detailed and accurate data on the shaking of the ground and structures during a damaging earthquake. These data can be used by the structural engineering community in the recovery and rebuilding phase for more earthquake-resistant design and construction in the future.

ANSS-Directed Funding within EHP

FY	Amount (\$M)
2000	\$1.6
2001	\$3.6
2002	\$3.9
2003	\$3.9
2004	\$4.4
2005	\$8.9
2006	\$8.0
2007	\$8.0
2008	\$8.8
2009	\$8.8
2010	\$8.8

By the end of 2009, the USGS and partners expect to have installed a cumulative total of 822 ANSS earthquake monitoring stations. This includes the completion of the national ANSS Backbone seismic network in the contiguous U.S. thanks to a partner contribution by NSF in 2004–2006. The ANSS network is now capable of detecting almost all felt earthquakes in the United States except remote areas of Alaska. In 2010, ANSS-directed resources will be devoted to operating and maintaining the installed system. New sensor installations are planned through the Multi-Hazards Demonstration Project. Efforts will be directed at maintaining a high level of performance of the installed system, and meeting commitments to partners for data availability, management and quality.

ANSS Spending by Type



The chart above shows total annual ANSS-directed funding (in thousands) broken down by type (the first year of ANSS funding was in 2000; the large increase in 2005 reflects supplemental funding received as part of the tsunami initiative, most of which was added to the base in 2006). As the system has expanded through development funding, operational costs have increased.

Example projects in monitoring and reporting earthquake activity and crustal deformation include:

Regional Earthquake Monitoring — As part of the ANSS, the USGS and cooperating universities operate regional seismic networks in areas of high seismicity. Data from all U.S. seismic networks are used to monitor active faults and ground shaking, in much greater detail and accuracy than is possible with the national-scale network. Each region has appropriate local data processing capabilities; regional data are contributed to a national ANSS catalog of earthquakes. ANSS regional networks serve as State or local distribution points for

Future costs reduced through innovation: USGS has developed a high-performance, low cost earthquake sensor that takes advantage of wireless technologies and internet collectivity. The new “NetQuakes” sensors, which will be deployed in 2009, are expected to cut development costs by a factor of two, and operating costs by a factor of four, for this class of ground motion recorders.

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information about earthquakes to the public, local and State agencies, and other regional interests. The regional data centers also relay earthquake data in real time to the USGS NEIC, as well as to other regional networks. They also provide information about regional earthquake hazards, risks, and accepted mitigation practices, and those centers located at universities provide training and research facilities for students. To support partner activities in regional earthquake monitoring, approximately \$6.75 million will be provided in 2009 through cooperative agreements, \$3.9 million of which comes from base program funds of which \$2.8 million comes from funds targeted for development and maintenance of the ANSS. In 2008, the USGS supported 16 regional seismic networks, structural arrays and geotechnical arrays, operated by the following colleges and universities:

Seismic Monitoring Networks Supported by the USGS	
Boston College, Weston Geophysical Observatory	University of California at San Diego
California Institute of Technology	University of Kentucky
Columbia University, Lamont-Doherty Earth Observatory	University of Memphis
Montana Tech of the University of Montana	University of Oregon
Saint Louis University	University of South Carolina
University Nevada at Reno	University of Utah
University of Alaska Fairbanks and Anchorage	University of Washington
University of California at Berkeley	

In 2010, funding for regional network operations will remain a high priority, and will be directed toward ensuring robust regional network operations and maintenance, both by implementing standardized earthquake processing software in the regional networks and by targeting a larger proportion of the funding for network staffing.

Prompt Assessment of Global Earthquakes for Response (PAGER) — In October 2007, the USGS released the PAGER system, which uses advanced seismological methods to estimate the impact of significant earthquakes around the globe. PAGER assesses the potential societal impact for each earthquake by estimating the population exposed to potentially damaging levels of ground motion. Notifications automatically go online and are sent directly to critical users, including the U.S. Agency for International Development, the State Department, the Department of Defense's U.S. Northern Command, and many other agencies and aid providers. PAGER maps and exposure estimates were used by many in response to the May 2008 Sichuan, China earthquake (magnitude 7.9) that killed 89,000 people. In 2009, new modules are being developed to estimate casualties and building damage.

Earthquake Early Warning — Since 2006, the USGS has funded external research to investigate the feasibility of earthquake early warning. This research tests early-warning methods using actual data streams from ANSS sensors in California urban areas. Early warning systems have been deployed in Japan, Taiwan, Mexico, and Turkey to provide up to tens of seconds warning before strong shaking begins. Such systems can be used by utilities to rebalance electricity distribution and shut off gas lines; hospitals to initiate auxiliary power systems; and for other targeted uses. An evaluation of this research will take place in 2009, to determine whether the initial results warrant the substantial network upgrades that would be required for an operational system. Based on a successful evaluation, the USGS would seek State and private partnerships in California for the development of a prototype system.

Monitoring Deformation of the Earth's Surface — Geodetic networks provide essential information about the massive, slow deformation (strain) of the land surface near faults and the forces that cause earthquakes. Geodetic monitoring stations use precise Global Positioning System (GPS) techniques to measure changes in the shape of the Earth's surface that help

reveal the way stress accumulates on earthquake faults in the region, and how those faults are moving at depth. Precise geodetic data provides new constraints on the likely rate of large earthquakes in a region and are being used to improve hazard estimates in the National Seismic Hazard Maps. The USGS is working with universities, local agencies, and the Plate Boundary Observatory component of the NSF's EarthScope program to conduct geodetic investigations using GPS, laser-ranging surveys and sensitive borehole instruments. To address the problem of hazards in the urban Los Angeles region, the USGS operates and distributes data from state-of-the-art, continuously operating GPS stations installed in cooperation with the National Aeronautical and Space Administration (NASA) Jet Propulsion Laboratory, the Scripps Institution of Oceanography, and the Southern California Earthquake Center (SCEC). In addition, the USGS is employing a new satellite technology, Interferometric Synthetic Aperture Radar (InSAR), to quickly and accurately produce large aerial maps of pre- and post-earthquake land deformation. The USGS continues to develop computational tools necessary to efficiently analyze, interpret, and model InSAR data.

Geodetic Monitoring Networks Supported by the USGS	
Central Washington University	University of Colorado
San Francisco State University	University of Memphis
University of California at Berkeley	University of Utah
University of California at San Diego	

Conducting Research into Earthquake Causes and Effects

(Estimates for 2008, \$10.7 million; 2009, \$10.8 million; 2010, \$11.0 million)

The USGS conducts research on the causes, characteristics, and effects of earthquakes. This research has direct application in increasing the accuracy and precision of the agency's earthquake hazards assessments, earthquake forecasts, and earthquake mitigation practices.

A major focus of the USGS earthquake research is to understand earthquake occurrence in space and time. Ongoing USGS investigations reveal the physical conditions under which earthquakes initiate and grow; the processes of earthquake triggering; how individual faults in the same region interact; why some faults slip slowly without generating earthquakes while others generate earthquakes; and the factors that control variations in recurrence intervals of earthquakes along the same fault. The USGS research efforts are also directed at improving the understanding of earthquake-induced strong ground shaking and its effects. Specifically, USGS researchers are investigating how complexities in the earthquake source, Earth's crust, and near-surface soils and deposits influence seismic wave propagation and strong ground motion. Improving current techniques for forecasting the effects of strong ground motion will greatly improve seismic hazard maps for urban regions. These efforts are thus critical for cost-effective earthquake hazard mitigation. Another research priority is the identification and understanding of behavior of weak soils that liquefy and fail when subjected to earthquake shaking. Research on ground failure, carried out in collaboration with structural and geotechnical engineers, will lead to improved design of earthquake-resistant infrastructure and lifelines, such as bridges and airports, commonly built on fill or weak soil. These research activities are the principal

"I just want to thank USGS for everything they've done for us, everything that they provided to our local governments, our operational areas, to our federal partners and our state partners. One of the things that we really appreciate from USGS is the fact that they are giving us tools to actually look at what could happen during [a catastrophic earthquake]."

Mark Bassett
Deputy
Regional Administrator,
Governor's Office of Emergency
Services, State of California.
November 2008

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contributor to the program's output measure for number of systematic analyses and investigations delivered to customers.

Examples of projects researching earthquake causes and effects include:

Scenarios for Public Preparedness — As part of the MHDP in Southern California, the USGS is undertaking a systematic investigation of the earthquake history of the southern San Andreas Fault in partnership with the SCEC. This improved understanding of the recurrence history of large earthquakes in the region and the extent of strong shaking was incorporated into a multi-hazard scenario delivered for use in a major public preparedness exercise in 2009. It also will contribute to an urban hazard assessment for the Los Angeles region to be completed in future years. The goal of the broader MHDP is to link research results and data with information dissemination to provide an integrated approach to hazards research, warning, and mitigation. This multi-year effort focuses on the eight counties of Southern California, where catastrophic losses from natural hazards such as earthquakes, tsunamis, fires, landslides, and floods exceed \$3 billion per year. Partners include State, county, city, and public lands government agencies, public and private utilities, industry, academic researchers, FEMA, NOAA, USFS, BLM, and local emergency response agencies. The USGS and its NEHRP partner, NIST, supported a workshop on scenario development in order to identify best practices and develop common approaches to facilitate the use of these tools by emergency managers and other public officials to better understand and convey the risks faced by at-risk communities.

Supporting External Research Partnerships — External collaboration advances targeted research and addresses specific needs of the USGS using the experience and knowledge of world experts. The EHP provides competitive, peer-reviewed, external research support through cooperative agreements and grants that enlist the talents and expertise of the academic community, State government, and the private sector. By involving the external community, the USGS program increases its geographical and institutional impact, promotes earthquake awareness across the Nation, encourages the application of new hazards assessment techniques by State and local governments and the private sector, and increases the level of technical knowledge within State and local government agencies. Investigations and activities supported through the external awards are closely coordinated with and complement the internal USGS program goals. Many of the external projects are co-funded with other agencies and sources, leveraging the effect of USGS support. Example external program activities include (1) mapping seismic hazards in urban areas, (2) developing credible earthquake planning scenarios including loss estimates, (3) defining the prehistoric record of large earthquakes, (4) investigating the origins of earthquakes, (5) improving methods for predicting earthquake effects, and (6) testing the feasibility and seismic network requirements for an earthquake early warning system. The USGS also has a cooperative agreement with SCEC, a 40-institution research consortium that the USGS funds in partnership with the NSF. To support external work in 2009, the EHP is providing competitively awarded earthquake research grants and cooperative agreements with university, State and local partners.

The following tables list the institutions and agencies receiving grants and cooperative agreements in 2009.

USGS 2009 Grants for Earthquake Research and Hazards Assessments	
AIR Worldwide Corp.	University of Durham
Boise State University	University of Massachusetts, Amherst
Brown University	University of Illinois
California Institute of Technology	University of Kentucky
California State University	University of Memphis
Clemson University	University of Minnesota Duluth
Colorado State University	University of Nevada at Reno
Columbia University Lamont-Doherty Earth Observatory	University of New Hampshire
Earthquake Engineering Research Institute	University of Oregon
Georgia Institute of Technology	University of Southern California
Humboldt State University	University of Texas Austin
Indiana University	University of Texas El Paso
Missouri Division of Geology and Land Survey	University of Utah
Oregon State University	University of Washington
Purdue University	URS Group, Inc.
San Diego State University	Utah State University
Tufts University	Virginia Polytechnic and State University
University of California at Berkeley	Washington Department of Natural Resources
University of California Davis	Western States Seismic Policy Council
University of California at Los Angeles	Weston Geophysical Corporation
University of California at Riverside	William Lettis and Associates
University of California San Diego	William McCann
University of California at Santa Barbara	

USGS 2009 Cooperative Agreements for Earthquake Hazards Assessments	
Southern California Earthquake Center (SCEC)	Oregon Dept. of Geology and Mineral Industries
Utah Geological Survey	

Geologic Hazard Assessments

Program Performance Overview

The table below summarizes the performance measures that either relate exclusively to the EHP or are shared among the USGS programs in Volcano Hazards, Landslide Hazards, Global Seismographic Network, and Geomagnetism.

End Outcome Goal 4.2: Improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Provide information to assist communities in managing risks from natural hazards										
# of areas for which detailed hazard assessments are completed (SP) (EHP)	C	UNK	3	4	4	4	4	5	+1	6
Comment	At the omnibus funding level, the USGS will complete and release a detailed urban seismic hazard map for Evansville IN in 2009.									
# of urban areas for which detailed earthquake hazard maps are completed (EHP)	A	3	3	3	4	4	4	5	+1	6
Comment	The costs per hazard assessment can vary greatly (between \$100K and \$1.0M). Cost is strongly depended on complexity of the volcano and access, whether by truck, helicopter, or ship plus helicopter.									
# of metropolitan regions where Shakemap is incorporated into emergency procedures (SP) (EHP)	A	5	5	5	5	5	5	5	0	5
<i>Use Rate:</i> <i>Earthquakes:</i> X% of communities/tribes using DOI science on hazard mitigation, preparedness and avoidance for each hazard management activity (07 Plan baseline is 885 at risk counties) (EHP)	C	63.4% (565/891)	63.9% (569/891)	67% (593/885)	67% (593/885)	67% (593/885)	67% (593/885)	67% (593/885)	0	67% (593/885)

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (4/4)	100% (2/2)	100% (152/152)	100% (155/155)	100% (132/132)	100% (140/140)	100% (155/155)	0	100% (155/155)
Efficiency and Other Output Measures										
# of systematic analyses and investigations completed (EHP)	A	4	2	152	155	132	140	155	+15	155
Actual/Projected cost per systematic analyses (whole dollars)				182,000	182,000	182,000	182,000	182,000		
Cumulative # of ANSS seismic monitoring stations (EHP)	A	40 (cum 563)	27 (cum 723)	63 (cum 786)	19 (cum 803)	2 (cum 805)	17 (cum 822)	12 (cum 834)	12	834
Comment	<p>Average cost per sensor (purchase and install) varies by the type of sensor installed and its performance requirement, from \$5,000 to about \$75,000. For example, the 17 sensors that were purchased in 2008 -for installation in 2009- cost an average of about \$50,000. The President's Tsunami Initiative, which increased funding to the program in 2005, did not include funding for new seismic stations in the U.S. Thus, the number of new stations has decreased every year as development funding dwindles (see figure at end of narrative). An exception occurred when partner contributions from the National Science Foundation in 2004 installed 95 stations well above the target. Note that significant performance improvements were realized in 2005-2006 in the GSN program from Tsunami Initiative funding in that program. In 2009, under a CR at the 2008 enacted level, the program would retain ~\$0.8M of ANSS development funds, which will be used to expand the network. By 2010, under a current services budget, ANSS development funding will end, as operating costs increase for sensors and processing systems that were installed the previous year(s). This results in no new sensors targeted for 2010. An over-target request is being submitted that will allow further expansion of ANSS in BY2010 (+\$3.2 million for +100 new sensors).</p> <p>Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.</p>									
# of formal workshops or training provided to customers (EHP)	A	11	7	9	6	10	7	6	-1	6
Comment	<p>Workshop number and costs vary from year to year depending on program objectives, partner contributions and other factors. For example, in one year, a small number of low-cost workshops may be held to gather stakeholder input or provide regional reviews of a product. In another year, one or two large workshops may be held to highlight a centennial or bring multiple stakeholder groups together. Workshop costs may also span fiscal years because planning may begin 1-2 years in advance.</p>									

Geologic Hazard Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of communities/tribes using DOI science on hazard mitigation, preparedness, and avoidance for Earthquake hazard management activity (07 Baseline is 885 at risk counties)	C	565	569	593	593	593	593	593	0	593

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Volcano Hazards

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Volcano Hazards Program (\$000)	22,190	23,901	+270	0	24,171	+270
<i>Total FTE</i>	<i>139</i>	<i>137</i>	<i>0</i>	<i>0</i>	<i>137</i>	<i>0</i>

Summary of 2010 Program Changes for the Volcano Hazards Program

The 2010 budget request for the Volcano Hazards Program is \$24,171,000 and 137 FTE. There are no program changes requested for the Volcano Hazards Program in 2010.

Program Overview

Under the Stafford Act (P.L. 93–288), the Department of Interior has the responsibility to issue timely warnings of potential geologic disasters to the affected populace and civil authorities. Accordingly, the mission of the VHP is to provide the geoscience data and information, analyses, and research needed to reduce the loss of life, property, and economic and societal impacts of hazards related to volcanoes. The USGS and its academic and state partners accomplish this mission through a system of five observatories that continuously monitor seismic activity, surface deformation, gas emission, and satellite imagery of high-threat volcanoes. Interpretation of this real and near-real time data is based on detailed geologic field investigations and hazard assessments. Eruption warnings and volcano-status notifications are rapidly disseminated to the public and private sectors and impacted communities and businesses through a rigorous system of telephone call-downs and electronic notification. Much of the data are available to the public in near real time on the program websites.

To reduce societal exposure to the threats posed by volcanoes, the VHP conducts a range of on-going activities that may be broadly divided into volcano-hazard-assessment and volcano-monitoring components. Process-oriented research is conducted under both components to improve accuracy of hazard assessments and accuracy of interpretations and forecasts of volcanic activity. Both components provide training and technical assistance to inform decision-makers at Federal, State, and local levels on managing risks from natural hazards.

The long-term goal for the volcano-hazard-assessment component of VHP is to provide hazard assessments for all dangerous volcanoes in the U.S. and its territories and to establish response plans for all communities that they threaten. Each volcano hazard assessment requires a geologic map and involves field work, laboratory analysis, and data analysis by research scientists, typically requiring 3 to 5 years to complete. This goal is tracked by performance measures for (1) number of counties or comparable jurisdictions that have adopted

emergency response plans, (2) percent of completed hazard assessments for 101 targeted volcanoes, (3) number of formal workshops or training provided to customers, and (4) number of systematic analyses and investigations completed. Process-oriented research conducted in support of hazard assessments includes studies on dynamics of explosive eruptions and distribution of eruption products, including ash, lava, and mudflows. Major progress has been made in quantitatively predicting the path of destructive volcanic mudflows.

The volcano-monitoring component of VHP involves (1) collection and scientific interpretation of real-time and near-real-time geophysical data indicative of the state of volcanic systems, (2) integration of data collected by other groups, such as NASA and NOAA satellite imagery, and (3) management and distribution of data to provide hazard awareness, transparency of operations, and credibility of interpretations with the public and to inform decision-makers on managing risk from volcanic hazards, and (4) technical assistance to decision-makers on managing risk from natural hazards. Volcano monitoring is a continuing activity that includes detection of earthquakes and explosions, ground deformation, temperature change, and volcanic gas and ash emissions. Sophisticated instruments are required, including arrays of sensitive seismometers, geodetic instruments and microphones, ground-based and airborne gas and thermal sensors, and satellite-based sensors. Monitoring activities include maintenance of the existing network, expansion of the network to include previously unmonitored volcanoes, improvements in the monitoring of under-monitored volcanoes, and response to volcanic unrest and eruptions.

VHP's volcano monitoring network is maintained and operated through five volcano observatories, Alaska Volcano Observatory (AVO); Cascades Volcano Observatory (CVO), Hawaiian Volcano Observatory (HVO), Long Valley Observatory (LVO), and Yellowstone Volcano Observatory (YVO). These observatories are operated in partnership with the Universities of Alaska, Washington, Utah, and Hawaii, the Alaska Division of Geological and Geophysical Surveys, and Yellowstone National Park. Collaborations with the NOAA, Federal Aviation Administration (FAA), the Air Force Weather Agency (AFWA), and the International Civil Aviation Organization (ICAO) provide early warning and situational awareness of volcanic ash threats to jet aircraft. Through a partnership with U.S. Agency for International Development (USAID), VHP provides emergency response support and training to developing nations faced with volcanic disasters. The VHP also collaborates with the Smithsonian Institution Global Volcanism Program to collect and disseminate information about volcanic activity worldwide and to conduct research about volcanic hazard potential and impacts using the Smithsonian's global volcanism database.

The long-term goal of VHP's monitoring component is tracked by performance measures for (1) percent of 101 moderate to very high threat volcanoes with at least basic real time monitoring; (2) number of volcanoes for which information supports public safety decisions; and (3) number of sites (mobile or fixed) monitored for ground deformation to identify volcanic activity. Process-oriented research conducted in support of monitoring includes studies on the origin of earthquakes and seismic tremor associated with volcanic activity, the contributions of hydrothermal fluid and magma to unrest at Long Valley and Yellowstone calderas, the use of gas emission data to assess magma supply rates, and the characteristics and dynamics of the magmatic plumbing system of volcanoes. VHP is also developing improved volcanic gas monitoring techniques, advancing radar satellite data application to volcano monitoring, and conducting multi-disciplinary experiments to identify and characterize subsurface magma movement.

The VHP has made progress on both monitoring and hazard-assessment efforts and in underlying research. Using funds provided by the FAA during 1996 through 2008, the volcano monitoring network was expanded to include 29 remote volcanoes in Alaska that threaten international air routes. By the end of 2008, 52 volcanoes were monitored in real time with multiple geophysical ground stations by the VHP. One to two hazard assessments have been released to customers each year, and there has been steady progress on development of community response plans in Washington and Oregon. Synthesis of the many data streams gathered from erupting volcanoes together with laboratory and numerical simulations have led to a more realistic understanding of the source magma systems and surface impacts, as documented in 60 - 80 peer-reviewed publications per year. Each eruption and period of unrest provides the basis for improving the monitoring and interpretation of the next event.

A need for improved monitoring of the Nation's volcanoes to strengthen disaster warnings was identified by the Office of Science and Technology Policy in "Grand Challenges for Disaster Reduction (2005)," (<http://www.sdr.gov/>) and by the United States Group on Earth Observations (USGEO) in its Strategic Plan for an integrated Earth Observation System (http://usgeo.gov/docs/EOCStrategic_Plan.pdf). USGEO also states in its near-term opportunities plan (http://usgeo.gov/docs/nto/Disaster_Observations_NTO_2006-0925.pdf) that existing volcano monitoring is lacking or suboptimal for many hazardous volcanoes and that monitoring networks need to be more fully integrated at the national level.

Implementation of NVEWS is now a major goal of the VHP, following a systematic assessment of volcanic threat and monitoring capabilities for all 169 of the Nation's active volcanoes (USGS Open-File Report 2005-1164; <http://pubs.usgs.gov/of/2005/1164/>). The report concludes that many U.S. volcanoes are under-monitored. As part of the NVEWS plan, a comprehensive inventory of current monitoring instrumentation and prescriptions of equipment suites constituting appropriate monitoring levels was published in 2008 (USGS Scientific Investigations Report 2008-5114; <http://pubs.usgs.gov/sir/2008/5114/>). An implementation plan for the NVEWS path forward is being formulated in 2009. NVEWS will move the VHP towards state-of-the-art monitoring of all hazardous volcanoes at levels commensurate with the threats posed. The NVEWS concept is also designed to provide 24 x 7 situational awareness, organized and accessible data for all potentially hazardous U.S. volcanoes, new hazard information products for the most vulnerable communities, businesses, and infrastructure, and new research on volcanic processes, technology development, and hazard evaluation and risk mitigation. At present, the highest priority targets are:

- Volcanoes that are currently erupting (Kilauea in Hawaii, Redoubt in Alaska) or exhibiting precursory unrest (Cleveland and Okmok in Alaska, Mauna Loa in Hawaii, Anatahan in the Northern Mariana Islands),
- 13 very-high-threat volcanoes with inadequate monitoring (9 in the Cascade Range, including Mount Rainier, and 4 in Alaska), and
- 19 volcanoes in Alaska and the Mariana Islands that pose threats to aviation but have no real-time, ground-based monitoring to detect precursory unrest or eruption onset.

Implementation of NVEWS thus far has led to: upgrades of instrumentation at Mount St. Helens, Mount Rainier and Crater Lake; monitoring and hazard assessment in the Northern Mariana Islands which will support the Department of Defense (DoD) planned buildup in Guam; and many changes in volcano hazard messages to better meet the operational needs of partners, customers, and communities at risk.

GPRA/PART performance metrics that will track progress on the development of NVEWS are (1) measures of percentages of volcanoes monitored, (2) sites monitored for ground deformation, (3) number volcanoes for which information supports public safety decisions, and (4) percentage of at least basic real time monitoring achieved.

An external review of the VHP was conducted by the AAAS in 2007, using a panel of six outside experts. The AAAS panel determined that the VHP had successfully executed its previous 5-Year Plan and previous (2000) external review recommendations, and that the current 5-Year Plan was sound. The panel endorsed the NVEWS plan, and proposed that the VHP work more closely with State and local partners in developing risk-focused products that deal with future eruption scenarios and community vulnerability. The VHP is acting on these recommendations. Strengthening of cooperative relationships with academic and state agency partners in the operation of volcano observatories is currently underway.

2009 Enacted and 2010 Program Performance

At the 2010 funding level, VHP accomplishments will include the following:

Response to Eruption and Unrest — VHP will direct resources as necessary towards response to volcanoes that are erupting or exhibiting unrest (earthquakes, deformation, increased heat emission, or gas emissions) that may be precursory to an eruption. Although it is impossible to predict which volcanoes will erupt or show unrest in 2010, the increasingly vigorous eruption of Kilauea volcano in Hawaii and explosive events from numerous possible sources in Alaska and the Mariana Islands will almost certainly require additional close attention.

Early in 2008, changes in the vent system at Kilauea diverted flow of lava away from the sea and towards populated areas south of Hilo. Later, a new vent opened at the summit and by midsummer the toxic gas flux had reached record levels. Lava threats to communities, degradation of air quality throughout the state, crop damage, and the necessity of Hawaiian Volcanoes National Park closures and evacuations have stimulated even closer cooperation and joint planning among HVO, the National Park, the County of Hawaii, and Hawaii State Civil Defense, as well as innovations by HVO in predicting lava flow behavior and monitoring gas emissions. Extra attention and resources may be required at Mauna Loa in Hawaii, which has erupted about every 5 to 25 years in historical times and which has been deforming since 2002 as a result of magma filling a chamber beneath the summit. Lava flows from Mauna Loa could impact densely populated areas and sever critical transportation arteries in a matter of hours from onset of eruption. The VHP supported intensive 24/7 operations to track and manage eruptions at Kilauea in Hawaii, and Okmok and Kasatochi volcanoes in Alaska in 2008, and unrest at Yellowstone in Wyoming and Redoubt in Alaska in early 2009.

The Kilauea eruption involved temporary closures and evacuations, and the two Alaska eruptions caused interruptions to air travel between Alaska and the US mainland. AVO was instrumental in the rescue of Federal workers from Kasatochi just before the island was swept by pyroclastic flows. AVO warned of and tracked eruptions of Redoubt that closed the Anchorage airport with ash falls and inundated the Drift river oil terminal with mudflows. YVO worked closely with Yellowstone National Park Incident Command in response to an intense volcanic earthquake swarm under Yellowstone Lake during late 2008/early 2009. AVO was again on 24/7 duty for weeks during early 2009 due to unrest at Redoubt Volcano characterized by volcanic seismic tremor and large increases in heat and gas emission rates. During eruption of this dangerous volcano in 1989/1990, an airline crash was narrowly averted and an oil

storage terminal was inundated by mudflows. In partnership with USAID, VHP responded to eruptions in Colombia and Chile at the request of the governments of those countries, and assisted Indonesia with building its volcano monitoring infrastructure.

Monitoring and Operations Improvements guided by NVEWS — The VHP will direct resources towards improvement of the monitoring network in the Cascade Range. Plans in 2010 include further monitoring improvements at Mount Hood volcano, which lies only 50 miles east of Portland, Oregon, the largest city in Oregon, further improvements to the telemetry backbone throughout the Cascades that are necessary to bring monitoring signals back to the Observatory, and maintenance of networks already in place. In addition, permitting processes will be continued as a prerequisite to improved monitoring at Glacier Peak volcano in Washington and at Newberry Caldera in Oregon. In Alaska, the VHP will focus efforts on improving the reliability of existing volcano monitoring networks and systems for data acquisition and analysis and learning lessons from the major eruptions of Kasatochi and Okmok Volcano in 2008 and unrest at Redoubt in 2009. Progress will be made towards improving the monitoring systems on Cook Inlet volcanoes to NVEWS-recommended levels. In addition, the VHP will continue collaboration with Washington State University on a research and development effort to develop smart networks to improve deployment speed, resilience, and data capturing capacity of future volcano monitoring networks, as well as strengthen ties with the University of Washington, which shares responsibility for the seismic monitoring of Pacific Northwest volcanoes. Similarly, ties between HVO and the University of Hawaii in monitoring and research will be augmented. Resources will also be devoted to bringing seismic instrumentation on the Island of Hawaii and in Yellowstone National Park up to ANSS standards in cooperation with the EHP. To the extent possible through reimbursable funding, expansion of the monitoring network in the Aleutian Islands in support of aviation safety and in the Commonwealth of Northern Mariana Islands (CNMI) will be conducted in support of aviation safety and the DoD buildup in Guam and CNMI. A Memorandum of Understanding (MOU) between USGS and the CNMI concerning volcano monitoring was completed and signed in 2007, as was an Memorandum of Agreement (MOA) with the Air Force Weather Agency to share global volcanic hazard information. Hydrothermal explosions and toxic gas emissions pose a significant risk to visitors to Yellowstone, and an MOU among the USGS, the University of Utah, and Yellowstone National Park was completed in 2008 to provide the basis for improved hazard mitigation at Yellowstone in 2010.

Volcanic Hazard Assessments and Systematic Analyses — The VHP will continue to make progress on production of volcanic hazard assessments to guide development of community response plans and interpretation of volcanic unrest. A hazard assessment was completed for Gareloi Volcano in Alaska in 2008 and for Lassen Volcanic National Park in 2009; geologic maps for Lassen Volcanic National Park and Medicine Lake Volcano, both in northeastern California, will be completed in 2010, as will a hazard assessment for Veniaminof Volcano on the Alaska Peninsula. Geologic investigations will continue at Cook Inlet volcanoes in Alaska, which can directly impact over half the population of the State, to better understand their eruptive history and the volcanic processes that drive eruptions. An ash hazard assessment for the United States, with special attention to the Pacific Northwest, will continue, in consultation with potentially vulnerable businesses, utilities, and transportation providers. The VHP will also continue to publish the results of research on volcanic processes, aiming at a total of 75 systematic analyses (including reports, maps and hazard assessments) delivered to the public in 2010. These will include peer-reviewed volumes on the 2004-2008 lava dome-building eruption episode of Mount St. Helens and the explosive eruption of Augustine Volcano, Alaska, in 2006. These publications will document lessons learned for application in future volcanic crises.

Eruption Response Plans — An interagency community response plan for the Mount St. Helens – Mount Adams region of Washington State is being completed in 2009. A national volcanic-ash operations plan for aviation involving the FAA, USGS, NOAA, and AFWA was completed in 2007. This plan, which mirrors the operational procedures of the ICAO global ash avoidance program, is in support of the U.S. interagency program to detect, track, and warn about volcanic-ash clouds that affect the safety of flight operations in the National Airspace. The development of a complementary regional ash-aviation plan for the western conterminous United States, which started in 2009, will be completed in 2010.

“USGS has been a vital contributor to aviation safety by informing our operators of potential hazardous eruptions.”

Keith Nagy
Director of Engineering and Air Safety, Air Line Pilots Association.

November 2007

Program Improvements — A major redesign of the VHP website that upgrades the real-time delivery of dynamic hazard information about volcanic activity and improves public access to a wide variety of hazard data and products is being implemented in 2009. To improve the productivity of VHP’s geographically dispersed observatories, program-wide tools and technologies continue to be developed for storing, managing, and interpreting real-time and legacy data. Additional partnerships with neighboring universities and state geological surveys will be developed to extend breadth and depth of expertise and analytical and monitoring capacity. In 2009, VHP is supporting cooperative agreements and arrangements with 10 partners.

USGS 2008 Cooperative Agreements for Volcano Monitoring and Research	
University of Alaska	Alaska Division of Geological and Geophysical Surveys
University of Utah	Yellowstone National Park
University of Oregon	Smithsonian Institution
University of Hawaii	USAID/Office of Disaster Assistance
University of Washington	Air Force Weather Agency

Program Performance Overview

End Outcome Goal 4.2: Improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Provide information to assist communities in managing risks from natural hazards										
# of areas for which detailed hazard assessments are completed (SP) (VHP)	C	UNK	45	46	47	47	48	49	+1	51
Actual/planned cost per hazard assessment (\$000)					200	200	200	200	0	
Comment	The costs per hazard assessment can vary greatly (between \$100K and \$1.0M). Cost is strongly depended on complexity of the volcano and access, whether by truck, helicopter, or ship plus helicopter.									
% of potentially hazardous volcanoes with published hazard assessments (SP) (VHP)	C	62.8% (44/70)	64.3% (45/70)	65.7% (46/70)	67.1% (47/70)	67.1% (47/70)	68.6% (48/70)	Replaced in 2009 by new measure below because redefining the measure baseline (denominator) to align with definition of moderate to very high threat volcanoes in VHP's blueprint for the future, the National Volcano Early Warning System (NVEWS; OFR 2005-1164).		
% of moderate to very high threat volcanoes with published hazard assessments (denominator reset to 101) (SP) (VHP)	C	NA	NA	NA	NA	NA	47.5% (48/101)	48.5% (49/101)	+1.0%	50.5% (51/101)
# of monitoring and telemetry nodes upgraded (e.g., analog to digital conversion, added sensors, improved power systems, upgraded radio transmitters and receivers) (VHP)	A					12	13	12	-1	10
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									

Geologic Hazard Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of very high threat volcanoes with at optimal level monitoring (X number of 18) (VHP)	C					22.2%	22.2%	22.2%	0	22.2%
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
<i>Use Rate: Volcanoes:</i> X% of communities/tribes using DOI science on hazard mitigation, preparedness, and avoidance for each hazard management activity (Baseline is 256 at risk counties) (VHP)	C	66.4% (170/256)	74.2% (190/256)	76.6% (196/256)	85.9% (220/256)	85.9% (220/256)	85.9% (220/256)	91.8% (235/256)	+5.9%	94% (240/256)
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100%	100%	100% (75/75)	100% (67/67)	100% (71/71)	100% (75/75)	100% (75/75)	0	100% (75/75)
Efficiency and Other Output Measures										
# of systematic analyses and investigations completed (VHP)	A	1	1	75	67	71	75	75	0	75
Total Actual/Planned Investigation Cost (\$000)		500	500	300	300	300	300	300	0	
Actual/Projected Costs Investigation Delivered (whole dollars)		500,000	500,000	22,500	20,100	20,400	22,500	22,500	0	
Comment	In the 2007 Plan, a new baseline number was established for the systematic analyses. VHP systematic analyses are scientific publications that are typically produced after 3 to 5 years of data collection and analysis, and the rate of release is highly variable from year to year. The decline in publications in 2008 is due to the increased level of response to eruptions of Mount St. Helens, Augustine, and Kilauea. The estimate for 2009 is based on the average rate of release for years without major eruptions. These are the peer-reviewed products, available to the public, so the whole program can be considered to be the supporting this effort. The cost figure is derived by dividing the total budget by the target number of publications. Note that this does not include volcano status reports and eruption warnings.									
# of formal workshops or training provided to customers (VHP)	A	5	4	4	4	6	4	4	0	4

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Total Actual/Planned Workshop Cost (\$000)		120	120	120	120	120	120	120	0	
Actual/Projected Costs Workshop Delivered (whole dollars)		30,000	30,000	30,000	30,000	30,000	30,000	30,000	0	
# of sites (mobile or fixed) monitored for ground deformation to identify volcanic activity (VHP)	C	88	94	159	170	174	175	185	+10	200
# of volcanoes for which information supports public safety decisions (VHP)	C	51	51	52	52	52	52	Redefined in 2009 to align with definition of basic real time monitoring in VHP's blueprint for the future, the National Volcano Early Warning System (NVEWS; OFR 2005-1164).		
# of volcanoes for which information supports public safety decisions (VHP) (this is the numerator of the basic monitoring measure)							38	38	--	40
Total Actual/Planned # volcanoes (\$000)		2,000	0	1,000	0					
Actual/Projected Costs per new site monitored (whole dollars)		1,000,000	0	1,000,000	800,000	800,000	800,000	800,000	0	
Comment	The cost depends strongly on: (1) location – whether access is by truck, helicopter, or ship + helicopter and (2) complexity of the installation- whether basic, short-period, analog seismic networks or includes digital broadband seismic, GPS, webcams, etc. Permitting on protected federal lands can also be a substantial cost.									
X% of potentially active volcanoes monitored (x number of 70) (VHP)	C	72.9% (51/70)	72.9% (51/70)	74.3% (52/70)	74.3% (52/70)	74.3% (52/70)	74.3% (52/70)	Redefined in 2009 to align the numerator to basic real time monitoring and denominator to moderate to very high threat volcanoes as defined in VHP's blueprint for the future, the National Volcano Early Warning System (NVEWS; OFR 2005-1164).		
% of moderate to very high threat volcanoes with at least basic real time monitoring (x number of 101) (VHP)	C	NA	NA	NA	NA	NA	37.6% (38/101)	37.6% (38/101)	0	39.6% (40/101)

Geologic Hazard Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of communities/tribes using DOI science on hazard mitigation, preparedness, and avoidance for Volcano hazard management activity (Baseline is 256 at risk counties)	C	170	190	196	220	220	220	235	+15	240

Activity: Geologic Hazards, Resources and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Landslide Hazards

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Landslides Hazards Program (\$000)	3,308	3,350	+55	0	3,405	+55
<i>Total FTE</i>	22	21	0	0	21	0

Summary of 2010 Program Changes for Landslides Hazards Program

The 2010 budget request for the Landslides Hazards program is \$3,405,000 and 21 FTE. There are no program changes requested for the Landslides Hazards program in 2010.

Program Overview

The LHP gathers information, conducts research, responds to landslide disasters, and produces scientific reports and other products that can be used by a broadly based user community, including Federal, State, and local governments and the private sector. LHP investigations focus on research to better understand, assess, and monitor the causes and mechanisms of ground failure. Its main goal is to reduce losses from landslides through improved understanding of landslide hazards and application of new strategies for hazard mitigation.

Landslide-hazard assessments provide the scientific basis for land-use, emergency management, and loss reduction measures. For example, studies of landslide susceptibility and hazards are providing much needed information to reduce landslide losses in parts of the country that have significant landslide problems including, but not limited to: California, the Pacific Northwest, and the Blue Ridge of the Eastern United States. The USGS cooperates with local partners in California, Colorado, Oregon, and Washington, as well as Federal agencies such as the NPS and the USFS.

Landslide hazard research concentrates on understanding landslide processes, developing and deploying instruments that monitor threatening landslides, and forecasting the onset of catastrophic movement of future landslides. Research into processes and forecasting methodologies is conducted on the types of landslides that produce losses in the United States such as landslides related to steep slopes, heavy rains, and vegetation loss due to wildfires.

The USGS deploys near-real-time monitoring systems at sites near Yosemite National Park in California and in Portland and near Newport, Oregon. These sites provide continuous rainfall and soil-moisture and pore-pressure data needed to understand the mechanisms of landslide occurrence. Such understanding can form the scientific underpinnings for early warning of conditions that may trigger landslides. A landslide early-warning system based on such information is useful in reducing hazards in landslide-prone areas.

USGS scientists respond to landslide emergencies and disasters nationwide. Federal, State, and local agencies are assisted through landslide site evaluations and recommendations of strategies for reducing ongoing and future damages from landslides. When there is sufficient information or knowledge of a particular area, such as in southern California, LHP provides information on potential hazards. Specifically, if rainfall intensity-duration thresholds for landslide activity have been developed for an area or if landslide-hazard maps have been produced, LHP can issue an advisory. LHP works in conjunction with the National Weather Service (NWS) to issue advisories and press releases regarding the potential for landslide activity in previously burned areas in southern California. For foreign disasters, the USGS works with the AID's Office of Foreign Disaster Assistance (OFDA) in responding to appeals for technical assistance from affected countries.

The USGS provides timely information through the National Landslide Information Center (NLIC). The Center communicates with the public about ongoing emergency responses and provides information to the external user-community through fact sheets, books, reports, and press releases, consistent with the Department's goal to protect lives, resources, and property by providing information to assist communities in managing risks from natural hazards. The NLIC maintains several databases: the Landslide Bibliography (more than 15,000 entries), the International Landslide Experts Roster of about 2,000 entries, and Major Landslide Events of the United States (part of the USGS National Atlas). The NLIC also has real-time measurements from ongoing landslide monitoring projects available for viewing via the Internet. These measurements are used to forecast landslide movement or changes in an individual landslide's behavior.

The USGS conducts monitoring efforts in cooperation with other Federal, State, and local agencies, including NPS; BLM; Federal Highway Administration; NWS in NOAA, California, Washington, Oregon, and Colorado State Departments of Transportation; Colorado Geological Survey; Colorado School of Mines; Oregon Department of Geology and Mineral Industries, and private companies.

2009 Enacted and 2010 Program Performance

The LHP includes the following three program components: Landslide-Hazard Assessment Activities, Landslide Monitoring Activities, and Landslide Information Dissemination Activities. LHP accomplishments will include the following:

Landslide-Hazard Assessment Activities

(Estimates for 2008, \$1.9 million; 2009, \$2.0 million; 2010, \$2.0 million)

Risk/Hazard Assessments Delivered to Customers — In 2009, LHP will deliver emergency assessments of debris-flow hazards in southern California. The assessments are derived from information obtained from basins burned by the fires of 2007 and 2008 in southern California. LHP is providing these products as part of the Multi Hazard Demonstration Project for southern California where it works with other USGS disciplines, other Federal agencies and State and local government agencies. The burned areas in southern California are highly susceptible to landslides during the winter rainy season, and even small amounts of rain can have disastrous consequences. In 2009 and 2010, LHP will be a critical partner in the planning for the "Winter Storm" preparedness exercise planned for all of California south of Napa in the winter of 2011. In 2008, LHP provided landslide hazard assessments for neighborhoods in the Portland, Oregon metropolitan area, which encountered numerous debris flows and landslides. In 2009

and 2010, LHP will continue to work with the Oregon Department of Geology and Mineral Industries to prepare landslide hazard assessments from acquired LiDAR data that can be used by agencies in Oregon for planning and response purposes.

Counties or Comparable Jurisdictions that have Adopted Improved Land-Use Plans, Emergency Response Plans or Other Hazard Mitigations Measures

In 2009 and 2010, LHP will continue to provide information to counties and other jurisdictions in Oregon, California, Colorado, eastern United States, and Department land management bureaus that incorporate this information into emergency response and land-use plans and warning systems. In 2008, LHP provided susceptibility maps, hazard assessments, and emergency warnings to National Forests in northern and southern California, to several National Parks in California, to the California Department of Transportation and the California Coastal Commission, and to communities in Oregon, Colorado and California. All of these jurisdictions used the USGS products to mitigate the effects of landslides and debris flows through land-use planning, response planning, and warning systems.

“The products of your work have given the NPS and other cooperative agencies insights into debris-flow hazards associated with post-fire conditions on the Moon Fire and Whiskeytown Complex. The debris flow product has been particularly helpful for me in justifying area closures to the public and employees. I feel that your product has and will help people understand why and where areas are closed, potentially saving lives and preventing serious injury. “

Jim F. Milestone, Superintendent
Whiskeytown-Shasta-Trinity
National Recreation Area, NPS
Whiskeytown, CA

September 2008

Landslide Monitoring Activities

(Estimates for 2008, \$1.0 million; 2009, \$1.0 million; 2010, \$1.05 million)

Areas for which Models Exist that are Used to Interpret Monitoring Data — In 2009, LHP is continuing to develop rainfall thresholds for areas burned in southern California that will refine the predictive capabilities of the Joint NOAA/USGS Early Warning System and continuing monitoring and analysis of the rainfall response of landslides and landslide-prone areas in western Oregon. In 2008, LHP scientists released version 2.0 of TRIGRS (A Fortran Program for Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis), which will be used to analyze debris flow potential in Oregon in 2009 and 2010.

Landslide Hazards Emergency Response — In 2009 and 2010, LHP will continue to respond to landslide emergencies in the United States and internationally and to monitor these landslides where necessary. Information and maps of post-fire debris flows in southern California will be entered into interactive geographic information system (GIS) databases to provide immediate and comprehensive response tools for decision makers and the public. Landslide emergencies were posted through the Department's Common Alert Protocol to reach the largest audience of land and emergency managers in 2007 and 2008 and will continue to be posted in 2009 and 2010. In 2010, LHP will provide information on debris flow probability, volume, and inundation areas from a hypothetical set of recent burned areas for the Winter Storm Scenario for a response exercise in southern California.

Landslide Information Dissemination Activities

(Estimates for 2008, \$0.3 million; 2009, \$0.35 million; 2010, \$0.35 million)

National Landslide Information Center (NLIC) — The LHP will continue to respond to inquiries from the public, educators, and public officials on hazard mitigation, preparedness and avoidance strategies for landslide hazards. The NLIC is leading an effort for States and the

Geologic Hazard Assessments

USGS and other Federal agencies to exchange landslide data and information and will continue to provide the leadership in 2009 and 2010 for the National Landslide Hazard Exchange Group.

Publications for Users of Hazard Information — In 2009, LHP will expand the distribution of a handbook on landslide hazards for non-scientists published in 2008 by the USGS under the auspices of the International Landslide Consortium. The USGS will facilitate the translation of this handbook into Chinese, Japanese, Portuguese, and Spanish. The 2008 findings from a study of how information from the focused landslide research in the Seattle area that has been used by local government and the public was presented to USGS scientists and will be used in 2009 to assist USGS in designing future research and application activities. During 2009 and 2010, LHP will complete 15 systematic analyses each year, including maps, technical reports, and peer-reviewed research papers, for technical users of landslide information and decisionmakers.

Program Performance Overview

The table below summarizes the performance measures that either relate exclusively to the Landslide Hazards Program or are shared among the USGS programs in Earthquake Hazards, Volcano Hazards, Global Seismographic Network, and Geomagnetism.

End Outcome Goal 4.2: Improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Provide information to assist communities in managing risks from natural hazards										
# of areas for which detailed hazard assessments are completed (SP) (LHP)	C	UNK	1	2	2	2	3	4	+1	7
Actual/projected cost per hazard assessments (whole dollars)					1,000,000	1,000,000	1,000,000	1,000,000	0	
Comment	The amount of time and effort, and therefore, the cost to complete each individual hazard assessment varies depending on various factors									
Use Rate: Landslides: X% of communities/tribes using DOI science on hazard mitigation, preparedness, and avoidance for each hazard management activity (LHP)	C	3.9% (71/1800)	4.4% (80/1800)	4.9% (89/1800)	5.4% (98/1800)	5.4% (98/1800)	5.8% (106/1800)	6.4% (116/1800)	+0.6%	7.9% (140/1800)
Use Rate: Landslide Hazards: # of responses to inquiries from the public, educators, and public officials to the National Landslide Information Center on hazard mitigation, preparedness and avoidance strategies for landslide hazards (LHP)	A	5,200	1,600	1,600	1,600	1,600	1,200	1,200	0	1,200

Geologic Hazard Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	With the efficiency and improvement of the Landslide Hazards Program web site, more users are able to get the information that they need without making a specific inquiry.									
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (1/1)	100% (1/1)	100% (16/16)	100% (15/15)	100% (15/15)	100% (15/15)	100% (15/15)	0	100% (15/15)
Efficiency and Other Output Measures										
# of systematic analyses and investigations completed (LHP)	A	1	1	16	15	15	15	15	0	15
# of formal workshops or training provided to customers (LHP)	A	3	2	1	1	1	1	1	0	1
# of areas in the U.S. for which models exist that are used to interpret monitoring data (LHP)	C	4 1/3	4 2/3	5	5 1/3	5 1/3	5 2/3	6	+1/3	7
# of communities/tribes using DOI science on hazard mitigation, preparedness and avoidance of each Landslide management activity (Baseline is 1,800 counties and parks with moderate to high landslide susceptibility in the U.S. (99-03, 60 adopted measure)	C	71	80	89	98	98	106	116	+10	140 (8 per yr) (+24)

Activity: Geologic Hazards, Resources and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Global Seismographic Network

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Global Seismic Network (\$000)	4,441	5,482	+46	0	5,528	+46
<i>Total FTE</i>	<i>10</i>	<i>10</i>	<i>0</i>	<i>0</i>	<i>10</i>	<i>0</i>

Summary of 2010 Program Changes for the Global Seismic Network Program

The 2010 budget request for the Global Seismographic Network program is \$5,528,000 and 10 FTE. There are no program changes requested for the Global Seismographic Network program in 2010.

Program Overview

The GSN Program provides high-quality seismic data to support earthquake alerting, tsunami warning, hazards assessments, national security (through nuclear test treaty monitoring), loss reduction, and research on earthquake sources and the structure and dynamics of the Earth. The GSN is a joint program between the USGS and the NSF, implemented by the USGS, the Institute for Geophysics and Planetary Physics (IGPP) of the University of California, and the Incorporated Research Institutions for Seismology (IRIS), a consortium of universities.

2009 Enacted and 2010 Program Performance

Initiated in 1986, the GSN currently consists of 150 globally-distributed stations, installed over two decades by the USGS and IGPP. Funds for the purchase and installation of new sites are provided by NSF to IRIS. The USGS is responsible for maintenance and operation, data collection, and quality control of two-thirds of the GSN stations, and IRIS supports the University of California to operate and maintain the other third. Maintenance is accomplished in cooperation with many international partners who, in most cases, provide facilities to shelter the instruments and personnel to oversee the security and operation of each station. The USGS tasks include station maintenance and upgrades, monitoring and maintaining telecommunications, troubleshooting problems and providing major repairs, conducting routine service visits to network stations, training station operators, providing direct financial aid in support of station operations at those sites lacking a host organization, and ensuring data quality and completeness.

As part of GSN activities, the USGS and IRIS also evaluate, develop, and advance new technologies in sensors, instrument installation, data acquisition, and management. To improve performance, stations with unusually high background noise are relocated to quieter sites or configurations (e.g., burying sensors in boreholes) so that smaller events (earthquakes or

explosions) or signals of interest may be detected. The GSN has become a critical element of the USGS hazard warning activities and will be operated indefinitely. With proper lifecycle maintenance and upgrades the network can produce data indefinitely and with expanded capabilities.

Under a Memorandum of Understanding between the USGS and NSF, the GSN Program is overseen by a "Standing Committee" of advisors, consisting of external stakeholders and one USGS representative. The GSN Standing Committee typically meets twice a year.

Data and products derived from the GSN program have multiple and diverse uses and the program supports the Department's goal to improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property. The information provided to end users supports the intermediate outcome goal of providing information to assist communities in managing risks from natural hazards.

GSN real-time data are transmitted continuously to the USGS National Earthquake Information Center (NEIC) in Golden, Colorado, where they are used, with other data, to rapidly determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide. The high quality of GSN data allows the data to be used for the rapid determination of the geometric orientation of the fault that caused the earthquake and provide an estimate of the length of the fault that ruptured during the earthquake.

The rapid availability of earthquake information is critical for first responders and government officials responsible for assessing an earthquake disaster. In the case of significant domestic earthquakes, the USGS and partners provide information to Federal and State emergency management and public safety agencies, operators of transportation facilities, public utilities, and national news media. In the case of potentially damaging events outside the United States, information from the NEIC is immediately sent to the Department of State, embassies and consulates in the affected region, the USAID OFDA, the Red Cross, and the United Nations, as well as national and international news media.

GSN stations provide near-real-time data to National Oceanic and Atmospheric Administration (NOAA) tsunami warning centers, supporting tsunami monitoring in the Pacific Rim and disaster alerting in all U.S. coastal states and territories in the Pacific and Caribbean. NOAA relies on GSN real-time data to trigger analysis of the ocean-bottom sensors that detect tsunami waves, making it possible for NOAA to transmit tsunami alerts to response agencies within minutes of these quakes.

All GSN data are freely and openly available to anyone via the Internet. Copies of all the data from the USGS GSN stations are sent to the IRIS Data Management Center (DMC) in Seattle, Washington, which responded to over 340,000 requests for GSN data in 2008 – twice as many as in 2007. In addition, data from most GSN stations are currently available within hours of large earthquakes to the worldwide user community via the USGS *Live Internet Seismic Server*.

Data from the GSN are used extensively for basic and applied research on earthquakes, Earth structure, and other geophysical problems in studies conducted and supported by the USGS and other agencies like NSF, the U.S. Department of Energy, and the U.S. Air Force. Some of this research and data support national security through the seismic monitoring of nuclear explosions and the improved calibration of nuclear explosion monitoring networks.

The GSN continues its close cooperation with the GPS community with co-located instrumentation at 43 sites, and shared telemetry infrastructure in Africa, Siberia, and at Easter Island in the Pacific. The USGS is also evaluating the use of GSN data for climate change studies. In terms of cost-performance, other federal government programs benefit by use of the GSN infrastructure (station sites and communications) by reducing their operational costs. For example, the US contributes seismic data from 29 GSN stations to the International Monitoring System for the Comprehensive Nuclear Test Ban Treaty, a United Nations (UN) organization. It would cost the U.S. approximately \$1.0 million per year to maintain a separate network for this purpose, and that separate network would cost the government approximately \$4.0 million to develop. By leveraging the GSN investment, another purpose is achieved at no cost.

Given the high rate of significant earthquakes around the world, the GSN is an important tool in earthquake-related education and outreach. The USGS has worked with IRIS to develop educational museum displays based on data from the GSN. These displays explain the basic concepts of seismology and earthquake occurrence and have proven to be quite popular with the public. Displays are in place at the Smithsonian Institution in Washington, D.C., the American Museum of Natural History in New York, the Carnegie Museum in Pittsburgh, the USGS Headquarters, the New Mexico Museum of Natural History in Albuquerque, and the Franklin Institute's traveling "Powers of Nature" exhibit.

At the 2010 funding level, GSN will:

- Operate the USGS portion of the network at a high level of data recovery, real-time telemetry performance, and high cost-efficiency,
- Continue deployment of next-generation data-loggers to improve station reliability and data quality,
- Make progress on the development of low-maintenance seismic stations for deployment at less accessible sites, and
- Work with partners in the U.S. Air Force, the Comprehensive Nuclear Test Ban Treaty Organization, and the International Federation of Digital Seismographic Networks, to improve the efficiency of station operations and reduce maintenance costs.

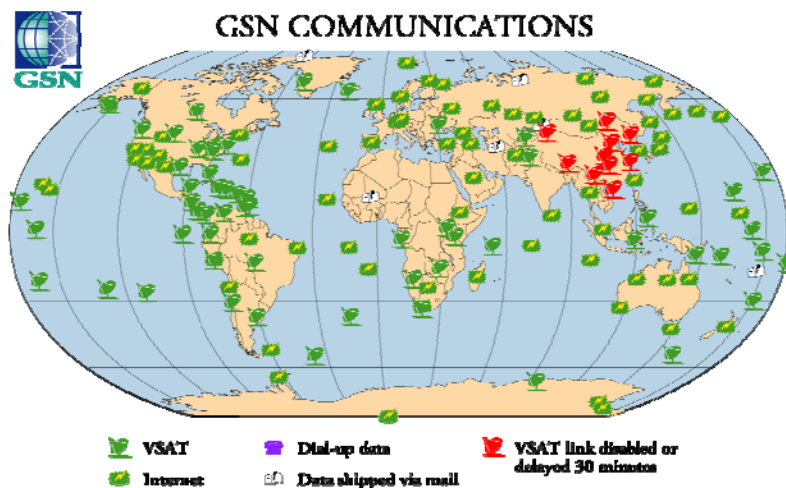


Figure 1. Telemetry has been expanded across the GSN so that now over 90% of the stations provide real-time data for earthquake alerting and tsunami warning.

Geologic Hazard Assessments

In 2009, the USGS will continue to strive to maintain the GSN at high reliability and low cost. The USGS portion of the GSN has grown from 72 to 100 stations since 1998. Through the Tsunami Warning Initiative, the USGS has added GSN-affiliated stations in the Caribbean and increased the number of stations with real-time telemetry over the past 3 years, providing new capabilities for the network but also increasing operations and maintenance costs, which must be absorbed at fixed funding levels.

The 2010 performance assumes specific goals for 2009 are met including (1) improved station reliability through more timely maintenance, an expanded inventory of spare parts, replacement of obsolete technologies and standardization of equipment, (2) further incorporation of the GSN into the Global Earth Observation System of Systems effort and cooperate with IRIS, NSF, and other agencies in continuing to use the GSN as a platform for global geophysical observations, (3) enhanced network performance by relocating noisy stations to quieter sites and by the use of new seismometer and installation technologies, and (4) enhanced data quality-control operations.

The USGS will also participate with partners in the development and testing of new sensor technology. The existing STS-1 seismometers, which have unmatched capabilities but are no longer manufactured, are aging and beginning to fail. A replacement for this seismometer is necessary to support network performance.

The performance metrics for percent telemetry and cost efficiency are expected to remain level in 2010, as equipment purchased and deployed in 2009 stabilizes the network.

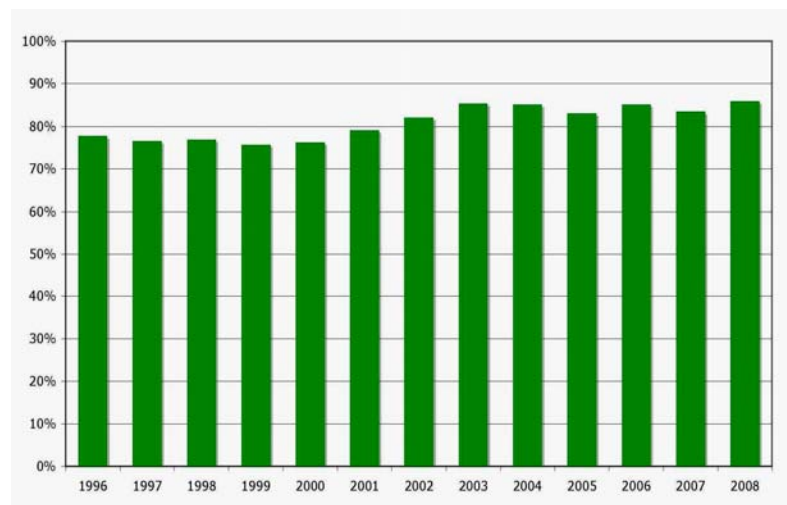


Figure 2. The availability of GSN data increased to over 85 percent in 2006. This exceeds that of other global seismic monitoring operations such as that run by the Comprehensive Nuclear Test Ban Treaty Organization.

All GSN data passes through a quality control process before archiving, and GSN archives are heavily used by researchers.

Program Performance Overview

The table below summarizes the performance measures that either relate exclusively to the GSN or are shared among the USGS programs in Earthquake Hazards, Volcano Hazards, Landslide Hazards, and Geomagnetism.

End Outcome Goal 4.2: Improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Provide information to assist communities in managing risks from natural hazards										
# of GSN next-generation systems deployed (of 87 needed)*	C	NA	NA	NA	NA	1	9	9	0	9
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
Efficiency and Other Output Measures										
# of formal workshops or training provided to customers (GSN)	A	0	1	0	0	1	0	1	+1	1
Comment	Workshop number and costs vary from year to year depending on program objectives, partner contributions and other factors. For example, in one year, a small number of low-cost workshops may be held to gather stakeholder input or provide regional reviews of a product. In another year, one or two large workshops may be held to highlight a centennial or bring multiple stakeholder groups together. Workshop costs may also span fiscal years because planning may begin 1-2 years in advance.									
X% data availability for real-time data from the GSN (GSN)	A	89%	88%	87.8%	86%	87%	84%	88%	+4%	90%
Comment	Omnibus restores cuts proposed in President's request and provides an increase for upgrading stations. These increases will show improvements to 88% in current and out years.									
Data processing and notification costs per unit volume of input data from sensors in monitoring networks (in cost per gigabyte) (GSN)	A	0.79 \$k/GB	1.30 \$k/GB	1.19 \$k/GB	1.33 \$k/GB	0.89 \$k/GB	1.33 \$k/GB	1.30 \$k/GB	-0.03	1.20 \$k/GB
Comment	Omnibus restores cuts proposed in President's request and provided increase that will improve performance and decrease unit cost to \$1.30 \$k/GB in 2009 relative to original target.									

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Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Geomagnetism

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Geomagnetism (\$000)	2,059	2,092	+46	0	2,138	+46
Total FTE*	17	17	0	0	17	0

* some FTE partially covered by other agency funding (OFA)

Summary of 2010 Program Changes for the Geomagnetism Program

The 2010 budget request for the Geomagnetism program is \$2,138,000 and 17 FTE. There are no program changes requested for the Geomagnetism program in 2010.

Program Overview

The mission of the USGS Geomagnetism Program is to monitor the Earth's magnetic field through an array of ground-based magnetic observatories; to provide high temporal resolution records of magnetic field variations covering long timescales; to disseminate magnetic data to various governmental, academic, and private institutions; and to conduct research into the nature of geomagnetic variations for purposes of scientific understanding and hazard mitigation. The program consists of three main elements:

- Geomagnetic observatory operations,
- Data transportation, management, processing and dissemination, and
- Scientific research.

Short-term variations in the Earth's magnetic field, in particular those during geomagnetic storms, are hazardous to satellites and electrical power distribution systems and make radio communications, navigation, and geophysical surveys difficult. During such storms, astronauts and high-flying aircraft pilots can be exposed to dangerous levels of radiation. Data from the program's observatories are used for tracking near-Earth space-weather conditions by both the NOAA Space Weather Prediction Center (SWPC) and the AFWA. With those and other partners, the program is an integral part of the interagency National Space Weather Program.

Use of Cost and Performance Information

Cost/performance data are used to prioritize maintenance activities across the 14-observatory geomagnetic monitoring network in order to maximize the value of fixed maintenance funds to station performance.

The Geomagnetism program continues to partner with the U.S. Air Force, British Geological Survey, and Natural Resources Canada to ensure adequate dissemination of geomagnetic data and monitoring of the geomagnetic field, leveraging the investment by all three entities by avoiding unnecessary duplication and optimizing station location. Air Force funds are targeted for the operation of five of the 14 USGS geomagnetic observatories, for which they demand high operational performance and data quality.

Geologic Hazard Assessments

The estimated annual economic impact of magnetic storms runs into the hundreds of millions of dollars, not to mention the potential impact upon national security. Because many navigational systems use the magnetic field direction as a means of orientation, it is essential to track these long-term changes. Moreover, drilling programs undertaken within the oil industry rely on magnetic orientation, and these can be degraded during magnetic storms, particularly at high latitude. Many historical property boundaries are based on magnetic orientation, and knowledge of the magnetic field is needed to reconstruct or re-establish these boundaries.

This program supports the Department's goal to improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property. Output measures for which targets are established in support of achieving the intermediate outcome goal include the presentation of formal workshops or training to customers and systematic analyses and investigations completed. The Geomagnetism Program works very closely with NOAA Space Weather Prediction Center and AFWA to ensure complementary roles and responsibilities in delivery and dissemination of geomagnetic hazards data to the space weather community.

2009 Enacted and 2010 Program Performance

At the proposed 2010 funding level, the Geomagnetism Program will perform the following activities:

- Continue operation of 13 Geomagnetic Observatories and delivery of 1-second geomagnetic data to customers and users;
 - Note: one geomagnetic observatory (Del Rio, TX) will be closed in 2009.
- Continue collaboration with the NOAA, SWPC, and AFWA, to ensure complementary roles and responsibilities in delivery and dissemination of geomagnetic hazards data to the space weather community;
- Complete major upgrades at the Barrow, Alaska, Observatory including repair or replacement of the primary sensor building, installation of the data-acquisition system, and installing Internet links; and
- Release of a geomagnetic hazard map of the United States.

Geomagnetic Observatory Operations

(Estimates for 2008, \$1.46 million; 2009, \$1.38 million; 2010, \$1.38 million)

The USGS Geomagnetism Program currently operates a network of 14 geomagnetic observatories, distributed across the United States and its territories. Data are collected continuously from each observatory by a variety of instruments housed in buildings designed to provide environmental stability and to ensure long-term baseline stability. Each site is visited regularly to conduct calibrations of the instruments. Data are transmitted in real time to program headquarters in Golden, CO, via a set of satellite and Internet linkages. The program is currently working to improve the basic infrastructure at each observatory and to improve the temporal resolution of the measurements, by increasing the sampling frequency from 1 minute to 1 second.

The 2010 performance will build upon the following 2008 accomplishments:

Geomagnetic Observatory Operations — In 2008, the new 1-second acquisition system was tested, with the aim of preparing for fully operational 1-second acquisition at selected observatories and broader deployment in 2009.

Users will benefit from these efforts in 2009, primarily through improved data quality and reduced operational expenses. With the installation of the new data acquisition system at all observatories, continuous operations and software upgrades should make the network easier to manage

Data Processing, Management, and Dissemination

(Estimates for 2008, \$0.37 million; 2009, \$0.40 million; 2010, \$0.40 million)

Once the data from the observatories are received in Golden, CO, they are subjected to an initial processing. They are then organized for immediate transmission to both NOAA's Space Weather Prediction Center in Boulder, CO, and the AFWA in Omaha, NE. For longer-term studies, the magnetic data are further refined using periodic calibrations for each observatory, making them useful for research on rapid magnetic field variations and for mapping the field on a global scale. These fully calibrated, definitive data are published yearly in cooperation with foreign national geomagnetism programs working through the Intermagnet consortium. The USGS also distributes data and maps and models of the magnetic field through the <http://geomag.usgs.gov> Web site, which receives up to 1,000 visits per day from the public.

Scientific and Applications Research

(Estimates for 2008, \$0.23 million; 2009, \$0.35 million; 2010, \$0.35 million)

USGS Geomagnetism Program staff conduct geomagnetic research to achieve a better understanding of basic geomagnetic processes and their effects on physical and social environments. Recent projects have included the development of a statistical framework for characterizing the long-term secular variation of the magnetic field and studies of the dynamo generating the field within the Earth's core. The program has recently begun an analysis of the statistics of rapid magnetic field variations with the goal of characterizing them both spatially and temporally so that geomagnetic hazards can be mapped and so that risks can be quantified.

The 2010 performance will build upon the following 2008 accomplishments:

Scientific and Applications Research — A predictive model of global geomagnetic activity was developed in 2008, primarily through statistical analysis of observatory data and through development of a magnetic disturbance index service. A simple but operationally useful measure of magnetic activity will be developed for display in 2010 on the program Web site.

Program Performance Overview

The table below summarizes the performance measures that either relate exclusively to Geomagnetism or are shared among the USGS programs in Earthquake Hazards, Volcano Hazards, Landslide Hazards, and the GSN.

End Outcome Goal 4.2: Improve understanding, prediction, and monitoring of natural hazards to inform decisions by civil authorities and the public to plan for, manage, and mitigate the effects of hazard events on people and property.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Efficiency and Other Output Measures										
# of systematic analyses and investigations completed (Geomag)	A	na	na	4	2	3	2	2	0	2
Actual/projected cost per systematic analyses (whole dollars) or Total actual/projected costs (\$000)				42,000	42,000	42,000	42,000	42,000		42,000
Comment	The average cost of a systematic analysis was based on Activity Based Costing data.									
# of formal workshops or training provided to customers (Geomag)	A	na	1	0	1	1	0	1	+1	1
Comment	Workshop number and costs vary from year to year depending on program objectives, partner contributions and other factors. For example, in one year, a small number of low-cost workshops may be held to gather stakeholder input or provide regional reviews of a product. In another year, one or two large workshops may be held to highlight a centennial or bring multiple stakeholder groups together. Workshop costs may also span fiscal years because planning may begin 1-2 years in advance.									

Activity: Geologic Hazards, Resources and Processes

Subactivity: Geologic Landscape and Coastal Assessments
Program Component: National Cooperative Geologic Mapping Program

	2008 Actual	2009 Omnibus	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
National Cooperative Geologic Mapping Program (\$000)	26,626	27,724	+439	0	28,163	+439
<i>Total FTE</i>	132	130	0	0	130	0

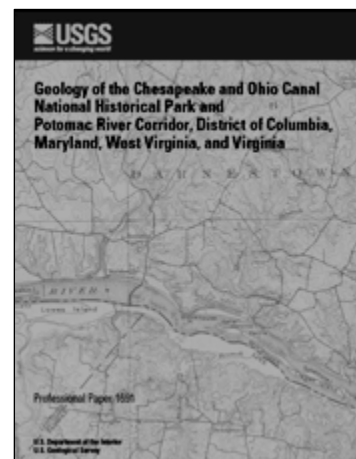
Summary of 2010 Program Changes for the National Cooperative Geologic Mapping Program

The 2010 budget request for the National Cooperative Geologic Mapping Program is \$28,163,000 and 130 FTE. There are no program changes requested for the NCGMP in 2010.

Program Overview

The NCGMP represents 15 years of successful cooperation among Federal, State, and university partners in delivering state-of-the-art digital geologic maps to the Nation in a cost-effective, timely manner. Each of these partners has a unique role, yet all work cooperatively to leverage financial resources and to determine the areas of highest priority for new geologic mapping.

The NCGMP was created following the passage of the National Geologic Mapping Act of 1992, which was reauthorized in 1997 and 1999 (P.L. 105–36 and 106–148). In 2009, Congress reauthorized the Act for the third time (P.L. 111-11). The NCGMP is the primary source of multiple-purpose geologic maps that depict the distribution of the Nation's sediment and rocks and the resources they provide. Geologic maps are vital for exploring, developing, and preserving mineral, energy, and water resources; evaluating and planning for land management and environmental protection; reducing losses from natural hazards, including earthquakes, volcanoes, landslides, and other ground failures; mitigating effects of coastal and stream erosion; siting of critical facilities; and planning for basic earth science research. In short, geologic maps are the synthesis of earth science data pulling expertise from many aspects of geology, such as geochemistry, geochronology, paleontology, structural geology, stratigraphy, and geophysics. Geologic maps provide subsurface data important in the development of models that conceptualize ground water flow, mineral deposition, and earthquake shaking to name a few.



Hikers and history buffs in particular will enjoy the newly released “Geology of the Chesapeake and Ohio Canal National Historical Park” (USGS Professional Paper 1691), which includes a history of the canal, the geologic setting that influenced engineering, archival photos, and a large plate insert of the park.

Geologic Landscape and Coastal Assessments

This program supports the Department's goal to improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment. The mission of the NCGMP is to provide accurate geologic maps and three- and four-dimensional frameworks that contribute to sustaining and improving the quality of life and economic vitality of the Nation and mitigating geologic hazardous events and conditions.

Program priorities are outlined in the National Geologic Mapping Act of 1992 and in the program's 5-Year Plan for 2007-2011. The NCGMP 5-Year Plan has three goals:

- Produce high-quality, multi-purpose digital geologic maps and accompanying databases and reports to solve diverse land-use problems in high-priority areas. Develop three-dimensional geologic frameworks that extend into the subsurface for use in a variety of predictive models, such as ground-water flow, seismic shaking, landslide probabilities, landscape change, and ecosystem health. Measures under this goal deal with increasing regional geologic map coverage of the United States, promoting use of geologic maps by the NPS, water resource managers, and in the mitigation of natural hazards, as well as documenting the Systematic Analyses and Investigations completed.
- Make geologic map information more accessible to the public by providing geologic maps, reports, and databases in a variety of digital formats. Preserve and make accessible the extensive USGS paleontologic collections and accompanying databases. Measures under this goal document the maps and reports that are made accessible on the internet through the National Geologic Map Database (<http://ngmdb.usgs.gov/>) and the information provided to our customers through formal workshops and training.
- Ensure that the NCGMP will have the capabilities and work force to meet the geologic mapping future needs of the Nation. Measures include documenting how students trained through the EDMAP component of the program use their mapping experience to further their geoscience education and careers.

Over the past few years, geologists within the NCGMP have been working to advance and improve the production of geologic maps through the use of new field mapping techniques that streamline the process from data collection to map production. NCGMP has established ambitious targets to make the process even more efficient and will continue to collect quantitative data on the success of these improvements.

The NCGMP priorities are reviewed annually by a congressionally mandated Federal Advisory Committee (FAC), which includes representatives from the Department of Interior, U.S. Department of Energy (DOE), U.S. Department of Agriculture (USDA), U.S. Environmental Protection Agency (EPA), State geological surveys, academia, and the private sector. Progress and status reports on the NCGMP are prepared for the Secretary of the Interior to deliver to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate. In addition, State Mapping Advisory Committees in 48 States meet each year to prioritize local geologic mapping needs and assist USGS managers in modifying and prioritizing long-range plans. These priorities are based upon customer needs for the maps.

In 1987, geologic maps had five primary applications: oil and gas, metals, industrial minerals, ground water, and coal, listed in decreasing order. Since that time, the number of applications has increased to 13, as can be seen in Figure 1.

Societal Applications of Federal and State Geologic Mapping

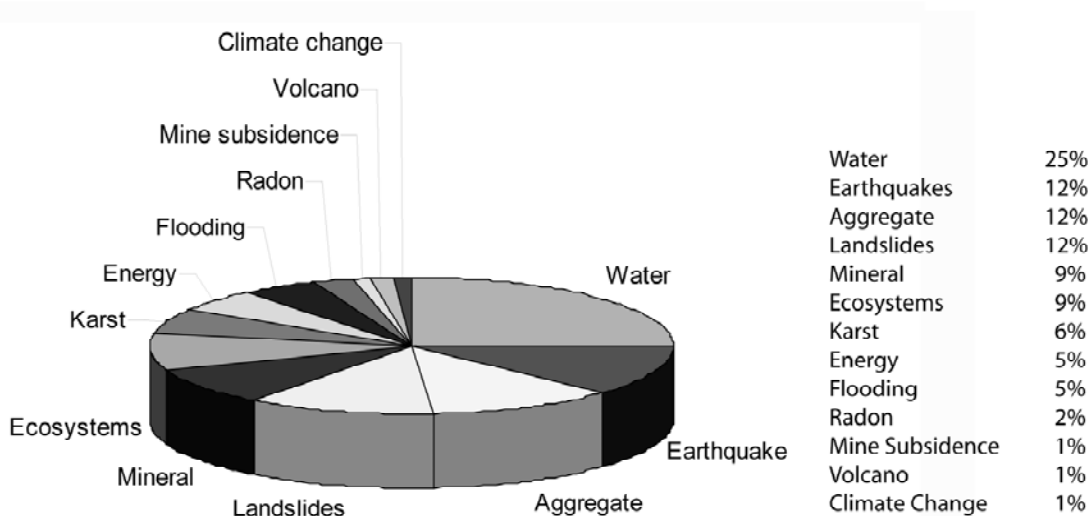


Figure 1. Percent of applications for geologic mapping supported by the FEDMAP and STATEMAP components of NCGMP.

The Energy Policy Act of 2005 contains section 2011, preservation of geological and geophysical data. This section calls for the establishment of the National Geological and Geophysical Data Preservation Program (NGGDPP) within the USGS, which is to “archive geologic, geophysical, and engineering data, maps, well logs, and samples [and] provide a national catalog of such archival material.” In addition to its duties under the National Geologic Mapping Act, the NCGMP FAC is charged by this act to develop guidelines and procedures for and to review progress of the NGGDPP.

In the Omnibus Appropriation Act of 2009 (P.L. 111–8), funding (\$750,000) for the Central Great Lakes Geologic Mapping Coalition was transferred to the NCGMP from the Earth Surface Dynamics Program. The Coalition is a Federal-State partnership created to produce urgently needed, detailed, three-dimensional surficial materials maps of the Great Lakes States. The States in this region have a similar geologic heritage and need to address common societal issues about land and water resources, the environment, and geologic hazards. Geologic maps produced by the project provide a foundation for making economic and environmental decisions related to ground water resources, land, and other natural resources in the Central Great Lakes region.

2009 and 2010 Program Performance

The NCGMP carries out the Mapping Act through three main program components: FEDMAP, STATEMAP, and EDMAP. Each year, panels that include scientists from Federal and State governments and academia critically review all work plans that are submitted to the three components.

Geologic Landscape and Coastal Assessments

Although NCGMP-funded projects provide support for all of the USGS Science Strategies, approximately 70 percent of FEDMAP projects and 95 percent of STATEMAP projects have some involvement with water issues. One of the program's Program Assessment Rating Tool (PART) measures (percent of United States with geologic maps that are being integrated into ground-water availability status and trends to support resource management decisions) complements the USGS Water Resources (WRD) measure: percent of principal aquifers of the United States with ground-water availability status and trends information to support resource management decisions. WRD cannot meet their goal effectively without using information from geologic maps and related information provided by NCGMP scientists because the geologic formations mapped in the subsurface define (1) the shape of the aquifers (the vessels that hold the ground water), (2) how much water can be stored in them, and (3) parameters for water movement through the ground. For example, geologic data gathered about the Arbuckle-Simpson aquifer in Oklahoma will be incorporated into USGS WRD's multi-layer ground-water model of the region.

Many NCGMP-funded projects also provide useful information for predicting and dealing with natural hazards, such as landslides, earthquakes, and volcanoes. A program PART measure counts the number of counties or comparable jurisdictions that have adopted hazard mitigation measures based in part on geologic mapping and research. For example, in the multi-county area of southern California where recent forest fires have destroyed 800,000 acres, the USGS has provided FEMA with landslide risk assessment maps. These maps are being used to help make decisions on road closures and home evacuations. The program also funds a recently begun project that is constructing 3-dimensional maps through time of earthquake-induced ground shaking. These maps, based on accurate geologic parameters, offer enormous help in earthquake disaster planning and mitigation efforts.

Through a Science in the Parks effort, and at the request of the NPS, in 2009 the USGS will continue to construct a geologic map of Big Bend National Park. NPS ranks this the second most important national park to receive new geologic mapping. The map is greatly needed for park managers to understand and make decisions related to potential toxic concentrations of heavy metals in the groundwater, springs, and surface water of the park.

NCGMP anticipates that approximately 45-47 State geologic surveys and 40 universities will receive financial support in 2009 from NCGMP through our grant programs. These projects will produce over 400 new geologic maps and train approximately 45 students.

**National Geologic Mapping Act:
Successful Federal-State-University Partnering**

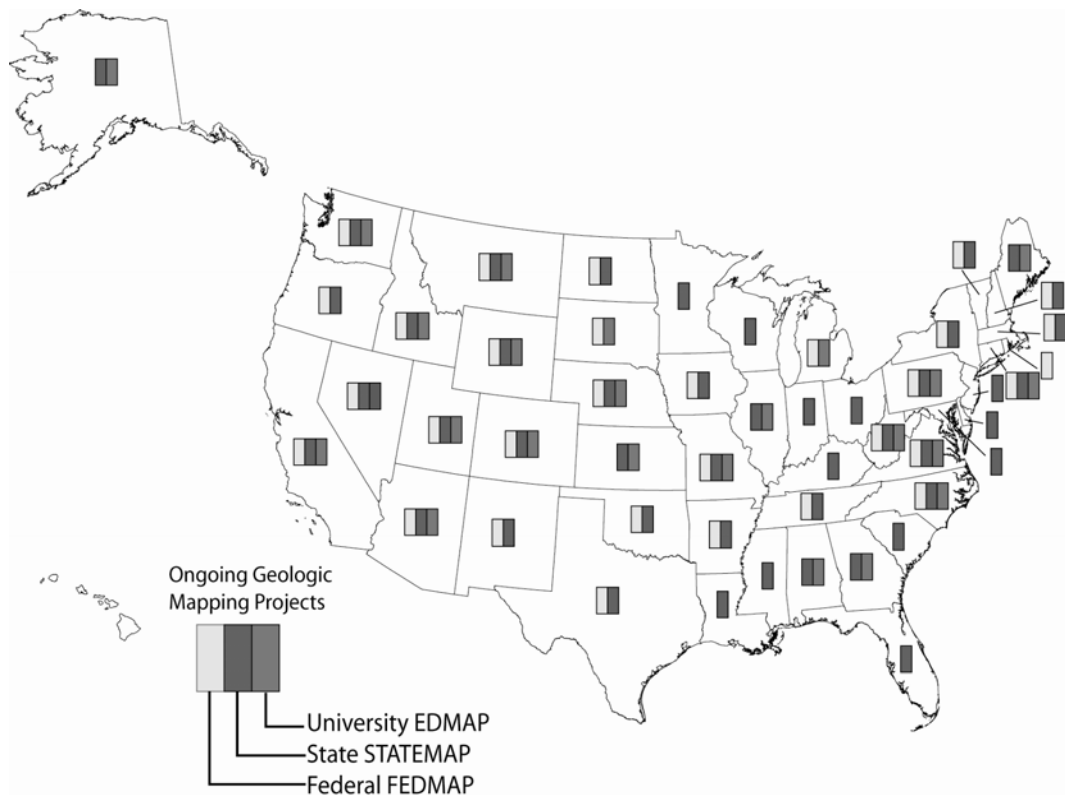


Figure 2. Map of the nation showing NCGMP components active in each state.

FEDMAP

(Estimates for 2008, \$18.39 million; 2009, \$18.70 million; 2010, \$18.97 million)

The FEDMAP component currently supports, totally or in part, 32 regional geologic mapping and synthesis projects that cross jurisdictional boundaries or involve work on Federal lands. These projects are located primarily within three regional teams of the USGS: Western Earth Surface Processes Team, Central Earth Surface Processes Team, and Eastern Earth Surface Processes Team. However, NCGMP also funds interdisciplinary projects with the Mineral Resources Program, Earthquake Hazards Program, Landslide Hazards Program, and the Ground Water Resources Program. Most of these projects have a lifespan of approximately 5 years. In 2008, studies were undertaken in 38 States. The program also partially supports a number of geochronology and

Release of Geologic Map Standards

The Federal Geographic Data Committee (FGDC) Digital Cartographic Standard for Geologic Map Symbolization (http://ngmdb.usgs.gov/fgdc_gds/) has been widely accepted by the geologic mapping community in the United States and elsewhere.

For example, William Andrews, Chief of the Geologic Mapping Section of the Kentucky Geological Survey (January 2009) says, "The completed FGDC Digital Cartographic Standard for Geologic Map Symbolization has been received with great interest in our Geologic Mapping Section here at the KGS."

To support broad interest in using the FGDC Standard for geologic mapping, ESRI, Inc., an industry leader in geographic information system technology, has invested in an implementation of the standard to be made available in 2009 as a resource for ArcGIS, their widely used GIS software.

Geologic Landscape and Coastal Assessments

other common-use laboratories in the Geologic Discipline and the National Geologic Map Database Project (NGMDP), which represents a major cooperative effort with the Association of American State Geologists to serve information about all geologic maps produced in the United States. New and ongoing geologic mapping work plans are evaluated annually by a FEDMAP Review Panel, which includes representatives from State geological surveys, NPS, and USGS scientists with diverse scientific backgrounds.

The NGMDP is an ongoing effort with State geological surveys, universities, the Canadian Geological Survey, and the Consejo de Recursos Minerales, Mexico, to present all geologic mapping data from North America on one web site and with a common set of map standards such as geologic map symbols, colors, and patterns. Additionally, users can access information on current geologic mapping activities and the proper use of geologic names. The project's web site serves more than 40,000 users per month.

Through a Science in the Parks effort, the NCGMP is the principal USGS partner coordinating and prioritizing geologic mapping studies with the NPS. Projects are developed and selected jointly by the NPS and the USGS to merge the earth science information needs of individual parks with the geologic mapping mission of the USGS. The resulting geologic data are made available in digital, as well as standard, formats that are needed for NPS land-use management, educational outreach, inventory, and monitoring of natural resources. NCGMP-funded projects also work with other Federal land management agencies (e.g., FWS, BLM, and the USFS).

STATEMAP

(Estimates for 2008, \$7.66 million; 2009, \$8.41 million; 2010 \$8.57 million)

The STATEMAP component currently supports geologic mapping studies by 45 State geological surveys through a competitive grant program that matches every Federal dollar with a State dollar. Since 1993, more than \$74 million have been matched by 48 States. Mapping priorities are determined with the help of State Mapping Advisory Committees in each State, which include representatives from all levels of government, the private sector, academia, and industry. Currently, more than 500 individuals offer their time on these committees to prioritize geologic mapping needs.

STATEMAP Products Aid Public Health Response

The availability of detailed maps of the bedrock and surficial geology ...provided not just the basic information regarding the bedrock units, but [also] detailed information regarding faults, bedrock valleys, karst development, and groundwater flow [and has] allowed the Minnesota Health Department and the Minnesota Pollution Control Agency to:

- Quickly identify potential areas of particular groundwater sensitivity,
- Tailor our investigation to rapidly locate the most highly contaminated wells and provide alternative water supplies to residents, and
- Understand what would otherwise have been considered anomalous contaminant migration pathways.

Without the mapping work... this investigation would have taken far longer resulting in delayed public health response and inefficient use of state resources.

Virginia Yingling
Environmental Health Division
Minnesota Department of Health
September 2008

EDMAP

(Estimates for 2008, \$0.58 million; 2009, \$0.61 million; 2010, \$0.62 million)

The EDMAP component supports the training of a new generation of geologic mappers in universities and colleges through a competitive matching-fund grant program. Since EDMAP's inception in 1996, more than \$5.0 million from the NCGMP has supported geologic mapping efforts of more than 700 students working with more than 220 professors at 136 universities in 44 States, the District of Columbia, and Puerto Rico. Funds for graduate projects are limited to \$15,000 with undergraduate project funds limited to \$7,500. These funds are used to cover field expenses and map production but not faculty salaries. The sponsoring college or university matches the EDMAP funding.

In 2008, the NCGMP continued a career study of EDMAP students that was begun in 2004. Students are sent a questionnaire 3 years after completion of their EDMAP experience. The results clearly demonstrate that EDMAP students (1) fall well above the national average for pursuing advanced academic degrees in the geoscience field, (2) easily obtain geoscience positions due to the knowledge gained through the EDMAP experience, and (3) frequently use the geologic mapping skills gained through the EDMAP.

Responses to 2008 EDMAP Student Survey:

Are you satisfied with the scientific knowledge you gained through the EDMAP program?

- EDMAP was a fantastic opportunity and I enjoyed it very much. I had no possibility of gaining anything like this type of education on this kind of scale without the benefits and support of EDMAP, so I am delighted with the scientific knowledge I gained.
- Yes, it was great! I learned a great deal through my M.S., and without the EDMAP support, my project would not have been possible.

How has this experience helped you in selecting a university and/or career, obtaining employment, in the day-to-day function on the job, etc.?

- ...given that I now have a job doing field mapping, I'd have to say that my EDMAP experience has not only influenced my employment choice, but it has helped me get that job [with a State Geological Survey]. ... Thanks in no small part to my EDMAP experience, I've been trusted to go out and map the majority of a quadrangle on my own. ... This is due to the fact that I was able to gain enormous experience and confidence thanks to EDMAP.
- I have a solid mapping and field based foundation, which aids me every day at work in my geologic mapping and also gives me confidence in my skills toward future possible field-based positions I may pursue.
- I now have a very good understanding of how a map should be drawn. ... Also, the analytical work done by me as part of this EDMAP grant is invaluable to me, let me gain high level experience using advanced research tools, and was in part responsible for my present employment.

Geologic Landscape and Coastal Assessments

Program Performance Overview

End Outcome Goal: Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of US with regional geologic map coverage that is available to customers through the NGMDB	C	53%	55%	60.4%	63%	64.6%	65%	67%	+2%	73%
Total Projected Cost (\$000)					23,460	23,460	23,460	23,460	0	23,460
Projected Cost per Square Mile (whole dollars)					1,750	1,750	1,750	1,750	0	1,750
Comment	The percentages shown above are calculated by dividing the coverage (maps published) within last year by square miles of the U.S. which is 3.7 million sq miles									
X% of geologic investigations in National Park Service (NPS) units that are cited for use by the NPS within three years of delivery (NCGM)	A	80%	80%	100%	80%	92%	80%	80%	0	80%
Comment	The percentages shown above are calculated by dividing the # of pubs used by NPS within 3 years by the total # of pubs produced for NPS. An 80% target was chosen in consultation with OMB as a target for customer use of USGS investigations. 2007 actual exceeded target.									
X% of EDMAP students that work on subsequent geoscience degrees or obtain a job in a geoscience field (NCGM)	A	94%	95%	94%	95%	100%	95%	95%	0	95%
Comment	The percentages shown above are calculated by dividing the EDMAP trained students (grant recipients) who went on in geoscience fields (education or employment) by the number of students able to be reached within 4 years after their training to confirm status. Of those trained, most have stayed in the geosciences. The resulting consistently high percentage is an indication that the training / mentoring provided by the program is effective.									

National Cooperative Geologic Mapping

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
X% of U.S. with geologic maps that are being integrated into ground-water availability status and trends to support resource management decisions (NCGM)	A	5%	6%	8%	10%	12%	11%	12%	+1%	15%
Comment	The percentages shown above are calculated by dividing the number of aquifers with completed geologic mapping by the number of principal aquifers, which is 65. 2008 Plan reflects program growth.									
# of counties or comparable jurisdictions that have adopted hazard mitigation measures based in part on geologic mapping and research (NCGM)	C	10	12	14	14	17	15	15	0	16
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (6/6)	100% (9/9)	100% (95/95)	100% (98/98)	100% (99/99)	100% (96/96)	100% (99/99)	0	100% (99/99)
Efficiency and Other Output Measures										
# of gigabytes collected annually (NCGMP)	A	110	200	1,525	200	303	200	200	0	200
Total/actual projected cost per gigabyte collected (whole dollars)					500	500	500	500	0	500
Comment	Cost per gigabyte is calculated by dividing the annual collection costs (approximately \$100,000 in salary for data entry -- acquire, process, and load images) by the number of gigabytes (200), which yields an estimate of \$500 per gigabyte.									
# of gigabytes managed and distributed cumulatively (NCGMP)	C	950	1,150	2,675	2,875	2,978	3,075	3,275	+200	3,875
# of systematic analyses and investigations completed (NCGMP)	A	6	9	95	98	101	96	99	+3	99
Total Actual/Projected Cost (\$000)				9,500	9,800	9,800	9,800	9,900	+100	9,900

Geologic Landscape and Coastal Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Actual/Projected cost per systematic analyses (whole dollars)				100,000	100,000	100,000	100,000	100,000	0	100,000
# of formal workshops or training provided to customers (NCGMP)	A	10	10	10	10	11	10	10	0	10
# of hours for fieldwork, compilation, and publication of a typical geologic map (NCGMP)	A	3,070	2,980	2,890	2,810	2,786	2,720	2,670	-50	2,620
# of EDMAP students trained each year (NCGMP)	A	62	66	58	60	44	45	45	0	45
Total actual/projected cost					473,000	473,000	473,000	510,000	37,000	510,000
Actual/projected cost per student (whole dollars)					7,880	7,880	7,880	8,500	620	8,500
Comment	Costs shown for the training shown above are obtained from grant DI-1s.									

Activity: Geologic Hazards, Resources and Processes

Subactivity: Geologic Landscape and Coastal Assessments
Program Component: Coastal and Marine Geology

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Coastal and Marine Geology (\$000)	40,646	44,657	+656	+875	46,188	+1,531
<i>Total FTE</i>	218	215	0	0	215	0

Summary of 2010 Program Changes for Coastal and Marine Geology Program

Request Component	(\$000)	FTE
• New Energy Frontier – Wind and Solar Energy	+375	0
• Extended Continental Shelf	+1,000	0
• California Seafloor Mapping	-500	0
TOTAL Program Changes	+875	0

Justification of 2010 Program Changes

The 2010 budget request for the Coastal and Marine Geology Program is \$46,188,000 and 215 FTE, a net program change of \$875,000 and 0 FTE from the 2009 Enacted level.

New Energy Frontier - Wind and Solar Energy (+\$375,000 / 0 FTE)

This increase is to support renewable energy efforts related to wind and solar energy. This will include geologic characterization to provide the information framework to support offshore wind-energy development including the production of a regional digital seafloor map, in conjunction with Minerals Management Service (MMS), State agencies and other Federal mapping, charting, and regulatory agencies. Resultant maps would be part of an information portfolio used by MMS, NPS and FWS to evaluate proposals for offshore wind-energy sites and to assess cumulative regional impacts of turbine installations. Program changes associated with the New Energy Frontier initiative are described in section C, Key Increases.

Extended Continental Shelf (+\$1,000,000 / 0 FTE)

This increase would provide the funds necessary to complete funding for the analysis and synthesis of data collected during two previous seafloor mapping cruises in the Arctic. Additionally, it would allow the principal investigators, working with the Department of State led Interagency Task Force on the ECS to develop plans and lay the groundwork for additional

Geologic Landscape and Coastal Assessments

seafloor mapping expeditions, to develop a data management infrastructure for the effort, and to advance collaborative development of a successful U.S. ECS delineation.

California Seafloor Mapping

(-\$500,000 / 0 FTE)

The reduction eliminates congressional funding that was not requested by the Administration or USGS and does not address the highest priority science needs. This will keep the core program intact while allowing the USGS to make the best use of available resources. The 2009 funds provided are being used to support the State-led California State Waters sea-floor mapping program in cooperation with other Federal agencies. This activity will be discontinued in 2010.

Program Overview

The CMGP maintains and applies capabilities in marine geology, geophysics, geochemistry and oceanography to provide information and research products on geologic conditions and processes critical to the management of the Nation's coastal and marine environments. The CMGP addresses a broad suite of national issues in the thematic areas of natural hazards, environmental quality and human health, and natural resources requiring credible and objective scientific data, information, and understanding. As the primary Federal marine geologic research, information, and knowledge provider, the CMGP develops, maintains, and delivers information, technologies, and products that provide Federal, State, and local agencies and the public the authoritative, scientific basis for regulating, managing, and protecting the Nation's coastal and marine resources and communities. Program objectives spanning the thematic program components include:

- Characterization of geological setting, processes, and change at regional or system scales as required to provide the framework understanding for management and policy in response to a broad range of issues. Framework development and synthesis of geologic information and understanding is the foundation for USGS research activities to understand and model the physical processes that control the status, function, and evolution of coastal and marine systems and the resulting environmental, hazard, and resource implications for human and environmental health, economic growth, public safety, and resource use, protection, and management.
- Development of regional and national hazard, resource and environmental assessments of coastal and marine conditions, change and vulnerability to human and natural processes. Regional geological framework development and topical research on geological processes provides the foundation for development of assessment products.
- Development of broadly applicable models of coastal and marine evolution and change. Geologic framework development and process understanding provides the basis for development and evaluation of hindcast and forecast models. Model application to specific issues and settings and expanding the range of relevant applications is supported by regional information development and targeted process studies.

Overall direction of CMGP activities is established by the Comprehensive National Coastal Program Plan which provides overall direction, goals and objectives for a five-year period. The plan reflects internal and external inputs and periodic reviews of the program and program elements by the National Academy of Science (NAS). The CMGP is broadly directed by the

objectives of the National Coastal Program Plan (2003) submitted to Congress by the USGS. The overall goals of this program are to (1) provide the scientific information, knowledge, and tools required to ensure that land and resource use decisions, management practices, and future development in the coastal zone and adjacent watersheds can be evaluated with a complete understanding of the effects on coastal ecosystems and communities and (2) provide a full assessment of the vulnerability of coastal and marine ecosystems and communities to natural and human-driven changes.

The CMGP supports the Department's goal to improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment. GPRA goals for project and program outputs, including analyses, models, information resources, and workshops to transfer information and capabilities are established as part of the program planning process and performance is evaluated quarterly and annually.

In pursuit of these goals, the CMGP develops and implements national, regional, and topical studies that advance knowledge relevant to national issues. Program activities are developed in response to long-term program objectives, partner needs, and potential to leverage USGS resources with partner resources to effectively meet shared objectives. Leveraging or cost-sharing provides partners access to unique USGS capabilities while enhancing the cost-effectiveness of USGS mission activities. Historically, partners provide 7 to 10 percent of funding for program activities, with significant in-kind contributions additionally provided through collaborative studies developed to respond to critical needs identified by stakeholders. This practice ensures that study products have immediate application while advancing long-term program objectives. Regional studies are designed to provide essential framework information to Federal, State, and local managers with respect to specific issues and topics as well as providing broadly applicable information products. Topical studies, often implemented within regional efforts, are designed to develop fundamental information that has broad applicability. Synthesis of regional and topical studies provides the basis for national assessments and products. Project work plans submitted to the CMGP are reviewed annually by internal and external scientists and managers knowledgeable in the relevant area of proposed and ongoing work. Reviewers provide guidance that informs program and project directions and implementation.

The CMGP supports research projects implemented primarily by the Coastal and Marine Geology centers in Woods Hole, MA, St. Petersburg, FL, and Menlo Park and Santa Cruz, CA. The CMGP uses the expertise found in other the USGS science centers as well as external cooperators (academic, State) to ensure needed capabilities are employed in program activity.

2009 Enacted and 2010 Program Performance

Use of Cost and Performance Information

In 2010, CMGP will continue to assess customer satisfaction with accessibility to USGS ocean and coastal data and to develop robust data tools for resource managers and regional planners.

During 2008, CMGP established interagency objectives and performance measures for ORPP priority studies through interagency collaboration in study design, review, and implementation. Particular emphasis was placed on evaluating the increased accessibility of coastal and ocean mapping information using the FGDC/GOS portal. Feedback will be gathered from Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM) agencies in 2011.

At the 2010 funding level, program performance will be maintained at established levels. With increased stakeholder input, largely the result of workshops and meetings with State consortium and with regional ocean councils during 2009, there will be merit-based selection for

Geologic Landscape and Coastal Assessments

continuation of integrated studies of coastal systems from California and the Gulf of Mexico to the Great Lakes and the Pacific Northwest. Lessons learned from hazard and environmental studies in the southeastern and mid-Atlantic United States during 2008 and 2009 will be applied in the Long Island and Northeast seashores.

As part of the interagency effort for delineating U.S. limits of the ECS, the USGS is supporting departmental priorities in this effort. During 2008, the USGS and members of an Interagency Task Force on the ECS initiated data collection on the Arctic in conjunction with Canadian counterparts. The USGS provides essential capabilities to conduct substantial and targeted seafloor mapping activities, using sophisticated equipment, experienced scientists and field data collection crew members, who will collect and interpret large-volume geophysical and geological data. The USGS's Federal leadership in geological characterization is critical to the success of establishment of ECS limits. Activities in 2010 will address the priorities of the Interagency Task Force on the ECS and will include field programs for data collection as well as data analysis and report writing associated with the summer 2008 and 2009 research cruises in the Arctic.

Program changes will have a modest impact on 2010 performance. The number of interactions with partners will remain constant. At this level, the increase in the number of gigabytes of data managed (+300 annually) is a significant increase over 2007. The number of systematic analyses will remain steady at 200 annually as will the number of workshops or training sessions held to engage regional partners.

Highlights of projects in 2009 include:

Tsunami Potential in the Caribbean – The USGS is analyzing data collected from offshore geophysical surveys completed in 2008. Through the development of elevation models and characterization of preserved sediment deposits, the USGS expects to improve inundation models for US territories in the Caribbean that have experienced and will experience tsunamis. This improved hazard assessment will assist local planners with better placement of infrastructure and designation of low risk zones for municipal facilities such as schools, hospitals, and fire stations.

National Benthic Habitat Studies (Atlantic) – Discovery of the invasive tunicate (type of marine filter feeder) off New England increased regional interest in better defining the geologic conditions in Marine Protected Areas and in areas that are prime targets for commercial fishing. During 2009, this project is working with the Gulf of Maine Council for the Marine Environment on conducting region-wide workshops in order to finalize a benthic habitat classification scheme that better ties the geologic conditions to the plant and animal habitats.

Northern Gulf Coast Ecosystem Change and Hazard Susceptibility Project – the USGS scientists are responding to resource managers' needs for forecasting tools to anticipate susceptibility of Northern Gulf Coast region ecosystems and human communities to catastrophic change caused by severe storms. This project is reconstructing and evaluating the Holocene geologic stratigraphy, paleo-environments, climate and sea-level histories. Project scientists will conduct a regional synthesis of present day northern Gulf Coast ecosystem and human community structure in order to forecast the evolution of this landscape over the next century from both regular natural processes, from changes induced by human development, and from severe storms throughout the coming century.

Coastal Vulnerability Forecasting – In order to help coastal communities and coastal resource managers anticipate and respond to changes in the vulnerability of the coastal zone

from persistent processes, extreme events and climate change; the USGS will invest in geospatial data, in the development of assessment and forecast modeling tools, and will further cement a partnership with NOAA to develop decision-support tools for changing coastal conditions and vulnerability. This project activity complements the priorities and directions of the the USGS Global Climate Change Program and will be implemented collaboratively with that program. It is anticipated that this project will, with contributions from other USGS programs and in partnership with other federal agencies, be enhanced over future years leading to improved and more widely available products to assist coastal managers in anticipating and responding to coastal change due to storms, erosion, and sea-level rise.

Highlights of proposed work in 2010 include:

San Francisco Bay Ocean Study – Shoreline facilities in the San Francisco Bay area are facing maintenance and management challenges associated with the volume of sediment that is moving out of the Bay, under the Golden Gate Bridge and out into the Pacific Ocean. Using discoveries from the USGS Coastal Evolution and Coastal Restoration projects which ended in 2008, this project will model the hydrodynamic conditions that are causing the movement of sediment and determine effects of different types of built structures on sediment movement. Ultimately, the scientists plan to demonstrate how different rates of sea-level rise will change the patterns of sediment and contamination transport, aiding resource managers in protection of coastal ecosystems.

Integrated Geologic Studies of Coral Reefs – The USGS will report on a cross-comparison study from highly impaired to unimpaired reefs in the Dry Tortugas, Virgin Islands, and Bucco Reef in Tobago. This multidisciplinary effort looks at coral disease, benthic habitat distribution, and current and past biogenic calcification rates to better understand the response of coral reefs to environmental stresses. Additionally, measurements made by this project will determine the response of corals to changing temperature and pH over the last few hundred to thousands of years so as to better understand the potential impacts of future changes in oceanic conditions resulting from global change.

Habitat mapping in California – The USGS will map bathymetry, habitats, and geology in State waters as major contributors to the California State Waters Mapping Program. Map products from this effort provide essential information for (1) fisheries management and designation of marine protected areas; (2) documenting sediment budgets, sediment transport, and coastal processes; (3) assessment of coastal flooding and erosion, tsunamis, and earthquake hazards; (4) evaluation of sites for offshore infrastructure; and (5) development of baselines for monitoring change from rising sea-level rise and other factors.

Alternative Offshore Energy – The USGS coastal and marine experts will work in partnership with other DOI Bureaus (NPS, MMS, and FWS) on identifying and addressing gaps in regional information needed to assess potential impacts of siting and installation of offshore energy systems and associated cables for electrical transmission lines to coastal electrical power distribution stations. Marine areas of interest include New England, the Gulf of Mexico, and the Pacific Northwest. Cooperative planning and project development will engage regional ocean alliances such as the Northeast Regional Ocean Council; which has a standing committee on ocean energy and has identified critical gaps in seafloor mapping in the Gulf of Maine and the series of sounds along Connecticut, Rhode Island and southern Cape Cod.

Extended Continental Shelf (ECS) – Since 2004, the USGS has worked with the U.S. Extended Continental Shelf Task Force, chaired by the Department of State, to collect scientific

Geologic Landscape and Coastal Assessments

data about the legal continental shelf encompassing the oceanic basins north of Alaska. Because of the public interest in the Arctic with respect to global warming, the United States has an inherent government interest in knowing where the limits of its extended continental shelf exist with respect to the four other Arctic States (Russia, Canada, Denmark and Norway). In September 2008, USGS multibeam and seismic reflection experts were onboard the *US Coast Guard Cutter Healy* (a U.S. ice breaker) as part of a team with the *Canadian Coast Guard Cutter Louis S. St. Laurent* (a Canadian icebreaker). This experimental approach allowed the crew on the *Healy* to map the seafloor while the crew on the *Louis* (which traveled through a straight and open path cut through the ice by the *Healy*) collected multi-channel seismic reflection and refraction data for determining the thickness of sediment. This was an efficient and effective way to map an area of unknown geologic evolution and natural resources where U.S. and Canadian interests overlap. Plans are underway to undertake another joint research mission with Canadian counterparts in 2009, completing data collection near Alaska.

Program Performance Overview

End Outcome Goal: Improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
% of NPS units for which environmental characterization based on airborne remote sensing is provided as digital GIS products and for which products are cited or use by NPS within 2 years (C&M)	C	50% (6/12)	50% (7/14)	60% (10/16)	75% (12/16)	75% (12/16)	75% (12/16)	80% (19/24)	+5%	85%
% of regional and major topical studies for which interpretive and synthesis products are cited by identified partners and users within 3 years of study completion (C&M)	C	80% (23/29)	80% (24/30)	80% (25/32)	80% (26/32)	80% (26/32)	80% (25/31)	80% (26/32)	0	80%
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (8/8)	100% (8/8)	100% (218/218)	100% (200/200)	100% (200/200)	100% (180/180)	100% (200/200)	0	100% (225/225)
Efficiency and Other Output Measures										
# of gigabytes collected annually (CMGP)	A	5	16	8	8	381	100	300	+200	300
# of gigabytes managed and distributed cumulatively (CMGP)	C	55	71	79	87	460	560	1060	+500	2000
# of systematic analyses and investigations completed (C&M)	A	8	8	218	200	200	180	200	+20	225
Total/actual projected cost (\$000)		36,000	36,000	33,745	34,549	34,549	35,000	36,400	+1,400	

Geologic Landscape and Coastal Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Total/projected cost per systematic analysis (whole dollars)		4,000,000	4,000,000	155,000	173,000	175,000	205,880	191,575	-14,305	
Comment	Re-baselined in 2007 to standardize bureau-wide counting of all publications published within the fiscal year.									
# of formal workshops or training provided to customers (C&M)	A	10	10	11	11	11	10	12	+2	15
Total/actual projected cost (\$000)		250	250	277	300	300	275	302	-27	
Total/projected cost per workshop (whole dollars)		25,000	25,000	25,000	27,200	27,200	28,500	30,000	+1,500	
# of digital geographic information products for priority National Park Service units that provide environmental characterization based on airborne remote sensing (C&M)	C	10	8	10	10	10	10	11	+1	12
Fraction of significant landfalling hurricanes (coterminous US) for which post-storm assessments of impact are developed (C&M)	A	3/3	¾	0/1	≥3/4	2/2	≥3/4	≥3/4	0	≥3/4
% of open Ocean and Great-Lakes shoreline of coterminous US for which up-to-date characterization of the shoreline is provided (C&M)	C	62%	80%	80%	90%	90%	90%	95% (5700/6000)	+5%	95%
Cost of collection and processing of airborne remote sensing data for coastal characterization and impact assessments (C&M)	C	.56	.55	.57	.35	.50	.45	.32	-0.13	.30

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Resource Assessments
Program Component: Mineral Resources

	2008 Enacted	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Mineral Resources (\$000)	50,830	52,427	+1,253	-550	53,130	+703
<i>Total FTE</i>	334	329	0	0	329	0

Summary of 2010 Program Changes for Mineral Resources Program

Request Component	(\$000)	FTE
• New Energy Frontier - Biofuels	+100	0
• Mineral Resource Assessment for Nye County, NV	-650	0
TOTAL Program Changes	-550	0

Justification of 2010 Program Changes

The 2010 budget request for the Mineral Resources Program is \$53,130,000 and 329 FTE, a net program change of -\$550,000 and 0 FTE from the 2009 Enacted level.

New Energy Frontier - Biofuels (+\$100,000 / 0 FTE)

A program change of \$100,000 is proposed in support of the biofuels portion of the New Energy Frontier initiative. Biofuel production may bring significant changes to soil properties. Changes in soil erosion rate, soil carbon balance, microbiology, and soil nutrient geochemistry are among the probable consequences of biofuel production. The soil carbon balance is an important parameter in assessing the net atmospheric carbon gain or loss from biofuel production. This research is a part of the USGS-wide biofuels project, involving all four science disciplines, and will focus on a pilot study in the glaciated region of the northern midcontinent that will identify soil carbon impacts along a land-use gradient from native grasslands to cultivated areas. These studies will utilize soil CO₂ flux measurements, stable carbon isotope data, and soil microbial studies to determine controls on soil carbon gains and losses. The microbiological studies will utilize a newly acquired gas-chromatograph mass spectrometer to track abundance and types of soil microbes. The studies will document combined impacts of land use and climate change on soil properties, monitor their change over time, and provide a basis for including predictions of the future course of soil development in existing models. Program changes associated with the New Energy Frontier initiative are described in section C, Key Increases.

Geologic Resource Assessments

Mineral Resource Assessment for Nye County, NV

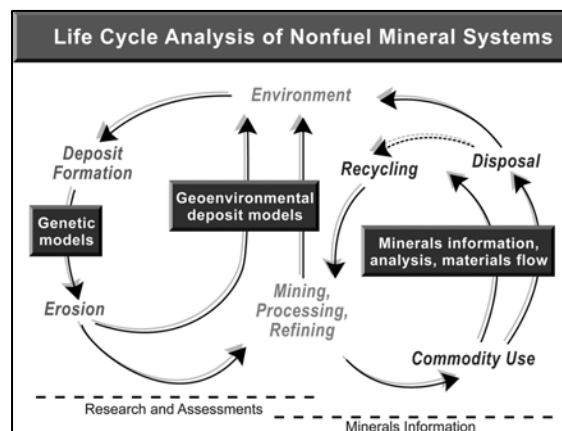
(-\$650,000 / 0 FTE)

The reduction eliminates congressional funding that was not requested by the Administration or the USGS and does not address the highest priority science needs. This will keep the core program intact while allowing the USGS to make the best use of available resources. These funds are being used to initiate a mineral resource assessment of Federal lands in Nye County, Nevada in collaboration with the University of Nevada, Las Vegas and the Nevada Bureau of Mines and Geology. This activity will be discontinued in 2010.

Program Overview

Nonfuel Minerals in U.S. Economy

The United States is the world's largest user of mineral commodities. The USGS is the Nation's only Federal source for current and reliable information about both domestic and international mineral resources and the consequences of their development. Planners and decision-makers at Federal, State, and local levels use this information to inform decisions that affect both supply and development of mineral commodities.



Nonfuel mineral materials such as copper, potash, and platinum group metals underpin significant portions of the U.S. economy and influence decisions related to energy and national security. Processed materials of mineral origin accounted for an estimated \$609 billion in the U.S. economy in 2008, an increase of 6 percent over the estimated 2007 value. In 2008, U.S. manufacturers and consumers of mineral products depended on other countries for 100 percent of 18 mineral commodities and for more than 50 percent of 44 mineral commodities that are critical to the U.S. economy.

The USGS works closely with its partners and customers in defining priorities and carrying out mineral resource data collection and research that supports the needs of decision makers in land management, defense, national security, and economic policy. Key partners include other DOI bureaus, Defense logistics and stockpile agencies, the intelligence community, and the Federal Reserve, as well as State and local government agencies and private organizations with interests in managing mineral lands and anticipating future mineral supply. These partnerships succeed because they represent shared commitment to providing the best possible information and research to support decisions affecting mineral resources. For example, domestic mineral production data reported by the USGS are supplied on a voluntary basis by 18,000 establishments who complete monthly, quarterly, or annual data reports. These data become part of the basis on which the Board of Governors of the Federal Reserve prepares its index of industrial production, a principal economic indicator. Similarly, the USGS partners with geological surveys around the world to conduct research resulting in estimates of global distribution of undiscovered mineral resources, the basis of future mineral supply.

The following sections describe the work of the MRP, together with its many partners, in support of the Department's goal of improving understanding of energy and mineral resources to promote responsible use and sustain the Nation's dynamic economy.

MRP is the sole Federal provider of scientific information for objective resource assessments and unbiased research results on mineral potential, production, consumption, and environmental effects.

Life cycle analysis of nonfuel mineral systems (see figure on previous page) demonstrates the connections between various natural and anthropogenic processes through which minerals are made available to sustain developed societies.

In its most recent review of the MRP (2003), the National Research Council identified four Federal roles in mineral science and engineering:

- an unbiased national source of science and information,
- basic research on mineral resources,
- advisory, and
- international (undertaking or supporting international activities that are in the national interest).

MRP addresses these four roles through work in two functions:

- a research and assessment function that provides information for land planners and decision makers about where mineral commodities are known and suspected in the Earth's crust, and
- a minerals information function that collects, analyzes, and disseminates data that describe current production and consumption of about 100 mineral commodities, both domestically and internationally for approximately 180 countries.

Each function meets the needs of different parts of the community of mineral resource information users, including:

- Federal, State, and local land managers;
- Federal, State, and international departments and agencies concerned with materials availability, defense, security, the economy, trade, environmental management, human health and safety;
- private sector companies concerned with materials availability, defense, security, the economy, trade, environmental management, human health and safety; academic institutions;
- policymakers in the U.S. Congress, and State and local governments; and
- the general public.

“Recently, the USGS re-analyzed a large collection of stream sediment and soil samples from Northern Nevada for gold and its associated pathfinder elements, arsenic and antimony. This data has revitalized exploration in Nevada by revealing new anomalous areas for exploration. Evolving Gold staked 279 claims covering about 5,400 acres of BLM-maintained land with federal minerals.”

Dr. Quinton Hennigh,
Chief Geologist for Evolving Gold

April 2008

Together these activities provide information ranging from that required for land planning decisions on specific management units to that required for national and international economic decisions.

The Federal Land Policy and Management Act of 1976 requires the USGS to "conduct mineral surveys of public lands to support the designation of Wilderness Areas . . . Prior to BLM making any recommendation for the designation of any area as wilderness, the Secretary of the Interior shall cause minerals surveys to be conducted by the USGS."

Geologic Resource Assessments

In addition, the USGS has significant responsibilities deriving from the Minerals Policy Act of 1970 and the National Materials and Minerals Policy, Research, and Development Act of 1980. The MRP responds to these and other economic and public policy needs of the Nation with both the research and information functions of the program.

2009 Enacted and 2010 Program Performance

Research and Assessments Function

(Estimates for 2008, \$35.47 million; 2009, \$36.9 million; 2010, \$37.07 million)

With funds proposed for 2010, this function will conduct the following activities:

- Complete and deliver 4 major multi-year bodies of work (systematic analyses), providing the Nation's decision-makers with information required to understand the context for actions affecting current and future supplies of nonfuel mineral commodities,
- Continue 3 research and development projects, begun in 2007, providing tools required for the planned 2012 start for updating the 1995 National Mineral Resource assessment,
- Undertake new, customer-driven mineral resource studies in support of economic development and land management in rural Alaska,
- Continue research on formation processes of deposits that host rare and scarce metals required for emerging technologies,
- Continue environmental geochemical research on processes that occur at sites of mined and unmined mineral deposits,
- Conduct regional-scale geologic data compilation, leading to a new State geologic map for Alaska, scheduled for delivery in 2012,
- Support geochemical, geophysical, and geographic information laboratories required to conduct MRP science and information projects,
- Manage 4 national-scale long term databases, and
- Provide 8 formal workshops or training to customers on topics such as understanding the utility of geoscience data for land planning.

"Integrated investigations of environmental effects of historical mining in the Animas River watershed, San Juan County, Colorado ... should be required reading for anyone involved in investigating the environmental effects of historical mining on a watershed."

Richard K. Glanzman in review for Applied Geochemistry of major scientific study supported by MRP

March 2008

"Our partnership with the USGS has allowed global investors an opportunity to receive the latest information on our minerals for more informed business decisions."

Said T. Jawad
Afghanistan's Ambassador
to the United States

November 2007

In 2010, MRP will deliver the results of a 9-year cooperative project providing the first-ever assessment of global potential for undiscovered deposits of copper, potash, and platinum-group metals, commodities essential to infrastructure, food security, and environmental health. Never before have decision-makers, scientists, and exploration companies had access to a publicly available, consistent global assessment of this type. The products of this work enhance national security by making

possible transparent planning to meet the Nation's long-term need for these important nonfuel minerals.

Also in 2010, MRP will deliver preliminary results of the first modern national survey of the geochemical components of our Nation's soils. This work involves other Federal agencies, State geological and soil survey organizations, academic soil scientists and geologists, and counterparts in both Canada and Mexico, providing the first truly continent-wide analysis of the soils of North America. It replaces a more than 30-year-old soil survey that included only 1,323 samples for the lower 48 states. The results of collecting and analyzing approximately 5,000 (including Alaska) new samples will enable planners, land managers, and remediation specialists to establish scientifically credible goals for remediation of damaged lands, provide a basis of comparison for any soil analysis that might cause concern, and provide a baseline against which future generations can measure changes in the health of the Nation's soils.

The Mineral Resources Data System (MRDS) is a worldwide database of metallic and industrial mineral sites with related geologic, commodity, and deposit information. It currently contains information describing about 115,000 locations; new records are continually being added and existing records updated or upgraded. About 200 data fields are available for each location, permitting storage of such disparate information as location, geology, description of deposit, exploration and development, description of workings, commodities present, production, reserves and resources, and published and unpublished references. These data are used by planners, land managers, exploration companies, and the public as a means of learning about known mineral deposits, those that are currently being mined and historic sites. The data are available on CD-ROM and as part of the MRP's data delivery web site (<http://mrdata.usgs.gov/>).

Developing and upgrading national databases, as well as converting those databases to standard formats, is an ongoing effort and will continue in 2010. Enhanced online data delivery tools provide information in digital format to any customer with Internet access; land-management agencies and regional-planning groups report that this direct access to authoritative geologic, geochemical, geophysical, and mineral deposits data is particularly helpful when priorities change and information for new areas is required quickly. The system is available at <http://mrdata.usgs.gov/>.

Data and conclusions from the USGS minerals research will continue to be available to users in easily accessible, accurate, and timely products in 2010. Information is disseminated through traditional paper products, in digital form, on the Internet (<http://minerals.usgs.gov/>), through interagency collaborations, and in technical and non-technical public presentations. Other methods through which MRP projects provide timely results for all customers include development of new geophysical and geochemical techniques for mineral-resource studies and the application of mineral-resource expertise and techniques to other societally relevant issues such as mapping earthquake and volcanic hazards, location and evaluation of energy resources, characterization of hydrology, or location of buried ordnance.

In 2010 research related to biofuels will focus on a pilot study in the glaciated region of the northern midcontinent that will identify soil carbon impacts along a land-use gradient from native grasslands to cultivated areas. Biofuel production may bring significant changes to soil properties. Changes in soil erosion rate, soil carbon balance, microbiology, and soil nutrient geochemistry are among the probable consequences of biofuel production. The soil carbon balance is an important parameter in assessing the net atmospheric carbon gain or loss from biofuel production. These studies will utilize soil CO₂ flux measurements, stable carbon isotope data, and soil microbial studies to determine controls on soil carbon gains and losses. The

Geologic Resource Assessments

microbiological studies will utilize a newly acquired gas-chromatograph mass spectrometer to track abundance and types of soil microbes. The studies will document combined impacts of land use and climate change on soil properties, monitor their change over time, and provide a basis for including predictions of the future course of soil development in existing models.

Minerals Information Function

(Estimates for 2008, \$15.36 million; 2009, \$15.53 million; 2010, \$16.06 million)

With funds proposed for 2010, this function will conduct the following activities:

- Collect, analyze, and disseminate timely information and data on domestic supply and availability for about 100 mineral commodities, in the United States and 180 other countries,
- Conduct specialized studies of materials flows and recycling of nonfuel minerals throughout the economy, and
- Deliver at least 720 mineral commodity and related reports.

“We find the data, analysis and assistance provided by the USGS to be invaluable in the preparation of the indexes of industrial production and of capacity. The USGS data add appreciably to the product content of industrial production and, moreover, are in an area where no data are otherwise available.”

Norman J. Morin
Senior Economist, Federal Reserve System

May 2008

Mineral materials are essential to the U.S. economy and national security. USGS information and data cover the extraction, production, and refining of mineral commodities and some of their products. The Departments of Interior, Defense, and State, Central Intelligence Agency, the Federal Reserve, and private sector companies utilize USGS mineral-related policy analysis in their regional and global analyses. Information on strategic minerals is also provided to the Department of Defense for managing the National Defense Stockpile.

The USGS mineral commodity specialists provide production and capacity data for the U.S. nonfuel minerals industry to the Federal Reserve Board (FRB). The FRB uses data in USGS minerals information reports to calculate the indexes of industrial production, capacity, and capacity utilization, which are among the most widely followed monthly indicators of the U.S. economy. These capacity indexes and the rates of capacity utilization based upon them are published monthly in FRB's G.17 release, Industrial Production and Capacity Utilization. The USGS scientists also provide assistance to FRB economists and policymakers in analyzing mineral industry indicators and trends.

Program Performance Overview

End Outcome Goal 2.4: Improve the understanding of Energy and Mineral Resources to Promote Responsible Use and Sustain the Nation's Dynamic Economy.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures Ensure availability of energy and mineral resource information and systematic analyses needed by land and resource managers for informed decision making										
% of targeted non-fuel mineral commodities for which up-to-date deposit models are available to support decision making (SP) (MRP)	C	0%	0%	0%	7%	7%	20%	53%	+33%	100%
Comment	The denominator is the total number of targeted commodities identified by internal and external experts in the rebaselining process in 2007. The 15 commodities are copper, lead, zinc, molybdenum, nickel, cobalt, chromium, beryllium, platinum-group metals, potash, rare earth elements, phosphate rock, titanium and titanium dioxide, iron ore, and gold.									
Intermediate Outcome Measures and Bureau and Outcome Measures Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (3/3)	100% (6/6)	100% (6/6)	100% (3/3)	100% (3/3)	100% (3/3)	100% (4/4)	0%	100% (4/4)
Efficiency and Other Output Measures										
# of gigabytes managed and distributed cumulatively (MRP)	C	16.131	16.221	16.3	16.3	16.3	16.3	16.4	+0.1	16.8
# of systematic analyses and investigations completed (MRP)	A	3	6	6	3	3	3	4	+1	4
Average cost of a systematic analysis or investigation (MRP)	A	\$4.18M	\$4.3M	\$3.7M	\$4.9M	\$4.7M	\$4.9M	\$9.0M	+\$4.1M	\$5.0M
Comment	The increased average cost estimated for 2010 results from the decrease in MRP in 2007 and the description of fixed and other costs in 2008 and 2009. These budget fluctuations have postponed of completion of two projects thereby increasing project costs and the overall average cost for 2010.									
# of formal workshops or training provided to customers (MRP)	A	8	8	7	6	6	6	8	+2	8
# of mineral commodity reports available for decisions (MRP)	A	746	690	717	700	649	700	720	+20	720

Geologic Resource Assessments

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	In 2008 publication of commodity data was changed to improve cost efficiency, reducing the number of reports for the same amount of data. This change was captured in the 2008 actual but not in the 2009 target which should be 650.									

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Resource Assessments
Program Component: Energy Resources

	2008 Enacted	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Energy Resources (\$000)	26,381	26,749	+488	+1,000	28,237	+1,488
<i>Total FTE</i>	<i>148</i>	<i>146</i>	<i>0</i>	<i>+1</i>	<i>147</i>	<i>+1</i>

Summary of 2010 Program Changes for Energy Resources Program

Request Component	(\$000)	FTE
• New Energy Frontier - geothermal	+1,000	1
TOTAL Program Changes	+1,000	1

Justification of 2010 Program Changes

The 2010 budget request for the Energy Resources Program is \$28,237,000 and 147 FTE, a net program change of \$1.0 million and 1 FTE from the 2009 Enacted level.

New Energy Frontier - Geothermal (+\$1,000,000 / 1 FTE)

As part of the Energy Policy Act of 2005, the USGS conducted an assessment of the moderate- and high-temperature geothermal resources of the United States, those resources capable of generating electricity. Subsequent work will highlight geothermal energy resources located on public lands, particularly working in conjunction with BLM and USDA-FS. The new assessment estimates the electric power generation potential of conventional identified geothermal resources at ~9,000 MW, of conventional undiscovered resources at ~30,000 MW, and of unconventional Enhanced Geothermal Systems (EGS) resources at ~500,000 MW.

The proposed funding would support studies to increase our detailed understanding of this underutilized, but potentially important resource. Geothermal energy constitutes one of the Nation's largest sources of renewable and environmentally benign electrical power, yet the installed capacity falls far short of estimated geothermal resources. In order to augment the results of the national assessment, studies will be undertaken to more fully understand the nature of geothermal systems and to better improve the viability of this important resource to contribute to the domestic energy mix. Program changes associated with the New Energy Frontier initiative are described in section C, Key Increases.

Program Performance Change

With the increase for geothermal as part of the New Energy Frontier initiative, the ERP will provide one formal workshop in 2010 and one systematic analysis in 2012.

Geologic Resource Assessments

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Request	Program Change Accruing in 2010	Program Change Accruing in Out-years
# of systematic analyses and investigations completed (ERP)	0	0	0	0	0	0	0	1
# of formal workshops or training provided to customers (ERP)	0	0	0	0	0	0	1	0
Comments	The performance measure changes indicated above are changes as a result of activities to be conducted in the Energy Resources as part of the New Energy Frontier initiative .							

Program Overview

The Nation faces simultaneous challenges from an increasing need for energy resources, dependence on imported petroleum resources, and growing demands to minimize environmental effects associated with energy resource development and utilization. The USGS ERP addresses these challenges by conducting research to better understand the fundamental processes that lead to the formation and accumulation of energy resources (oil, natural gas, coal, and others such as geothermal and gas hydrates) and the environmental and human health effects of energy resource occurrence and use. ERP scientists use the results of these geoscientific studies to evaluate energy resource accumulation and distribution and to assess the energy resource potential of the Nation and the world (exclusive of U.S. Federal offshore waters). ERP conveys results from these studies to land and resource managers and policymakers in support of the Department's goal of improving the understanding of energy and mineral resources. Collectively, this information is used to plan for a secure energy future and to allow for the strategic use and evaluation of resources. Major consumers of ERP products are the Department's land and resource management bureaus, other land management agencies such as the USFS, Federal environmental and national security agencies, policymakers and other Congressional offices, State geological surveys, the energy industry, the environmental community, the international energy community, academia, and the public.

2009 Enacted and 2010 Program Performance

Energy Policy Act of 2005 Implementation — The Energy Policy Act of 2005 calls for several major activities for which the USGS science is a critical component.

National Geological and Geophysical Data Preservation Program (Estimates for 2008, \$1.0 million; 2009, \$1.0 million; 2010, \$1.0 million)

Section 351 of the Energy Policy Act of 2005 established the National Geological and Geophysical Data Preservation Program. In 2007, 2008, and 2009, program priorities have been to support state geological surveys and DOI bureaus to inventory geological and geophysical data collections, create metadata for items in those collections, and provide a means for customers and stakeholders to discover the information through a web-based National Digital Catalog developed in conjunction with the USGS Geospatial Information Office.

Data include collections of physical Earth materials (rocks, soils, fluids, minerals, fossils), digital data collected from the Earth (seismic data, chemical data, well log data), and paper maps, charts, and logs. Significant resources were used to collect these irreplaceable data critical to understanding our Nation's resources and managing them wisely.

In 2007, the Program issued a Program Announcement inviting each State geological survey to apply for \$5,000 to begin inventorying their collections of geological and geophysical data and entering the information in an on-line collections inventory. Thirty-five State geological surveys responded and matched USGS funding of \$175,000 on a 1:1 basis resulting in a total of \$350,000 for States to inventory their collections.

In 2008, the USGS NNGDPP issued a Program Announcement inviting all State geological surveys to submit proposals for funding to continue inventorying collections and to begin creating metadata for items in those collections. The collection inventories and metadata will form the National Digital Catalog. The digital catalog will allow users to search for and discover geoscience data held by the States. Thirty-four States submitted proposals requesting a total of \$1,067,756 from the USGS. The USGS was able to provide \$541,000 which was matched on a 1:1 basis with State funds resulting in \$1,082,000 for States to inventory and create metadata.

In 2009, the USGS NNGDPP issued a Program Announcement inviting all state geological surveys to submit proposals to continue inventorying collections and creating metadata. The Program anticipates having \$550,000 to fund State efforts in 2009. Thirty States submitted proposals and the review panel is scheduled for March 25-27, 2009. The \$550,000 will be matched 1:1 by the States, resulting in \$1,100,000 to support inventory and metadata work. To date, there are approximately 375 collections entered in the on-line collections inventory representing several hundred thousand individual items. As work activities through the 2008 grants are completed, more collections will be added to the inventory and metadata files will be submitted for inclusion in the National Digital Catalog.

In 2009, the program is co-sponsoring a workshop for State participants to facilitate standardization of metadata formats and provide training to upload metadata records to the National Digital Catalog. The workshop is providing a forum to share best practices for data preservation.

Program priorities established in the 2006 Implementation Plan will be reviewed and evaluated as the Program begins writing a five-year plan in 2009.

Other Energy Policy Act Implementations — The Act addresses many energy sources, with an emphasis on assessment of geothermal resources, alternative energy sources such as gas hydrates and oil shale, and research into unconventional gas resources. The Act also reauthorizes the Energy Policy and Conservation Act Amendments of 2000 (EPCA), in which the USGS assesses the oil and gas resources underlying Federal lands in the United States. Detailed descriptions of these activities are given in the following sections.

Energy Independence and Security Act of 2007 Implementation – The Energy Independence and Security Act of 2007 calls for the USGS to develop a methodology for a national geologic carbon sequestration assessment and assist the BLM in an evaluation of geologic carbon sequestration on public lands and conduct a national assessment using the new methodology.

Geologic Resource Assessments

Geologic Carbon Sequestration Assessment Methodology

(Estimates for 2008, \$1 million; 2009, \$1.5 million; 2010, \$5.0 million [from Global Change Program])

The USGS has finalized a methodology to assess the Nation's resources for geologic carbon sequestration in oil and gas reservoirs and saline formations. This methodology has been designed to estimate storage resource potential that can be applied uniformly to geologic formations across the United States. The resource that is assessed is the volume of pore space into which CO₂ can be injected and retained for tens of thousands of years. The methodology uses probabilistic methods to incorporate uncertainty and natural variability in volumetric parameters. The methodology incorporates statistical evaluation of the sizes and numbers of potential storage sites to identify the range of possible storage resources within a storage assessment unit and the probability that some fraction of all the storage sites could retain a minimum storage mass of CO₂. The estimated mass of storage resource is further evaluated with parameters that describe the probability of successful containment of CO₂. Because the physical properties of CO₂ at subsurface pressures and temperatures are similar to the properties of petroleum, the CO₂ resource assessment methods reported are built on the principles of USGS geologic oil and gas resource evaluation and assessment. Oil and gas assessments conducted by the USGS evaluate the technically recoverable, undiscovered resource which is a fraction of the total in-place resource that may be recoverable with technology available at the time of the assessment and for some limited time into the future, for example, on the order of decades. Similarly, this assessment methodology for CO₂ storage resources focuses on the technically accessible resource, not a total in-place resource volume. This is a resource that may be available using present day geological and engineering knowledge and technology for CO₂ injection into geologic formations. No economic factors are used in the estimation of the volume of resource.

As required by the Act, the methodology will be made available for comment by the public and, as with all ERP assessment methodologies, an independent panel will be convened of individuals with expertise in these issues composed of appropriate representatives from Federal agencies, academia, nongovernmental organizations, State organizations, industry, and the international geoscience community to review the methodology. Upon completion of the review, the methodology will be published and available for public use.

Application of the new geological sequestration assessment methodology to evaluate the nation's potential resource of geological storage will begin in 2010, with funding from the New Energy Frontier initiative. The first year of this effort will focus on assessing the resource in known oil and gas fields, which is an extension of the existing practice of enhanced oil recovery using carbon dioxide injection. Subsequent years will focus on yet-to-be-discovered physical traps and saline formations.

National Oil and Gas Resources

(Estimates for 2008, \$14.5 million; 2009, \$15.0 million; 2010, \$15.0 million)

The Nation's future petroleum energy supplies will likely come from a mix of domestic natural gas accumulations, existing domestic oil and gas fields, from imports, and potentially from unconventional resources such as natural gas hydrates. The combination of concern about greenhouse gas emissions to the atmosphere, the re-enactment of the EPCA, and petroleum prices have collectively introduced a sense of urgency in the effort to identify and characterize the Nation's domestic petroleum resources. ERP research continues to focus on areas of the Nation that have high potential for future natural gas production (Figure 1), including coalbed

gas; those areas that have oil and gas resources under public lands; on the scientific challenge of reducing the uncertainty (or “improving the precision”) of petroleum resource assessments; and on studying unconventional resources such as natural gas hydrates and oil shale.

The ERP is estimating the volume of undiscovered oil and gas resources in the United States, including that underlying Federal lands. This scientific inventory of oil and gas resources on Federal lands is mandated by the EPCA (P.L. 106-469 §604) and forms the basis for the periodic report to Congress required by the Act. The EPCA legislation was reauthorized with the passage of the Energy Policy Act of 2005, P.L. 109-58. The legislation mandates use of USGS estimates of undiscovered oil and gas resources. The third phase of the EPCA inventory, “*Inventory of Onshore Federal Oil and Natural Gas Resources and Restrictions to Their Development*,” was released in May 2008. This document presented a comprehensive review of all Federal oil and gas resources in areas covered in Phases I and II, updated where needed, and six additional areas analyzed in detail (Central and Southern Alaska, Eastern Oregon-Washington, Ventura Basin, Williston Basin, and the Eastern Great Basin).

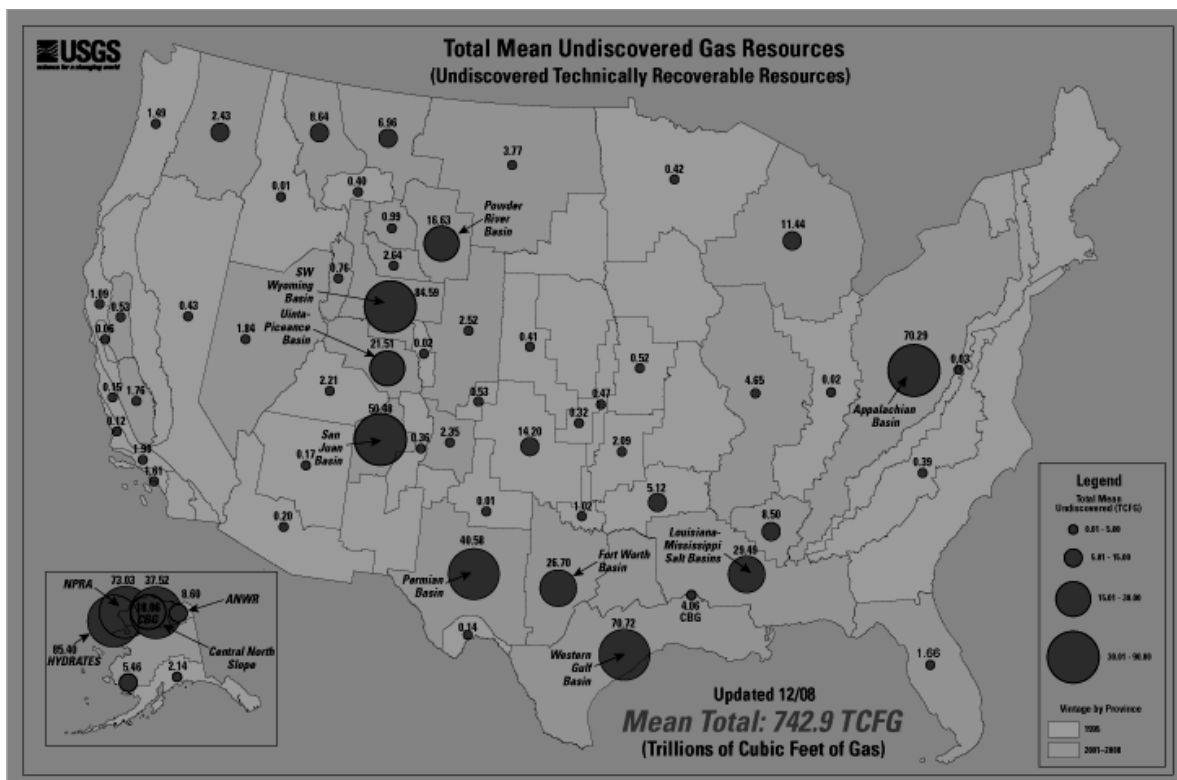


Figure 1. USGS estimates of total, mean, undiscovered, technically recoverable gas resources in the United States (available at http://certmapper.cr.usgs.gov/data/noga00/natl/graphic/2007/total_gas_mean_07.pdf)

The USGS will continue to update its oil and gas resource assessments for the United States and the world using a consistent, peer-reviewed methodology as authorized in the Energy Policy Act of 2005 (P.L. 109-58 §364). In 2009 and 2010, the USGS will complete assessments of the Cherokee Platform Province, the Arkoma Basin, the Anadarko Basin, Cook Inlet, and portions of the Gulf Coast.

As with all USGS petroleum assessments, the initial results are released in fact sheet form in order to provide assessment results to our many users in a timely fashion as soon as the assessment is completed. The assessment of the Bakken Formation, “*Assessment of*

Geologic Resource Assessments

Undiscovered Oil and Gas Resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, 2008," was released in April 2008 and can be found at <http://pubs.usgs.gov/fs/2008/3021>.

The geological model, data, interpretations, and all the background information used in an assessment are also published some months after the assessment is completed. The USGS strives to release information and data as quickly as possible consistent with adherence to accepted scientific practices, standard USGS release policies, and the Federal Data Quality Act. The benefit is objective, useful information that can be relied upon by policy makers and the public.

There are several publications released or planned that describe the information and interpretations used in the assessment of the Bakken Formation. The first of these, *"Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Bakken Formation, Williston Basin, Montana and North Dakota, 2008,"* has been completed and was released in December 2008. This report may be found at <http://pubs.usgs.gov/of/2008/1353/>. This report describes the framework geological studies and modeling of petroleum geochemistry, which was combined with historical exploration and production analyses, to estimate the undiscovered, technically recoverable oil resource of the Bakken Formation. This report also details the stratigraphic intervals assessed in the Bakken composite reservoir, and includes all producing intervals such as the Three Forks Formation and Sanish Member. All oil producing intervals in which the Bakken was found were included in the Bakken composite reservoir and assessed in early 2008. Bakken information also was presented at a regional Geological Society of America meeting in Dallas, Texas, in March 2009, at a Shale Reservoirs Symposium. The papers given at this session will be published as part of an American Association of Petroleum Geologists special publication.

Additionally, the petroleum resources of the entire Williston Basin have been assessed the the results published. These results, *"Assessment of Undiscovered Oil and Gas Resources of the Williston Basin Province of North Dakota, Montana, and South Dakota, 2008"* can be found at <http://pubs.usgs.gov/fs/2008/3092>.

Alaska — The North Slope of Alaska is thought to have the greatest remaining petroleum resource potential of any U.S. onshore area. The USGS is conducting an intensive examination of Alaska's geology and petroleum potential with current research focused on: synthesizing conventional oil and gas resources information for the entire North Slope of Alaska, including the National Petroleum Reserve Alaska (NPRA), Arctic National Wildlife Refuge (ANWR)-1002 area, the central portion of the North Slope (CNS), and the area west of NPRA; and, gathering the geologic information necessary to assess the nonconventional and unconventional resources of the North Slope, including heavy oil, coalbed methane, and gas hydrates.

During 2009, reports summarizing the aggregation of assessment results from ANWR, NPRA, CNS, and the area west of NPRA will be completed and estimates of undiscovered, technically recoverable petroleum resources for the entire northern Alaska province will be finalized. An economic analysis of the entire North Slope is also being developed that will take into account updated costs and will be based on the recently aggregated geologic assessment of the entire North Slope of Alaska. Field investigations will focus on gas-prone petroleum systems of the Brooks Range foothills, emphasizing research to reduce assessment uncertainties. Work on the Cook Inlet, an area of high resource potential and importance to Alaska, will continue in 2009 and 2010.

Gulf Coast Region — The Gulf Coast region is one of the major hydrocarbon-producing areas of the world. As such, the ERP is conducting investigations—using seismic, well, and geochemical data—into the geologic framework of this region. This effort will provide the geologic, geophysical, and geochemical framework studies necessary to evaluate the oil-, gas-, and coal-bearing rocks of TX, LA, MS, and AL that have the greatest potential for future oil, gas, and coalbed methane production. A better understanding of petroleum systems will enable USGS scientists to: (1) better assess the potential for undiscovered petroleum resources; and, (2) define potential onshore extensions of plays identified by the MMS for offshore Federal resources. Current cooperative efforts with industry, the State Geological Surveys and the MMS will continue to improve data quality and availability. During 2009 and 2010, project staff will conduct research in support of an assessment of the undiscovered petroleum resources within the Gulf Coast, with a focus on assessing the Bossier Shale and the Haynesville Shale during 2010, both of which are “continuous” accumulations of unconventional gas. This type of resource is recognized as having enormous potential and will be characterized in the upcoming assessment. The Cretaceous stratigraphic intervals will also be assessed in 2010.

Coalbed Methane — USGS geologists are investigating the potential coalbed methane (CBM) resources around the country, including southern Texas and north-central Louisiana, the Powder River Basin (PRB) in Montana and Wyoming, and other areas.

The USGS and the BLM have an ongoing cooperative agreement in the PRB under which the USGS, in the course of its national geologic studies, produces coal reservoir maps, stratigraphic cross sections, reservoir gas drainage maps, charts of coal reservoir characteristics, graphs of chemical and isotope composition of co-produced water, gas content charts, and estimates of CBM resources. These data and interpretations are used directly by BLM land managers, as well as gas operators and pipeline companies who are exploring and developing CBM resources. This information also enables land managers to moderate disputes between coal miners and gas operators. These data are also used by BLM, the Bureau of Indian Affairs (BIA), and several Tribes for land use management plans to forecast both the minimum number of wells necessary to produce a given volume of gas, and the anticipated effect of water extraction during field development on the surficial environment.

CBM gas content, high pressure adsorption (gas or liquid condensing on a surface) isotherms, isotope gas and chemical composition, and indigenous gas-generating microbes in low rank coals have not been well documented in coal basins such as in the PRB, Green River Basin (GRB), and Williston basins. Lack of publicly available, reliable, accurate data necessitated BLM to request ERP to collect new data in advance of development for their resource evaluation and land management work of Federal leases in these basins. In 2009 and 2010, the GRB, which is a new active CBM play, will be the focus of this effort and is following the PRB in the need of new data for BLM.

Origin and Controls on Microbial Gas Accumulations — Natural gas generated from microbial activity involving organic deposits (coal, black shale, petroleum) represents an increasingly important natural resource. Until recently, producers tended to ignore microbially derived natural gas deposits because they were considered too small to be economic; however the development in the PRB changed that perception. It is estimated that natural gas from microbial activity (methanogenesis) accounts for about 20 percent of the world's natural gas resource. Since this gas is biologically produced, it also represents a possible renewable resource.

Geologic Resource Assessments

Although a considerable body of research exists on the biology of methanogenesis, there is much less known about the microbially mediated conversion of materials such as coal to methane. Preliminary studies by the USGS and others have shown that coal gas in many parts of the United States is generated from microbial methanogenesis. The USGS will continue to conduct field and laboratory studies to better define the processes and organisms involved in microbial production of methane from these materials. In 2009 and 2010, ERP is examining new drilling opportunities in cooperation with BLM to examine factors influencing biogenic CBM production (e.g., geology, coal fracturing, groundwater quality, gas geochemistry), and to obtain new samples of coal, coal gas, coal-associated water, and endemic microbial populations for laboratory studies. Synthesis of the data and interpretation of methanogenesis pathways of the subbituminous coals of the PRB may assist to understand the potential to regenerate and sustain the coalbed gas in the PRB.

Continuous Resources — Continuous-type gas accumulations generally consist of large, single fields having spatial dimensions equal to or exceeding those of conventional plays, and, in contrast to conventional gas fields, cannot be represented in terms of discrete units delineated by downdip hydrocarbon-water contacts. Estimates show that the largest remaining undiscovered domestic resource occurs in what USGS scientists term "continuous" gas accumulations, e.g., coalbed methane and basin-centered gas from low-permeability geologic units such as 'tight gas sands' and 'shale-gas' reservoirs. (Note: Others use the term 'unconventional' when referring to these resources; however, because these resources can be developed with currently available technology and practices, the USGS employs a narrower definition for unconventional resources, e.g., referring to truly frontier, and currently uneconomic, energy resources such as gas hydrates and oil shale.) Understanding continuous gas resources — the fastest growing resource produced in the United States — is therefore critical, both in terms of the responsible use of this energy resource as well as the sustainability of the domestic energy supply. This work focuses on the identification of the controls on continuous-unconventional gas accumulations, the role of gas-generation processes, and the characteristics of petroleum and associated water. The goal is to develop a sound understanding of the evolution of present-day hydrocarbon accumulations, many of which are currently being produced, but with difficulty, because little is understood about these resources. The mechanisms of the petroleum systems that create and preserve continuous gas accumulations through geologic time are poorly understood for all types of continuous reservoirs. Efforts to reduce these uncertainties will substantially improve the USGS' ability to conduct future natural gas resource assessments. Research that will be emphasized during 2009 and 2010 are: (1) examination of gas-water-oil production, and (2) continued integration of controls on gas preservation.

Reserve Growth — The ERP has an important role in understanding and assessing petroleum resources, both domestically and internationally. Potential additions to reserves from these resources are from the discovery of new accumulations and reserve growth of existing fields. Approximately half of the world's additions to reserves are estimated to come from reserve growth. Because of the significant volumes of petroleum resources involved, the estimation of reserve growth is an integral part of USGS assessments. Because of the importance of reserve growth in accurately estimating resources, the ERP has a research activity focused on reserve growth to establish procedures to assess reserve growth by modifying new and existing methods and developing a strategy for assessing reserve growth that is peer reviewed before implemented. Reserve growth methods are being evaluated by the American Association of Petroleum Geologists (AAPG) Committee on Resource Evaluation (CORE).

Based on the recommendations of the outside peer-panel review, new and existing USGS methods will be selected to use individually or in combination to assess reserve growth. Test cases will be conducted on large and small parcels, as recommended by the panel, for quality assurance and applicability. Adjustments and modifications to the methods will be made and tested as needed. The resulting methodology will be implemented to provide probabilistic estimates of reserve growth. Activities in 2009 and 2010 will build on the AAPG CORE review and finalize a reserve growth methodology, publish that methodology, and begin the implementation of that methodology toward an estimation of reserve growth for selected geologic and geographic regions.

Gas Hydrates — Gas hydrate is a crystalline solid formed of water and natural gas (usually methane) and is potentially one of the most important energy resources for the future. The ERP participates in several international consortia composed of research, industry, and academic institutions. Currently, ERP works closely with the Indian Directorate General of Hydrocarbons (DGH) in an effort to study, characterize, and explore for hydrates off the coast of India. In 2008 and 2009, characterization of data from 21 sites offshore India, as well as examination of 3-D seismic data, will be conducted for future, more detailed study of offshore gas hydrates. The ultimate goal, depending on the results of the current studies, will be a gas hydrate production test in Indian waters. The data, syntheses, and analyses from the Indian collaboration will be invaluable in understanding world class hydrate accumulations and lessons learned will be transferable to U.S. domestic gas hydrate resources.

In 2008 and 2009, efforts have focused on research to characterize and assess the recoverability and production characteristics of permafrost-associated natural gas hydrates in the Prudhoe Bay-Kuparuk River area on the Alaska North Slope (ANS) and plan for an extended gas hydrate production test, probably to take place in 2010. In 2009, the USGS will continue to analyze and interpret the drilling results from the DOE/BPXA/USGS Mount Elbert Gas Hydrate Research Test Well, drilled in 2007, in order to continue to refine our geologic and engineering characterization of regional ANS gas hydrate occurrences and to develop detailed interpretations of the Milne Point Mount Elbert gas hydrate prospect. These data will be used to develop and constrain an extended gas hydrate production test on the ANS with the U.S. Department of Energy, BP Exploration, and other government and industry partners.

In 2008, the ERP completed the first-ever resource estimate of technically recoverable gas hydrates. The assessment of the undiscovered, technically recoverable gashydrate resources on the North Slope of Alaska (Figure 2) used a geology-based assessment methodology. The USGS estimates that there are about 85 trillion cubic feet of undiscovered, technically recoverable gas resources within gas hydrates in northern Alaska, which accounts for 11.5 percent of the volume of gas within all other undiscovered, technically recoverable gas resources onshore and in the state waters of the United States. The area assessed in northern Alaska extends from the National Petroleum Reserve in Alaska on the west through the Arctic National Wildlife Refuge on the east and from the Brooks Range northward to the state-federal offshore boundary (located three miles north of the coastline). The research project in support of this assessment was a cooperative effort with the BLM and the State of Alaska. In 2010, the USGS and BLM will focus on improving our understanding of gas hydrates as an energy resource in general and in northern Alaska, so that gas hydrates can be more effectively regulated and managed as a national resource. This project will also contribute to the DOE and industry led field programs designed to test existing and emerging gas hydrate production technology.

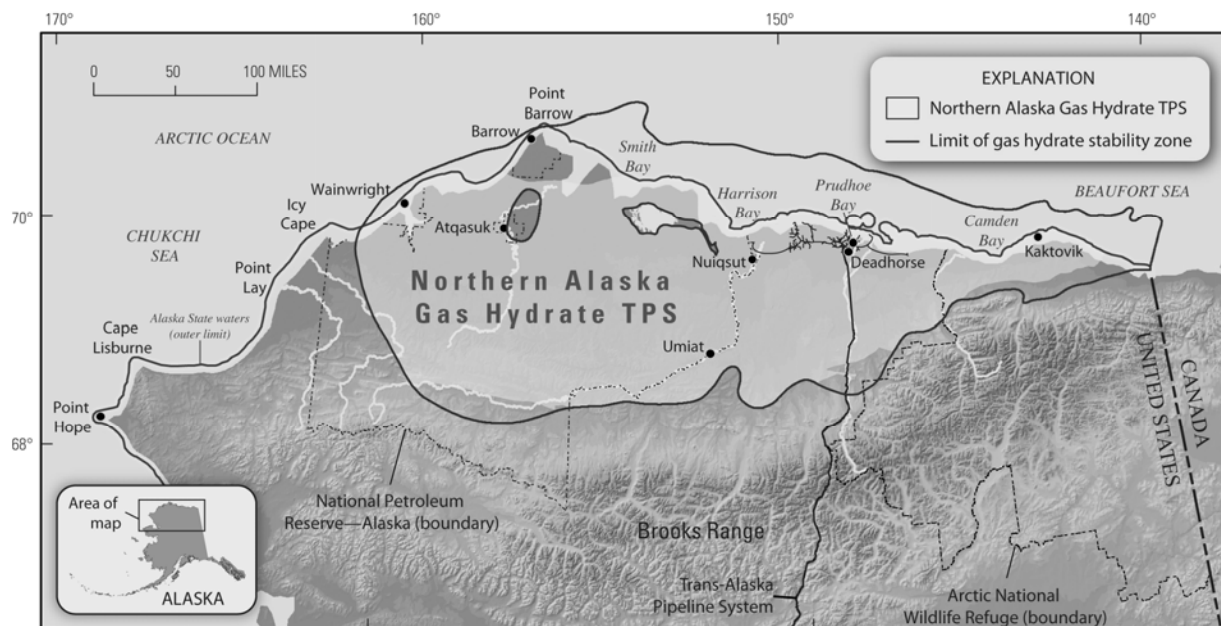


Figure 2. The Northern Alaska Gas Hydrate Total Petroleum System (TPS), and the limit of gas hydrate stability zone in northern Alaska (red outline).

The USGS continues to evaluate the distribution of gas hydrates in the Gulf of Mexico, participating in the Chevron- and DOE-led Joint Industry Project, with drilling and coring in 2009. The USGS has several key roles in this project, including pre-cruise seismic interpretation and drilling site evaluation, leading the logging while drilling operations during active deployment operations, and post-cruise data interpretation and write up. A number of excellent potential gas hydrate sites have been chosen for examination and this information will further our understanding of this energy resource in offshore areas in the Federal Outer Continental Shelf.

Oil Shale Resources – Published oil shale assessments are nearly 20 years old and need to be updated in order to understand the potential of oil shales to contribute to the U.S. energy mix. The Energy Policy Act of 2005 (P.L. 109-58 §369) recognized this need, and the USGS, in support of this Act, began a new national assessment of oil shale resources in 2009. In addition, previous studies did not include an evaluation of the presence or absence of minerals such as halite, nahcolite, or trona. Halite, in some cases occurring in significant quantities in oil shale, may require special handling. Nahcolite and trona are valuable resources that are presently mined at other locations, but the presence of these minerals in oil shale can affect the generation and extraction of oil from oil shale, as these minerals decompose when heated. The current USGS effort focuses on the oil shale resources of the Green River Basin. An assessment of these resources will be completed in 2009. Efforts are also underway to study and assess Devonian oil shales and other hydrocarbon bearing rocks having the nomenclature of “shale” located east of the Mississippi River, as mandated in the Act.

One important goal of the oil shale work is to make available on-line as much of the oil shale data from previous studies as possible, including geochemical (Fischer assay, a test for determining the oil yield from oil shale) data, scans of geophysical logs, core and rock descriptions, previous USGS assessments, and other publications. In addition, all USGS publications related to oil shale are now available online through the ERP web site.

Geothermal Resources

(Estimates for 2008, \$0.5 million; 2009, \$0.5 million; 2010, \$1.5 million)

Geothermal Resources — The last national geothermal resource assessment was published in 1979, and advances in the field of geothermal energy and technology indicate that much of that information, as well as the geologic models for geothermal resources, contained in the earlier assessment are outdated. Late in 2008, in support of the Energy Policy Act of 2005 (P.L. 109-58 §226), the USGS finished a 3-year project to produce a new national assessment of geothermal resources capable of producing electric power, with a focus on the western United States, including Alaska and Hawaii. This work is critical to our understanding of geothermal systems (Figure 3) and to determine the extent to which geothermal resources can play a part in the domestic energy mix. The research effort was conducted in partnership with the DOE, BLM, national laboratories, universities, State agencies, and a consortium of the geothermal industry. The results of this assessment indicate that full development of the conventional, identified systems alone could expand geothermal power production by approximately 6,500 MWe, or about 260 percent of the currently installed geothermal total of more than 2500 MWe. The resource estimate for unconventional EGS is more than an order of magnitude larger than the combined estimates for both identified and undiscovered conventional geothermal resources and, if successfully developed, could provide an installed geothermal electric power generation capacity equivalent to about half of the currently installed electric power generating capacity in the United States.

As part of the Energy Policy Act of 2005, the USGS conducted an assessment of the moderate- and high-temperature geothermal resources of the United States, those resources capable of generating electricity. Subsequent work will highlight geothermal energy resources located on public lands, particularly working in conjunction with BLM and USDA-FS. With a focus on efforts related to renewable energies, additional funding for geothermal activities would support studies to increase our detailed understanding of this underutilized, but potentially important resource.. In order to augment the results of the national assessment, studies will be undertaken to more fully understand the nature of geothermal systems and to better improve the viability of this important resource to contribute to the domestic energy mix. The work activities in 2010 include:

Life Cycle Models for Geothermal Systems – A critical issue in evaluating the nature and extent of geothermal resources is developing an improved understanding of the formation and evolution of the permeable faults and fractures that form most geothermal reservoirs. Characterizing and quantifying the interrelationships among the various geologic and geochemical parameters and effects on fluid and heat transport is critical to understanding what creates and maintains fracture permeability. Research will be devoted to the acquisition and analysis of data on the nature and evolution of geothermal systems in diverse environments. These studies will support the development of an improved geothermal resource assessment methodology relating geospatial observations to accurate predictions of the spatial and temporal frequency and distribution of geothermal reservoirs.

Unconventional Geothermal Resources - There are several unconventional geothermal resources that have potential for electrical generation, the most promising being Enhanced Geothermal Systems. EGS are geothermal resources that require some form of engineering to develop the permeability necessary for the circulation of hot water or steam and the recovery of heat for electrical power generation. The provisional evaluation of EGS in the new USGS assessment indicates that the electric power production potential from EGS is substantially larger than that from all conventional geothermal resources. Yet, significant questions remain regarding EGS development, and new research studies, in coordination with DOE, will be

Geologic Resource Assessments

directed at understanding the geologic and hydrologic aspects of EGS development and providing a framework for future assessments of EGS resource potential, including deep sedimentary basin environments.

Online Databases and GIS Products – As part of the resource assessment effort, supporting geological, geophysical, geochemical, and hydrologic data are being combined into databases and geospatial (GIS) maps for analysis. To provide detailed data to complement the assessment, to develop a solid foundation for future assessments, and to maintain comprehensive information on geothermal energy resources and development, these regional and system-specific databases will be placed online and updated on a regular basis. As new data and system understandings are developed in the two activities described above, they will be added to the databases and GIS maps. Availability of these types of data will also support the activities of local and national land and resource managers. The majority of geothermal resources in the United States are on public lands and the importance of data cannot be underestimated for responsible management of public resources.

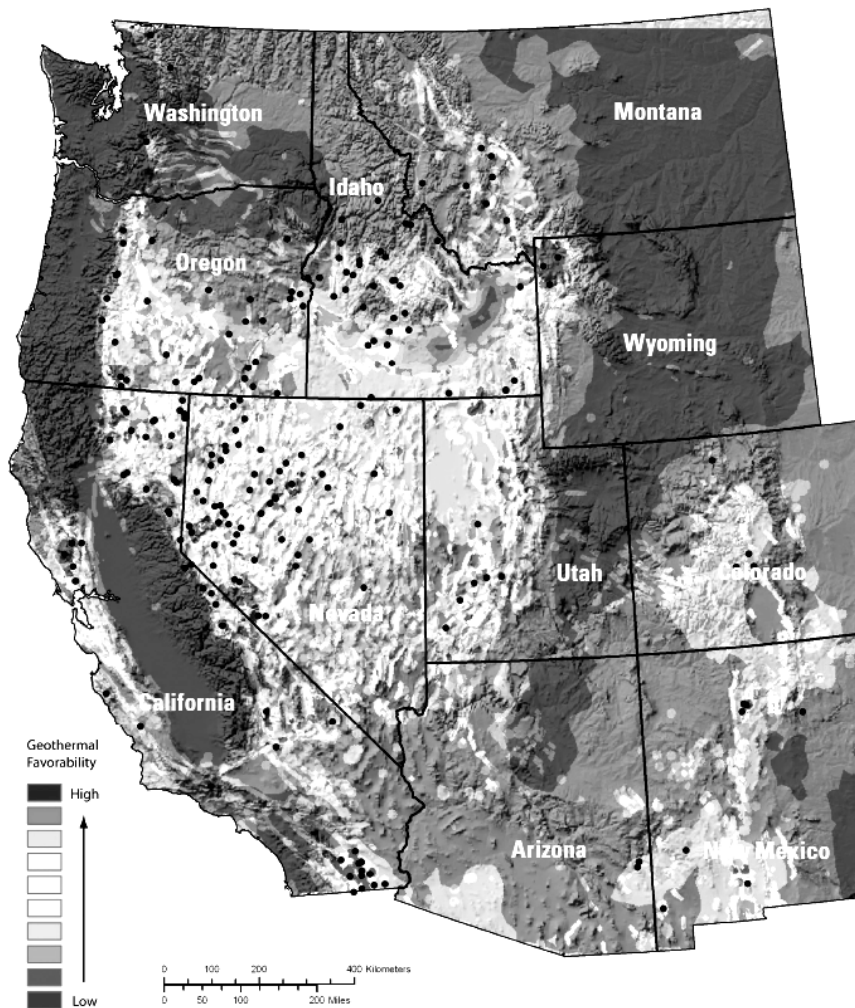


Figure 3. Example map from one of a series of 28 spatial models showing the relative favorability of occurrence for geothermal resources in the western contiguous United States. The other models differ in details but show generally similar favorability patterns. Warmer colors equate with higher favorability. Identified geothermal systems are represented by black dots.

In 2009 and 2010, in addition to finalizing the research products underpinning the assessment, additional research will focus on regional studies to augment the resolution of the national assessment. The primary objectives of which will be to (1) collect, analyze, and interpret those regional datasets that supplement a resource assessment, and (2) support development of a conceptual model that ties observations of particular parameters (e.g., thermal state of the crust, variations in basin depths) to the physical and tectonic processes (e.g., active extension, magmatic intrusions, fault interactions) responsible for the formation of geothermal systems. Consequently, a key emphasis throughout the life of the project will be on determining how information available at the regional level can be used to identify factors critical to the formation of geothermal systems that are often smaller than 10 km² in area and may not be characterized or identified by abundant surface manifestations. This effort represents an important extension of the national assessment, which focuses on geothermal resources within identified geothermal systems.

National Coal Resources

(Estimates for 2008, \$2.2 million, 2009, \$2.2 million: 2010, \$2.2 million)

Previous USGS ERP coal resource assessments evaluated the total in-ground coal resource. The USGS ERP has recently revised the USGS assessment methodology to determine the subset of U.S. coal resources that is both available for mining and technically recoverable (i.e., the coal reserve base). In 2006, ERP started to systematically evaluate the PRB, the single largest producing coal basin in the United States. In 2008, ERP published the revised assessment for the Gillette Coal Field, the largest coal field within the PRB. Work on the entire PRB will continue throughout 2009 and other analysis of other basins will begin in 2010 using this new approach, with a focus on coal-bearing basins of the Colorado Plateau. These new studies will illustrate how much resource is actually available and technically recoverable.

Federal and State land managers can use these results to support land-use decisions; environmental regulators use the information to evaluate compliance with regulations stemming from the 1990 Amendments to the Clean Air Act; and economists use the results to forecast economic trends at regional and national scales. Electric utilities, coal producers, and coal consumers also use these results and products for evaluating the availability and quality of coal feedstock to electricity generating power plants and to achieve compliance with emission standards and other environmental regulations. These studies form the basis for addressing the challenge of future changes in the energy mix as the Nation responds to increasing demands for cleaner-burning coal. The ERP is working closely with counterparts at other organizations (BLM, the Energy Information Administration, the Securities and Exchange Commission, and the Office of Surface Mining) to ensure that the revised products address a variety of needs.

The need for such a reserve evaluation of the U.S. coal endowment was emphasized in a recent National Academies of Science study "*Coal: Research and Development to Support National Energy Policy*" (2007). That study recognized the importance of coal to the U.S. economy and that Federal policy makers require accurate and complete estimates of national coal reserves to formulate coherent national energy policies. The study also validated the USGS role in such an effort by recommending that the USGS lead a Federal-State-industry initiative to quantify and characterize the Nation's coal reserves.

Geologic Resource Assessments

World Oil and Gas Resources

(Estimates for 2008, \$2.3 million; 2009, \$2.3 million; 2010, \$2.3 million)

Energy is critical to the health and vitality of the United States and world societies. Credible scientific information on the abundance and geologic distribution of energy resources is critically needed. The USGS World Petroleum Assessment Project conducts geologic studies that improve the understanding of the quantity, quality, and geologic distribution of world oil and gas resources.

In 2008 the USGS released the Circum-Arctic Resource Appraisal (CARA). This assessment of undiscovered conventional oil and gas resources covered all areas north of the Arctic Circle. Using a geology-based probabilistic methodology, the USGS estimated the occurrence of undiscovered oil and gas in all geologic provinces thought to be prospective for petroleum. The sum of the mean estimates for each province indicates that 90 billion barrels of oil, 1,670 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the Arctic, of which approximately 84 percent is expected to occur in offshore areas. This work builds on previous ERP world petroleum assessments, which identified the Arctic region as an area of significant petroleum potential. Knowing the potential resources of the Arctic — an area of tremendous resource potential, environmental sensitivity, technological risk and geological uncertainty — is critical to the understanding of natural resources and of future energy supplies to the United States and the world. The CARA shows that these resources account for about 22 percent of the undiscovered, technically recoverable resources in the world. The Arctic accounts for about 13 percent of the undiscovered oil, 30 percent of the undiscovered natural gas, and 20 percent of the undiscovered natural gas liquids in the world. In addition to the resource assessment, the USGS is conducting a full cycle analysis to put the resource estimates into an economic focus. Resource cost curves are being developed which will provide an indication of the viability of these resources economically. This full cycle analysis will be finished in 2009. Other analyses and syntheses of the data and results from the CARA will be developed throughout 2009 and 2010.

Currently, ERP is prioritizing and re-assessing basins of the world that were included in the USGS 2000 assessment with a focus on the Arabian Peninsula. In addition, ERP will initiate a screening process for the presence/absence of unconventional resources (heavy oil, tight gas, shale gas, coal-bed gas) in priority basins of the world.

Energy Information and the Environment

(Estimates for 2008, \$4.6 million; 2009, \$4.6 million ; 2010, \$4.6 million)

The production and use of all energy sources generates some type of environmental impact. For example, oil and gas production is attended by water production that must be disposed of in some way and coal combustion sometimes produces a wide range of potentially hazardous substances.

ERP scientific studies focused on environmental and human health challenges include characterization of waters co-produced with oil, gas, and coalbed methane, in order to determine best disposal practices, coastal subsidence associated with oil and gas production, and human health impacts of energy resource occurrence and use.

Coal Quality and Human Health — The USGS ERP conducts research to understand the natural variability of coal quality, and the ramifications of such variability on environmental quality and human health. For example, in many parts of the country and the world, coal

deposits may act as natural aquifers and convey large amounts of potable water. Balkan Endemic Nephropathy (BEN), a disease thought to develop from long-term exposure of susceptible individuals to low levels of toxic organic compounds derived from coal in drinking water in many parts of the Balkans, has been extensively studied by the USGS in conjunction with the human health care sector and international doctors. The ERP continues to build on the expertise developed during the BEN study by evaluating linkages in the United States and other countries where the confluence of specific human diseases and toxic organic compounds from coal may occur. In the United States, the water obtained from low-rank coal beds, either by drinking water wells or by coalbed methane production wells, may have leached toxic organic compounds from coal. The ERP is characterizing water quality in these settings. ERP researchers have been contacted by a number of foreign scientists who have noted BEN-like symptoms within their own countries. A number of cooperative efforts have formed from these contacts, leading to an increased understanding of this disease.

Because more than half of the Nation's electric power supply relies on coal as a fuel, and electric power demand will continue to increase in the future, an understanding of the connections among coal quality, environmental quality, and human health during aspects of coal resource utilization is essential to resource managers and policymakers alike. The ERP will continue to work with representatives from the human health care sector Center for Disease Control (CDC), National Institutes of Health (NIH), National Institute of Environmental Health Sciences, and other domestic and international groups of doctors, epidemiologists, and health care providers to investigate health effects that may be associated with energy resource use.

National Coal Resources Data System (NCRDS) – The NCRDS provides the world's largest, most comprehensive, publicly available, electronic coal quality and quantity databases. Started more than 25 years ago, the USGS databases contain information on the location, quantity, attributes, stratigraphy, and chemical components of U.S. coal deposits, including quality analyses of more than 14,000 coal samples and some 200,000 stratigraphic records. At least 136 coal-quality parameters are determined, including detailed location information and a wide range of physical and chemical properties. The NCRDS stratigraphic database contains more than 30 parameters describing the geologic section measured from drill holes and surface exposures including specific geo-referenced information. These data are accessible through USGS-constructed interfaces to perform several analytical capabilities and produce a robust suite of products addressing several coal resource assessment issues, including: locating coal deposits having desirable characteristics for various uses; assessing environmental impacts of coal use; evaluating coal resources; and describing technological properties of coal from specific areas and beds. A long-term partnership of the USGS and approximately 22 State geological surveys, both contributors to and users of the databases, has formed the basis of this sustained effort to collect, correlate, and analyze the basic data, build and verify the databases, and digitally utilize these USGS-maintained data sets. Portions of the coal resource and geochemical databases can be found on the USGS Energy Web site (<http://energy.usgs.gov>), or interested parties may request selected data in several formats.

Geologic Resource Assessments

Program Performance Overview

End Outcome Goal 2.4: Improve the understanding of Energy and Mineral Resources to Promote Responsible Use and Sustain the Nation's Dynamic Economy.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of energy and mineral resource information and systematic analyses needed by land and resource managers for informed decision making										
# of targeted basins/areas with energy resource assessments available to support management decisions (SP) (ERP)	A	7	6	5	5	5	5	5	0	5
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure the quality and relevance of science information and data to support decision making										
% of studies validated through appropriate peer review (SP)	A	100% (7/7)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	100% (5/5)	0	100% (6/6)
Efficiency and Other Output Measures										
# of gigabytes collected annually (ERP)	A	97.793	158.048	37.409	20.038	1.173	3.1189	3.3229	+0.204	3.3831
# of gigabytes managed and distributed cumulatively (ERP)	C	351.289	509.338	546.747	544.864	547.92	551.451	557.138	+5.687	567.227
# of metadata records (Data Preservation)		NA	NA	NA	NA	NA	New measure baseline	TBD	-	TBD
# of systematic analyses and investigations completed (ERP)	A	7	5	5	5	5	5	5	0	6
Total Actual/Projected Cost (\$000)		19,110	9,900	7,800	13,750	13,750	13,750	13,750	0	
Average cost of a systematic analysis or investigation (ERP)	A	\$2.73M	\$1.98M	\$1.3M	\$2.75M	\$2.46M	\$2.75M	\$2.75M	0	\$2.75M
Comment	2007 actual exceeded target. Target cost per systematic analysis is based on a National average that includes research in varied terrain, conditions, and geographic locations. The analyses completed in 2007 did not include extreme conditions and the cost was therefore were lower than the National average.									

Energy Resources

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
# of formal workshops or training provided to customers (ERP)	A	8	8	8	8	8	8	9	+1	8
Total actual/projected cost (\$000)		120,000	120,000	120,000	120,000	120,000	120,000	120,000	0	
Actual/projected cost per workshop (whole dollars)		15,000	15,000	15,000	15,000	15,000	15,000	15,000	0	

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Water Resources Investigations

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Hydrologic Monitoring, Assessments, and Research (\$000)	151,367	150,786	+3,042	+1,992	155,820	+5,034
<i>FTE</i>	973	897	0	0	897	0
Cooperative Water Program (\$000)	62,849	64,078	+1,483	0	65,561	+1,483
<i>FTE</i>	709	692	-12	0	680	-12
Water Resources Research Act Program (\$000)	6,304	6,500	0	0	6,500	0
<i>FTE</i>	2	2	0	0	2	0
Total Requirements (\$000)	220,520	221,364	+4,525	+1,992	227,881	+6,517
Total FTE	1,684	1,591	-12	0	1,579	-12

Activity Summary

The 2010 budget request for the Water Resources Investigations Activity is \$227,881,000 and 1,579 FTE, which is a net program change of +\$1,992,000 and 0 FTE from the 2009 enacted level. Additional information on program changes is provided in each subactivity section and in the Key Increases section beginning on page C-1.

Since 1879, the USGS has been involved in issues related to water availability, water quality, drought and flood hazards. This legacy continues through the efforts of hydrologic professionals and support staff located in all 50 States and Puerto Rico. As the primary Federal science agency for water information, the U.S. Geological Survey monitors and assesses the amount (quantity) and characteristics (quality) of the Nation's freshwater resources, assesses the sources and behavior of contaminants in the water environment, and develops tools to improve the management and understanding of water resources. The information and tools allow the public, water managers and planners, and policy makers to:

- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land surface movement;
- Effectively manage freshwaters, both above and below the land surface, for domestic, public, agricultural, commercial, industrial, recreational, and ecological uses;
- Protect and enhance water resources for human health, aquatic health, and environmental quality; and
- Contribute to wise physical and economic development of the Nation's resources for the benefit of present and future generations.

Fundamental to USGS water science is the collection and public dissemination of data describing the quantity and quality of the Nation's freshwater resources. For more than 120 years, the USGS has collected streamflow data at over 21,000 sites, water-level data at over 1,000,000 wells, and chemical data at over 338,000 surface-water (streams, rivers, natural lakes, and man-made reservoirs) and groundwater (water beneath the land surface) sites. These data are available online through the National Water Information System (NWIS) at <http://waterdata.usgs.gov/nwis>.

The water resources research, information, and monitoring activities currently underway in Water Resources Investigations programs will provide the foundation for development of a water census of the United States - one of six USGS strategic science directions identified in the USGS Science Strategy, Circular 1309, *Facing Tomorrow's Challenges – U.S. Geological Survey Science in the Decade 2007-2017*. A water census will fulfill the need for a comprehensive, scientific accounting of the status and trends of freshwater quantity and quality for human and environmental needs. Fundamental information on how much freshwater is available, and whether that supply of freshwater is increasing or decreasing over time, is essential for the Nation's economic and environmental health.

Program Reviews

To ensure that USGS programs are meeting the water science and information needs of the Nation, the USGS commissioned the National Academy of Sciences (NAS) to conduct the first independent and holistic review of USGS Water Resources programs. In 2006, the NAS National Research Council (NRC) formed a Committee on Water Resources Activities at the USGS. The Committee has looked at a wide variety of data collection and dissemination, hydrologic investigations and analyses, and basic and applied hydrologic research. The purpose of the review is to assess the water program and recommend how the USGS can best address the Nation's priority water issues. Such reviews in the past have yielded a strong endorsement of the USGS mission and provided useful insights to guide future program development. The NRC assembled a highly qualified panel of water resources experts from government, academia, and nongovernmental organizations. The Committee met with a wide range of USGS managers, scientists, and customers to obtain a full range of insights into our current program. At present, the Committee on Water Resources Activities at the USGS is preparing their final report. In recent years, the NRC has conducted detailed reviews of the National Streamflow Information Program (NSIP), the National Water Quality Assessment Program (NAWQA), the Water Use Program, Watershed Research, and River Science, among other topics. The last comprehensive review of the Water Discipline as a whole was completed in 1991.

"River gage data are critically important for flood safety and damage prevention. Historic flow information is used for floodplain mapping, which documents flood risks. These maps are vital tools for managing development in flood-prone areas and designing mitigation projects that protect lives and property (and thus reduce disaster relief expenses). Accurate historical flow information is also essential for designing bridges, dams, and other infrastructure. Real-time river flow and lake level gage data are used by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service to develop river and lake level forecasts. These forecasts and the current gage data are used for emergency operation of flood control projects (installation of levee closures, managing dam releases, etc.). Emergency personnel also rely on accurate real-time data and timely forecasts to respond effectively during flood events. These flood protection and response activities are credited with saving millions of dollars in flood damages. And more importantly - they save lives."

New York State Floodplain and Stormwater Managers Association
November 5, 2008

Our commitment to external review is also demonstrated by plans underway to have the NRC review the new 10-year plan for the NAWQA Program, 2013-2023, including recommendations on improvements to NAWQA's design and implementation to address the water-quality issues of the 21st Century. This review is scheduled to be completed in 2011.

The Office of Water Quality, Office of Groundwater, and Office of Surface Water collaborate to assemble multidisciplinary teams to conduct scientific technical reviews of Water Science Center (WSC) activities within the Water Resources programs of the USGS. These WSC reviews are scheduled at approximately 3-year intervals to allow for any given WSC to be reviewed once every 3 years. The purpose of WSC reviews is to ensure that all offices produce

nationally consistent hydrologic data and information that meet USGS standards. The reviews also assess overall strengths and weaknesses of the technical program and make recommendations for improvement.

Finally, the USGS has asked hydrologic equipment vendors to review field practices for water quality monitoring, surface-water monitoring, and groundwater monitoring. Their value engineering study began in March 2009 and their conclusions are expected in Fiscal Year 2010.

Subactivity Overview

Water Resources Investigations comprises three subactivities that operate with three distinctly different funding mechanisms:

The **Hydrologic Monitoring, Assessments, and Research subactivity** includes six programs funded directly from Federal appropriations and conduct work primarily in-house, using the expertise of USGS scientists. The programs in this subactivity include: Groundwater Resources (GWRP), NAWQA, Toxic Substances Hydrology, Hydrologic Research and Development, NSIP, and Hydrologic Networks and Analysis (HNA). These programs are primarily research oriented, with the exception of NSIP and portions of HNA, which focus on long-term data collection, and NAWQA, which provides status and trends information on water-quality conditions across the Nation. For 2010, the USGS is requesting increases in HNA (+\$200,000) as part of the Secretary's A New Energy Frontier initiative and NSIP (+\$5.0 million) to enhance the National Streamgauge Network. Details for each program requesting funds in 2010 are included in the individual program sections.

The **Cooperative Water Program subactivity** provides information needed to understand the Nation's water resources through a program of shared efforts and funding with State, local, municipal, and Tribal agencies. Authorizing legislation requires that partnering States and localities pay at least half the cost of the work that the USGS performs under this subactivity. The program effectively leverages Federal appropriations and develops program priorities in concert with partners to respond to both local and national needs. About half of program funding supports basic data collection, including 65 percent of the USGS streamgaging network, while the remaining half supports interpretive investigations which address water resources issues at both the local and national level. In recent years, non-Federal partners have increasingly supported a larger share of the program than is called for in the authorizing legislation. As State and local budgets become more constrained, it is unlikely that State and local funding for the program can be sustained at recent levels and could result in losses to the Nation's hydrologic information network.

Through the **Water Resources Research Act Program subactivity**, the USGS administers grants for 54 State research institutes designated by the Water Resources Research Act of 1984, as amended by the Water Resources Research Act Amendments of 2006 (Public Law 109-471). The program supports academic research to aid in the resolution of State and regional water problems, promotes technology transfer, and provides for the training of scientists and engineers. Grant monies under this program must be matched by the receiving universities.

Performance Improvement

The USGS has successfully used a number of external processes to review its science directions: Federal interagency groups, Federal advisory groups (that include Federal, State, and local agencies and private and non-governmental organizations), professional or academic science groups, and hydrologic equipment vendors. The USGS continues to take a lead role in working with other Federal agencies to review and integrate water information systems and develop water monitoring plans -- with the Environmental Protection Agency (EPA), the USGS leads the National Science and Technology Council (NSTC), Committee on Environment and Natural Resources (CENR), Subcommittee on Water Availability and Quality (SWAQ) in development and implementation of a strategic plan for Federal science and technology to support United States water availability and quality.

The USGS also recognizes the value of partnerships with Federal, State, local, and Tribal agencies and private and non-governmental organizations. The USGS plays an active role in the Advisory Committee on Water Information (ACWI) and several of its work groups including the National Water Quality Monitoring Council, the Subcommittee on Hydrology, and the Subcommittee on Groundwater. Through these and other partnerships, the USGS builds collaborative relationships and creates opportunities to establish mutually productive partnerships that keep science relevant and leverage scarce resources.

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Groundwater Resources Program

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Groundwater Resources Program (\$000)	7,853	9,008	+126	-900	8,234	-774
Total FTE	51	50	0	0	50	0

Summary of 2010 Program Changes for Groundwater Resources Program

Request Component	(\$000)	FTE
• San Diego Aquifer Mapping	-900	0
TOTAL Program Changes	-900	0

Justification of 2010 Program Changes

The 2010 budget request for the Groundwater Resources Program (GWRP) is \$8,234,000 and 50 FTE, a net program change of -\$900,000 and 0 FTE from the 2009 Enacted level.

San Diego Aquifer Mapping (-\$900,000/-0 FTE)

This reduction eliminates congressional action related to San Diego Aquifer mapping. This project is not an Administration or USGS priority and does not address the highest priority science needs in groundwater research and monitoring. This reduction will allow the core GWRP to remain intact.

Program Overview

Groundwater is one of the Nation's most important natural resources and is becoming increasingly important to all our lives. Groundwater is the primary source of drinking water to approximately half the Nation's population, provides about 40 percent of the irrigation water necessary for the Nation's agriculture, sustains the flow of most streams and rivers, and helps maintain a variety of aquatic ecosystems. Understanding this resource and how it is used is critical to the USGS strategic science direction of a water census for the U.S. The continued availability of groundwater is essential for current and future populations and the economic health of all 50 States.

The goals of the GWRP are to —

- Identify, describe, and make available fundamental information regarding groundwater availability in the Nation's major aquifer systems, and evaluate this information over time,

Hydrologic Monitoring, Assessments, and Research

- Characterize the natural and human factors that control recharge, storage, and discharge in the Nation's major aquifer systems, and improve understanding of these processes,
- Develop and test new tools and field methods for analyzing groundwater flow systems and their interactions with surface water, and
- Provide scientific leadership across all USGS programs on matters pertaining to the Nation's groundwater resources, including research directions, quality control, technology transfer, and information storage and delivery.

2010 Program Performance

Performance in GWRP is impacted by funding from other Water Resources Programs such as the Cooperative Water Program. In 2009, GWRP will review and propose revision to the performance measure which addresses the percentage of groundwater stations that have real-time reporting capability in the groundwater climate response network. During 2006 and 2007, the network in total grew more than the number of wells reporting real-time because funding partners opted to fund more non-real-time stations. As a result, the relative proportion of the network that is reporting real-time declined. Real-time measurement continues to grow in the USGS-funded portion of the network. As noted in the 2006 and 2007 year-end reports, overall expansion of the network can result in a decrease in the performance metric because not all of the new wells added to the network are real-time. In 2008 and 2009, the network expanded to include both Federal and cooperatively funded wells to make a larger climate network.

To address the goals listed in the Program Overview, the GWRP is planning the following activities for 2010 and anticipates these associated major accomplishments:

National and Regional Groundwater Evaluations

(Estimates for 2008, \$2.9 million; 2009, \$3.3 million; 2010, \$3.3 million)

The depletion of groundwater at a variety of scales and the compounding effects of recent droughts emphasize the need for an updated status on the availability of the Nation's groundwater resources. Assessments of the current state of the highest stressed groundwater flow systems are necessary tools for characterizing the availability of groundwater.

The GWRP is taking advantage of the quantitative work previously conducted by the Regional Aquifer-System Analysis (RASA) Program and information available from other USGS programs, other Federal agencies, States, Tribes, and local governments to provide an updated quantitative assessment of groundwater availability in areas of critical importance. Those assessments that are currently underway and continuing into 2010 and beyond will:

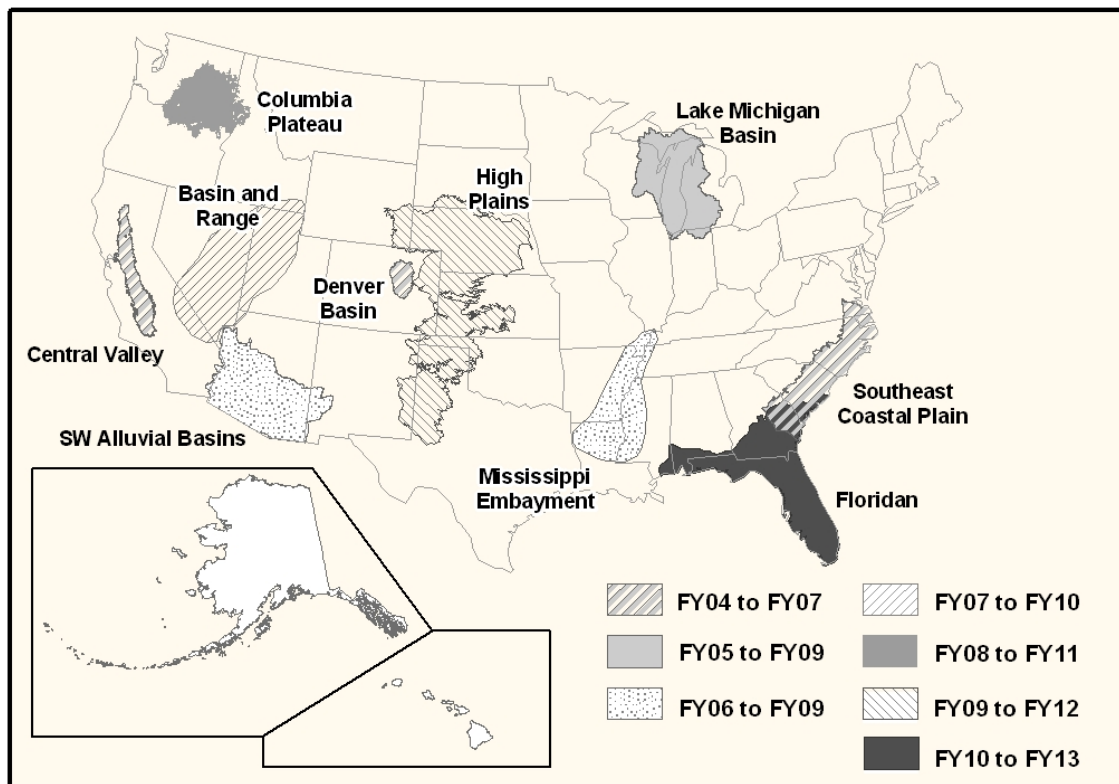
- document the effects of human activities on water levels, groundwater storage, and discharge to streams and other surface-water bodies,
- explore climate variability impacts on the regional water budget, and
- evaluate the adequacy of data networks to assess impacts at a regional scale.

There is growing recognition by water managers and municipalities of many fundamental advantages of managing groundwater resources on a regional, aquifer-wide scale. They are exploring ways to better manage known groundwater resources while also identifying supplemental sources of water. Upon completion, these multidisciplinary studies of regional groundwater availability across the U.S. will provide resource managers and policy makers with

essential information needed for managing limited water resources in areas experiencing chronic water-supply issues and concerns. As such, results from these studies are requisite for a comprehensive water census of the Country.

Investigations consist of multiple large-scale study areas or aquifers that collectively make up a national assessment of groundwater availability. Individual studies form the building blocks that can be used to develop a comprehensive regional and national perspective. In 2008, the USGS released Circular 1323 (<http://pubs.usgs.gov/circ/1323/>) that identifies challenges in determining ground-water availability, summarizes the current state of knowledge from a national perspective, and outlines an approach for developing the needed understanding of future water availability. Regional evaluations of the Nation's principal aquifers would form the foundation for a national assessment of ground-water availability. Thirty regional aquifers were identified that would build on a base of previous and ongoing ground-water studies that have been undertaken by USGS, other Federal agencies, States, Tribes, and local governments. The approach to national ground-water assessment described in the report is a key element of the water census of the United States, which is a strategic science direction of the USGS, as well as part of the proposed Federal science strategy to meet nationwide water challenges by the National Science and Technology Council (2007) Subcommittee on Water Availability and Quality. In 2010, the regional groundwater availability study in the Basin and Range Carbonate-Alluvial Aquifer System (Utah, Nevada, Idaho, and California) will be completed. At the same time, regional groundwater evaluation studies focused on the Columbia Plateau (Oregon, Washington, and Idaho), the High Plains Aquifer (Wyoming, South Dakota, Colorado, Nebraska, Oklahoma, Kansas, New Mexico, and Texas), and the initial year of the Floridan Aquifer (Florida, Georgia, Alabama, and South Carolina) study will be underway.

Location of Regional Groundwater Availability Studies



Interactions of Groundwater with the Environment

Estimates for 2008, \$3.2 million; 2009, \$3.9 million; 2010, \$3.0 million)

Over the past decade groundwater issues have evolved in scope and complexity as a result of escalating demands for the resource. USGS scientists are capable of addressing this increasing complexity by targeting a variety of information needs with a multi-faceted approach to understanding groundwater and linkages to humans and the natural environment. To that end, the GWRP will continue activities related to groundwater resource assessment while also recognizing the need to investigate all aspects of groundwater and its interdependence with the environment. The implementation of such an approach will be met through the Program's involvement in the following topical areas.

Field Methods and Model Development

In 2010, the GWRP will continue to search for more efficient methods to evaluate groundwater resources at a variety of scales. The USGS has been at the forefront of devising new analytical techniques to solve practical problems in the study of groundwater resources. Geophysical methods and application research, along with groundwater model development are specialized activities that support and benefit all USGS projects in accomplishing organizational goals.

The USGS, through the GWRP, conducts research into new and emerging geophysical methods and applications for groundwater investigations. Near-surface geophysical techniques can be used to rapidly and effectively characterize the shallow subsurface and to monitor hydrologic and remediation processes in ways not previously possible with standard technology. In 2010, the Branch of Geophysics will direct their efforts towards quantitative investigations of the spatial and temporal nature of hydrogeologic structures and processes. Ultimately, this continued effort to explore new technologies and their implementation in the field will help solve real world problems.

The USGS is at the forefront of devising numerical techniques to solve practical problems in the study of groundwater resources. Predictive models are needed to make informed decisions in many emerging areas related to the effects of groundwater development. New models and methods enhance all USGS water programs and provide critical tools and information needed for informed water-resource decision making. State and local governments as well as groundwater scientists and engineers in the private sector regularly use USGS models as an integral part of their work. The USGS Modular Groundwater Flow Model (MODFLOW) is the most widely used program in the world for simulating groundwater flow. In 2010, the Groundwater Resources Program will continue to support the enhancement of MODFLOW with updates that help scientists and engineers simulate common features in groundwater systems. New features will be added and the model will be updated to incorporate advancements in our understanding of groundwater hydrology, to respond to changes in user needs, and to take advantage of constantly increasing computing power. Moreover, in 2010, the GWRP will continue to support the application of USGS groundwater models in complex aquifer settings and to examine challenging water-resource management issues such as assessing water availability, saltwater intrusion, and the effects of groundwater withdrawals on aquatic ecosystems.

Data and Groundwater Level Monitoring

Collection of fundamental groundwater information is critical to the ability to assess and quantify the availability of the Nation's groundwater resources. The USGS maintains a database of groundwater data records from about 850,000 wells that have been compiled during the course of groundwater hydrology studies over the past 100 plus years. The GWRP makes these data

available for several networks in an easily accessible manner via the Internet (<http://groundwaterwatch.usgs.gov/>). The web pages group related wells and data from active well networks, and provide basic statistics about the water-level data collected by USGS water science centers and supplied by USGS partners through cooperative agreements. The Active Groundwater Level Network contains water levels and well information from more than 20,000 wells that have been measured by the USGS or USGS cooperators at least once within the past 365 days. This network includes all of these wells, regardless of measurement frequency, aquifer monitored, or the monitoring objective. Additionally, the Groundwater Climate Response Network was also developed and continues to be maintained to assess changes in groundwater conditions due to climate stresses. The groundwater climate response network, although small, continues to grow as the public, water managers, and scientists better understand the connection between climatic variations and shallow groundwater aquifers. The Climate Response Network Web pages are part of the *USGS Groundwater Watch Website*, which is the official USGS Website for illustrating current groundwater conditions in the United States and Puerto Rico. Moreover, it is necessary to perform periodic evaluation of water levels on a regional scale to properly inventory groundwater reserves in areas experiencing intense development, such as the High Plains aquifer, Atlantic Coastal Plain Aquifers, the Sparta-Memphis Aquifer, and the Columbia Plateau aquifers.

Technical Support

(Estimates for 2008, \$1.7 million; 2009, \$1.8 million; 2010, \$1.9 million)

This support provides quality control to assure the technical excellence of the groundwater field programs and provides a structured way of transferring new technology to activities that are conducted at USGS Water Science Centers in each State. This program component also provides a formal way of establishing research priorities and making groundwater information available to other agencies, the scientific community, and the public.

Major accomplishments anticipated from the Groundwater Resource Program in 2010 include—

- USGS professional papers assessing groundwater availability of the southeastern Coastal Plain aquifer system (North and South Carolina); the Denver Basin aquifer system (Colorado); and the Central Valley aquifer system (California) will be published.
- The Water Availability and Use Pilot study in the Great Lakes Basin and an effort focused on groundwater resources in the southwest alluvial basins of Arizona will release their findings. The Great Lakes Basin study will determine the best methods to evaluate water resources and to develop strategies for delivering information about water availability and use. Results from the Arizona alluvial basins study will emphasize the development of analysis methods, water-quantity indicators, and visual display options for historical and current groundwater conditions.
- Investigations will begin on three “challenge areas” directly linked to the regional groundwater availability studies. These are:
 - Assessment of saline groundwater resources,
 - Estimating groundwater withdrawals and consumptive use for principal aquifers, and
 - Monitoring the effects of climate change on groundwater resources.

Hydrologic Monitoring, Assessments, and Research

Results from these efforts will supplement ongoing studies and collectively contribute to achieving an assessment of the Nation's groundwater availability, which is a key element of the water census of the United States, one of six priorities outlined in the USGS Science Strategy.

- Several journal articles on the use of new geophysical methods and applications to support the quantitative understanding of hydrogeologic structure and processes will be released. The focus of the articles will include development of fiber-optics distributed temperature sensing field applications; development of rapid seismic subsurface imaging methods; development of methods for quantitative interpretation of geophysical tomography data; and, application of gravity methods to monitor changes in aquifer storage.
- Several updates and enhancements to the widely used modular groundwater flow model (MODFLOW) family of ground-water models will be released. These will include enhancements to the new coupled groundwater and surface-water flow model (GS-FLOW) - computer software for modeling watershed response to land-use changes and climate variability. Enhancements will also be made to the MODFLOW model to better manage the effects of water-resource development on hydrologic systems and to better represent man-made features, such as irrigation canals. All of these MODFLOW enhancements are publicly available at no cost at:
http://water.usgs.gov/software/lists/ground_water.
- A current groundwater conditions map of the major basalt aquifer units in the Columbia Plateau will be produced. A synoptic measurement of approximately 1,000 wells will be used to develop a regional understanding of how the groundwater system has responded to historical changes in stresses such as pumping, recharge from irrigation return flows, and climate variability. A report will document the status of regional ground-water conditions in the Columbia Plateau while also serving the information via the Web.

End Outcome Goal 1.4: Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of the Nation's 65 principal aquifers with monitoring wells used to measure responses of water levels to drought and climatic variations to provide information needed for water-supply decisionmaking (SP) (WRD)	C	61%	61%	60% (39/65)	60% (39/65)	58% (38/65)	62% (40/65)	62% (40/65)	0%	62% (40/65)
Comment	The decrease in 2007 is the result of a decrease in funding to the Cooperative Water Program. Level performance continues in 2008 with a slight increase in performance anticipated for 2009. It is important to note that due to the current economic downturn, States are finding it more and more difficult to meet existing commitments. Therefore, these numbers might actually decrease even though USGS funding has held steady. USGS is hopeful the numbers shown for 2009 will be maintained in 2010.									
X% of ground-water stations that have real-time reporting capability in the ground water climate response network (WRD)	C	67% (233/347)	47%	52% (181/347)	53% (290/544)	54% (290/544)	54% (324/598)	54% (324/598)	0%	54% (324/598)
Remediation of discontinued streamgages, cableways, and ground-water wells	A					0	0	0	0	0
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									

Hydrologic Monitoring, Assessments, and Research

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment		<p>During 2006 and 2007, the network in total grew more than the number of wells reporting real-time because funding partners opted to fund more non-real-time stations. As a result, the relative proportion of the network that is reporting real-time declined. Real-time measurement continues to grow in the USGS-funded portion of the network.</p> <p>The numerator represents the number of ground-water stations with real-time reporting capacity within the network while the denominator represents the total number of sites within the climate response network.</p> <p>The USGS has requested to redefine this measure. As noted in the 2006 and 2007 year-end reports, overall expansion of the network can result in a decrease in the performance metric because not all of the new wells added to the network are real-time.</p> <p>In 2008, the network was expanded to include both Federal and cooperatively funded wells to make a larger climate network; as a result of that change the denominator has changed. The mixture of wells that make up the network as well as the total number of wells in the network will continue to change over time. Therefore, the percentages for 2009 and 2010 are expected to change slightly while the number of wells tallied to compute those percentages could change significantly. The refined measure was proposed and approved and will, beginning in 2011, more accurately measure the USGS performance of the climate response network.</p>								
X% of U.S. with ground water availability status and trends information to support resource management decisions (WRD)	C	7% (4.5/65)	8% (5.5/65)	9% (6/65)	11% (7/65)	11% (7/65)	12% (8/65)	14% (9/65)	+2%	18% (12/65)
Total Actual/Project cost (\$000)		1,575	1,925	2,100	2,625	2,625	3,280	4,050	770	6,000
Actual/Projected cost per ground water status (whole dollars)		350,000	350,000	350,000	375,000	375,000	410,000	450,000	40,000	500,000
Comment		<p>Regional studies in 2007 included Carolina Coastal Plain, Denver Basin, Central Valley, Michigan Drainage Basin, Mississippi Embayment, and Basin and Range carbonate aquifers. Changes reflect the addition of one new study area in 2008 (Columbia Plateau), one in 2009 (High Plains), and another in 2010 (Floridan).</p> <p>The average cost per study varies depending on the scope and complexity of the studies being conducted in any given year. Initially, studies were smaller in scope resulting in a smaller average cost per study. Over time, the scope of studies has expanded requiring more funding per study.</p> <p>Measure indicates the number of regional ground-water evaluation projects (status and trends in ground-water availability) that coincide with the Nation's 65 principal aquifers, as designated in the National Atlas. Average cost per project is \$450,000, though actual costs can range from <\$300,000 to >\$600,000 per project per year, depending on the scope and complexity of the study. Project costs include salaries, travel, training, vehicles, supplies, report production, and printing.</p>								

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: National Water-Quality Assessment Program

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
National Water-Quality Assessment Program (\$000)	63,912	65,056	+1,451	0	66,507	+1,451
Total FTE	360	355	0	0	355	0

Summary of 2010 Program Changes for the National Water-Quality Assessment Program

The 2010 budget request for the NAWQA Program is \$66,507,000 and 355 FTE. There are no program changes requested for the NAWQA Program in 2010.

Program Overview

The NAWQA program addresses three long-term goals:

- Describe the status and trends in the quality of a large, representative part of the Nation's surface-water and groundwater resources,
- Provide an improved understanding of the primary natural factors and human activities affecting these conditions, and
- Provide information that supports development and evaluation of management, regulatory, policy, and monitoring decisions by other Federal, State, and local agencies.

The full scale NAWQA program began in 1991. During its first decade, the program established a baseline understanding of water-quality conditions and conducted interdisciplinary assessments in 51 of the Nation's most important river basin and aquifer systems, referred to as Study Units. A new cycle of studies involving selected streams and aquifers in 42 of the 51 Study Units was initiated in 2001 and is scheduled to be completed by 2012. In 2009, planning started for the next NAWQA cycle (2012-2023).

The goals of the NAWQA program support the USGS Science Strategy. Specific goals include improvement in our understanding of stream ecosystems and ecosystem change due to human and natural causes; the role of the water environment in human and ecosystem health; data integration; and serving as the water-quality component of a water census for the United States. The program works in conjunction with other USGS programs and an array of partner agencies.

Hydrologic Monitoring, Assessments, and Research

"The U.S. Geological Survey (USGS) is responsible for the two main water-quality monitoring programs for the Nation's waterways. These are the National Water Quality Assessment Program (NAWQA) and the Toxic Substances Hydrology Program. These two programs are crucial to understand water quality. Without a long-term commitment to monitoring, the Nation will lose its ability to assess trends in water quality, impacts of climate change, impacts of new and understudied contaminants, and efficacy of policy-decisions that impact water quality. The NAWQA is the larger of the two USGS water-quality monitoring programs, and looks at environmental contaminants using established measurement methodologies for measuring pesticides, VOCs, metals, etc."

Nancy K. Stoner, Co-Director, Water Program Natural Resources Defense Council, in her testimony to the House Science Committee, March 4, 2009, 21st Century Water Planning: The Importance of a Coordinated Approach

To share program knowledge and to solicit external input on program direction, NAWQA managers coordinate extensively with Federal agencies such as the EPA and U.S. Department of Agriculture (USDA), State and local agencies, non-governmental organizations, and the private sector. For example —

- NAWQA coordinates with the Gulf of Mexico Nutrient and Hypoxia Task Force to identify important sources and delivery of nitrogen and phosphorus to the northern Gulf of Mexico, which are the leading causes of oxygen loss (hypoxia). NAWQA findings reveal important nonpoint and point sources of nitrogen and (for the first time) results for phosphorus, and demonstrate the importance of reservoirs, stream size, and other hydrologic factors that control nutrient delivery to the Gulf. In 2009, NAWQA provided new information to the 31 States in the basin and Federal agencies, such as the EPA and USDA, on the relative amounts of nitrogen and phosphorus delivered to the northern Gulf of Mexico from more than 800 watersheds in the Mississippi/Atchafalaya River Basin. Probabilistic rankings of nutrient yields, by watershed, help water managers, policy makers, and scientists to identify watersheds that deliver relatively large amounts of nutrients to the Gulf of Mexico, thereby providing information needed to develop cost-effective strategies for nutrient reduction in the Mississippi/Atchafalaya River Basin. In addition, the findings are used by the EPA Science Advisory Board and the Gulf of Mexico Task Force in their development of basin-wide recommendations and actions to reduce the nutrient burden flowing into the Gulf of Mexico.

"The Kansas Department of Health and Environment utilized the results of the SPARROW model for Mississippi watershed nitrogen transport as the unifying theme behind the state's Nutrient Reduction Plan. We look forward to continued refinement of the SPARROW modeling efforts to identify high priority watersheds for mitigation of nitrogen and other pollutants. We are unaware of any similar projects that have been as valuable in helping to identify nitrogen contributions to the Gulf of Mexico, and upstream states on a watershed-by-watershed basis."

Michael B. Tate, PE, Kansas Department of Health and Environment

- Since 1998, NAWQA has participated in or co-hosted (in large part with the Water Environment Federation) 25 congressional briefings in Washington, D.C., all open to the public. In 2008, NAWQA co-hosted two public briefings, including one on water availability and quality, which provided critical stakeholder input for the bureau's plans for a U.S. water census. The second briefing informed the public on the quality of water supplies (before and after treatment) that draw source water from nine rivers, including the Washington Aqueduct on the Potomac River. Recently, a public briefing informed the public on the quality of water in more than 2,100 private wells located in 48 States – a drinking-water resource relied upon by about 43 million people—or 15 percent of the Nation's population. These briefings reflect NAWQA's increasing focus on assessing the quality of source water used for drinking; the role of environmental factors affecting such quality; and placing NAWQA findings in a human-health context, all of which directly support for the USGS Science Strategy priority of providing science relevant to human health.

"The United State Geological Survey (USGS) report on the source water quality of domestic wells provides an important reminder to well owners of their responsibility to maintain their private well systems, including treatment equipment, if needed. The study also confirms the geographic, regional and even local variation that can occur in ground water and that water testing should be tailored to these local concerns. The research undertaken by the USGS has helped inform the association's educational programming so that NGWA professional members can serve their customers – private well owners – with science-based knowledge and tools."

Kevin McCray, Executive Director, National Ground Water Association (NGWA)
- NAWQA scientists released a series of nine papers in the Journal of Environmental Quality on national and regional trends in groundwater quality in the U.S. This series marks the first of many trends studies which have collected consistent and comparable data for a large number of chemical constituents at wells across the Nation. Findings highlight national trends over the last 10-15 years, including increasing concentrations of nitrate in groundwater in selected aquifers underlying agricultural areas associated and decreasing trends, overall, in selected agricultural pesticides, such as atrazine. Findings clearly demonstrate that trends vary geographically and by aquifer, depending on many factors, including chemical use, aquifer type, and geochemical conditions.

"The NAWQA Program is unique in its capability to answer whether the Nation's water quality is improving. This is a fundamental long-term issue that policymakers are seeking to address."

Claudia Copeland, Resources and Environmental Policy, Congressional Research Service
- NAWQA scientists published a suite of papers in the Environmental Science and Technology journal that describes the availability of mercury in streams and how it makes its way into fish and other life-forms in stream ecosystems. The three papers represent one of the most comprehensive studies of stream mercury dynamics. Findings identify watershed characteristics that make some streams more vulnerable to mercury deposition than others. Findings are relevant and timely to current policy discussions within the EPA.

"The USGS scientists took a truly biogeochemical approach to seeing why certain streams have higher levels of mercury in them, where it is being produced, and how it's being accumulated in the food web. This kind of [research] has long been needed."

Vincent St. Louis, Biologist, University of Alberta (Canada) (cited in ES&T article by Naomi Nubick, March 2009)

Hydrologic Monitoring, Assessments, and Research

related to controlling mercury sources in atmospheric deposition and setting mercury standards to protect the environment.

- NAWQA continued its extensive working relationship with the H. John Heinz III Center for Science, Economics, and the Environment (Heinz Center) and the EPA Office of Information to develop 21 national indicators on nutrients (phosphorus and nitrogen) and contaminants (including pesticides) in streams and groundwater. This information was essential for the 2008 Heinz Center *State of the Nation's Ecosystems* and 2008 EPA *State of the Environment Report*. Building on the EPA and Heinz Center efforts, NAWQA is developing National Environmental Status and Trends (NEST) water-quality and ecological indicators, an activity spearheaded by the U.S. Forest Service, the Department of the Interior (USGS), NOAA, and EPA. .
- NAWQA co-leads the National Water-Quality Monitoring Council (composed of more than 50 representatives from other Federal, State, local, and Tribal agencies, non-governmental organizations, industry, and academia) in their effort to develop consistent methodology; integrated water assessments based on data from multiple organizations and diverse sources; and national water monitoring networks. In support of the National Monitoring Network for Coastal Waters and their Tributaries, NAWQA helped to reactivate 5 monitoring sites on the Nation's largest rivers, some of which had not been sampled since 1994, thereby, enhancing a key element of the Ocean Action Plan. In addition, NAWQA continues to spearhead and support the development of common Web services so that stakeholders can access data from multiple sources in a common format, which allows more comprehensive analyses of water quality and ecosystem health over broad geographic regions and of trends over time. These data activities support the USGS Science Strategy priority to integrate earth science data from different sources to support more comprehensive and interdisciplinary information for models, decision support tools, and scientific reports.
- NAWQA continues coordination with its National Liaison Committee, consisting of about 100 representatives with water-resources responsibilities or interests from Federal, State, and regional organizations, academia, public interest groups, professional and trade associations, and private industry. In 2008, meeting topics highlighted the need for a water census for the United States and priorities for the next cycle of the NAWQA Program. In 2009, a meeting topic will focus on the occurrence of, and factors affecting, mercury in streams studied by NAWQA across the Nation in different environmental settings. Discussions will focus on the relevance of the findings to proposed national policies for reducing mercury in the environment and for minimizing impacts on stream ecosystems, which is in direct support of the USGS Science Strategy priority of providing science relevant to ecosystem health.

2010 Program Performance

At the proposed level, the program will continue national synthesis of selected topics; regional and national assessments of status and trends in streams and groundwater; studies of source-water quality associated with large community water systems; and five studies of national priority topics, including: (1) effects of nutrient enrichment on stream ecosystems; (2) sources, transport, and fate of agricultural chemicals; (3) transport of contaminants to public-supply wells; (4) effects of urbanization on stream ecosystems; and (5) bioaccumulation of mercury in stream ecosystems.

In 2009 and 2010, long-term data collection on the quality of 113 rivers and streams, about 3,000 groundwater wells, and source water quality assessment at an additional set of 20 community water systems will continue. In 2010, long-term stream and groundwater monitoring will be enhanced with the addition of a modest amount of new data collection and assessment activities thereby improving program products such as models and scientific reports.

NAWQA implements and supports outreach and liaison activities at local, State, regional, and national scales. NAWQA's Web site (<http://water.usgs.gov/nawqa/>) provides rapid access to NAWQA's methods documents, publications and products and an up-to-date listing of current developments that allows interested parties to get new information in a timely fashion. In 2008, the program provided one of the largest nationally-consistent on-line collections of water-quality data and associated information through the NAWQA Data Warehouse (<http://water.usgs.gov/nawqa/data/>). Data include concentrations in water, sediment, and aquatic tissues for 2,000 chemical compounds at over 8,000 stream sites and 8,100 wells, and fish, aquatic insect, and algal community data for more than 20,000 stream samples. Geographic maps displaying data and data-collection locations and data graphing capabilities were added. As follow-up to user requests for specific information, over 1,237,000 data retrievals were delivered to the public and internal users through 2007. All data from NAWQA collected during prior years will continue to be available for users in 2009 and 2010.

NAWQA goals are accomplished using six major program elements. 2010 activities are described below:

National Synthesis of Key Findings Related to Important Water-Quality Topics

(Estimates for 2008, \$7.6 million; 2009, \$7.0 million; 2010, \$7.0 million)

National synthesis topics cover pesticides, nutrients, and aquatic ecology, and to a lesser extent, volatile organic compounds and trace elements. Findings contribute to a comprehensive national-scale perspective on water-quality conditions and trends and key factors (such as land use, hydrology, geology, and soils) that govern water quality.

Regional and Study Unit Assessments of Status and Trends

(Estimates for 2008, \$25.3 million; 2009, \$27.6 million; 2010, \$29.2 million)

Status and trends assessments focus on surface-water-quality in the 42 Study Units grouped within eight major river basins in the United States and groundwater-quality in about one-third of the Nation's 62 principal aquifers. These broad-scale assessments integrate modeling with monitoring to help extend water-quality understanding to unmonitored, yet comparable areas. They also involve collaboration and inclusion of data from other USGS programs, such as the National Stream Quality Accounting Network, other Federal agencies, and regional, State, Tribal, and local organizations to maximize the use of stream-monitoring information for broad water-resource understanding. Source-water-quality assessments are conducted to characterize water in selected drinking-water supply wells, stream intakes, and in finished drinking water associated with large community water systems. The source-water assessments complement drinking-water monitoring required by other Federal, State, and local programs, which focus primarily on post-treatment compliance monitoring.

Topical Studies of National Priority

(Estimates for 2008, \$12.4 million; 2009, \$10.1 million; 2010, \$9.8 million)

Topical studies address five national priority topics that establish links between sources and transport of contaminants, and the potential effects of contaminants on humans and aquatic ecosystems. The five topical studies are conducted in selected Study Units most affected by the issues. NAWQA relies on fundamental research accomplished in other water programs like the National Research Program and the Toxic Substances Hydrology program. For example, NAWQA collaborates with other USGS scientists on sampling and analytical techniques to understand key chemical and biological processes affecting water quality, such as mercury bioaccumulation in fish, stream metabolism, and contaminant degradation. The topical studies examine five issues:

- Effects of nutrient enrichment on stream ecosystems,
- Sources, transport, and fate of agricultural chemicals,
- Transport of contaminants to public-supply wells,
- Effects of urbanization on stream ecosystems, and
- Bioaccumulation of mercury in stream ecosystems.

Supporting Research and Methods

(Estimates for 2008, \$6.2 million; 2009, \$6.5 million; 2010, \$6.6 million)

To ensure NAWQA data collection and analyses are relevant to emerging issues, program resources are devoted to developing state-of-the-art methods of sample collection and analysis and to innovative research techniques, such as those involving age-dating, dye tracer tests, and isotope analysis.

Coordination at Local, State, Regional, and National Levels

(Estimates for 2008, \$2.7 million; 2009, \$2.7 million; 2010, \$2.8 million)

NAWQA continues to provide direct service to the EPA's Office of Pesticide Programs; Office of Wetlands, Oceans, and Watersheds; Office of Groundwater and Drinking Water; and Office of Science and Technology, assisting in the timely and relevant application of NAWQA data and predictive models to those offices' decision-making processes. Partnerships and liaisons with environmental and natural resources managers, regulators, planners, and policymakers, from national to local, have involved over 1,500 organizations and individuals.

Technical Support of USGS Activities

(Estimates for 2008, \$10.2 million; 2009, \$11.1 million; \$11.1 million)

The USGS has a long tradition of providing national technical support and training for its geographically distributed water-quality studies. This includes support for bureau publishing centers and ongoing stable support for quality control to assure the technical excellence of water-quality field programs. The technical support activities provide a structured way of transferring new technology to investigative and data activities that are primarily conducted in USGS Water Science Centers in each State. Technical support also includes a formal way of establishing priorities for water-quality research by the USGS and provides a mechanism to

make water-quality information available to other agencies, the scientific community, and the public.

Major NAWQA Program products anticipated in 2010 include —

- Release of two USGS circulars that provide national assessments on (1) nutrients in streams and groundwater across the Nation that can affect the health of major estuaries and the quality of groundwater used for drinking; and (2) quality of stream ecosystems across the United States. These circulars will be of high visibility and in direct support of the Bureau's strategic plans for providing science relevant to human and ecosystem health and changes due to human and natural factors.
- Release of detailed and data-rich water-quality models in six major continental-scale river basins that identify watersheds and nutrient sources contributing the largest amounts of nitrogen and phosphorus to sensitive coastal waters across the Nation. These critical waters include the Gulf of Mexico from the Mississippi/ Atchafalaya River Basin, the New England and Mid-Atlantic Coasts, the Great Lakes, the South Atlantic and Gulf Coasts (excluding the Mississippi River), and the Puget Sound and the Columbia River estuaries in the Pacific Northwest. Findings will help States, EPA and other Federal agencies, and other partners to target nutrient sources—such as from agricultural fields, livestock operations, pastureland, atmospheric deposition, and wastewater discharges—in the implementation of nutrient reduction strategies. Model findings will be used to identify watersheds where it would be most cost effective to implement such strategies and to test and fine tune the possible effectiveness of different nutrient management options.
- Release of two USGS circulars highlighting major findings on the transport of natural and man-made contaminants to public wells and effects of urban development over the last 30 years on stream ecosystems, including effects on fish, algae, aquatic insects, and stream habitat. These circulars will compare, contrast, and summarize findings from studies completed across the Nation from 2002-2007 with major implications for water quality management in urban and agricultural watersheds and principal aquifers. The circulars directly support the USGS Science Strategy priority of providing science relevant to human and ecosystem health and changes due to human and natural factors.
- Assessment of the occurrence of about 260 anthropogenic organic compounds in source water at groundwater wells (prior to water treatment) and finished water (defined as water that has passed through treatment processes but prior to distribution) at over 20 community groundwater systems across the Nation.
- Implementation of NWIS-Biology for USGS aquatic ecological data, based on an enhancement of the existing NAWQA Data Warehouse system. NAWQA is leading the development of a centrally managed system (akin to the USGS National Water Information System or NWIS) to manage, store, and retrieve aquatic biological and ecological information (referred to as "NWIS-Biology"). NWIS-Biology is being developed by NAWQA in partnership with the USGS Biological Resources Discipline, Geographic Information Office, and other USGS programs. Taxonomic identity and abundance information as well as other community-level aquatic ecological data cannot be stored and delivered by NWIS, hence the need for NWIS-Biology. NWIS-Biology is based on an enhancement of the existing and successful NAWQA Data Warehouse system which previously was not open to other USGS programs. NWIS-Biology will ultimately provide a publicly accessible and comprehensive system relevant to USGS aquatic ecological data-collection, data-management, and data-dissemination activities.

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This activity supports USGS Science Strategy priorities of data integration, water census, ecosystems, and advances accessibility to the public of ecological information for enhanced understanding and assessments of aquatic ecosystem health.

- NRC review of a new 10-year plan for the NAWQA Program to cover the period 2013-2023 including recommendations on improvements to NAWQA's design and implementation to address the water-quality issues of the 21st Century. The plan, once approved by the USGS, will be provided to the NRC for evaluation and recommendations for improvement.

Program Performance Overview

End Outcome Goal 1.4 Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of U.S. with groundwater quality status and trends information to support resource management decisions (WRD)	C	39%	58%	68%	70%	76%	80%	85%	+5%	100%
% improvement in accuracy of watershed (SPARROW) model prediction for total nitrogen and total phosphorus (measured as reduced error) (WRD)	C	31%	24%	20%	20%	20%	20%	20%	0	20%
% of U.S. with streamwater quality data for status and trends assessment and information to support resource management decisions (WRD)	C	UNK	UNK	16.6%	UNK	33.4%	49.8%	66.8%	17%	100%
Efficiency and Other Output Measures										
Average cost per analytical result, adjusted for inflation, is stable or declining over a 5-year period (WRD)	A	\$8.63	\$8.34	\$8.08	\$8.64	\$7.87	\$8.26	\$8.26	0	\$8.84
Comment		The cost of each analytical result will increase by 5 percent in 2009. The National Water Quality Lab (NWQL) was forced to institute a price increase due to a unilateral increase by GSA in lease costs at the Denver Federal Center. Through efficiencies and cost containing measures the NWQL was able to contain the price increase to only 5 percent in 2009 and 2010.								

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Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Toxic Substances Hydrology

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Toxics Substances Hydrology (\$000)	13,516	10,767	+317	0	11,084	+317
Total FTE	47	32	0	0	32	0

Summary of 2010 Program Changes for Toxic Substances Hydrology

The 2010 budget request for the Toxic Substances Hydrology Program is \$11,084,000 and 32 FTE. There are no program changes requested for the Toxic Substances Hydrology Program in 2010.

Program Overview

The Toxic Substances Hydrology (Toxics) program is a water quality research program that provides reliable scientific information and tools that explain the occurrence, behavior, and effects of toxic substances in the Nation's hydrologic environments. The results of those efforts provide a foundation for informed decision-making by resource managers, regulators, industry, and the public.

The contamination problems investigated by the Toxics program are widespread and pose significant risk to human health and the environment. Based on input from many agencies and organizations, the USGS identifies high priority problems for intensive, field-based research. These field studies are conducted at representative sites, watersheds, or regions that focus on subsurface, point-source or nonpoint-source contamination. Study results help water managers improve environmental monitoring, characterize and manage contamination, develop best management practices, form regulatory policies and standards, register the use of new chemicals, and guide chemical manufacture and use. The program complements other USGS programs that monitor and assess the quality of the Nation's waters by focusing rapidly on new issues and on emerging and understudied contaminants, by identifying which issues warrant future attention, and by developing and improving the methods necessary for detecting and characterizing toxic substances in the natural environment.

The continuing effort to provide information on new and understudied contaminants to resource managers, regulators, and the public, USGS scientists are developing new lab methods to measure environmental levels of contaminants and applying these methods to provide information on their environmental occurrence and behavior that is key to assessing potential health effects, establishing priorities for further research and designing protection and conservation measures. USGS scientists: (1) developed methods to measure the pharmaceutical antidepressants called Selective Serotonin Reuptake Inhibitors (SSRIs); (2) developed methods to measure the fungicide chlorothalonil and three of its environmental

Hydrologic Monitoring, Assessments, and Research

degradation byproducts in sediments, and then applied these methods to field studies in Texas and Oklahoma; and (3) measured the occurrence of pyrethroid insecticides in bed and suspended stream sediments in California. The publications presenting this information, as well as information on other new methods and environmental data are available online at <http://toxics/usgs.gov>. Other methods are under development and being applied to aquatic ecosystems across the Nation.

The Toxics program's strengths are its long-term field-based approach, interdisciplinary research teams, ability to address contamination problems with a wide range of geographic scales and environmental settings, and ability to bring fundamental scientific knowledge to maximize the inherent clean-up capacity of our natural environments. Maintenance of long-term field research laboratories and data collection on extensive regional and national networks makes this contribution particularly unique.

The Toxics program works in partnership with other Federal agencies to ensure that priorities for science needs are coordinated, including other Interior bureaus, the EPA, the USDA, the Department of Defense (DOD), the Department of Energy (DOE), the Nuclear Regulatory Commission, and more recently, public health agencies such as the Centers for Disease Control and Prevention, the Food and Drug Administration, and the National Institute for Environmental Health Sciences. Because the USGS is a science agency without regulatory or management responsibility, program information and methods often provide a basis for consensus in contentious issues and for achieving cost efficiencies by meeting the needs of numerous management and regulatory agencies. Scientists from universities, other Federal agencies, and industry find significant research opportunities through collaboration in Toxics program activities and at program research sites as evidenced by more than 150 student dissertations published as part of program research activities. Program results are distributed at briefings for regulatory agencies and industry groups, at workshops, at national scientific meetings, in USGS reports, and in scientific journals and books. In the last 5 years (2004–2008), the program has contributed to almost 1,000 scientific publications.

For example, animal manure and biosolids, the solid byproduct of wastewater treatment, often are applied to agricultural crops to provide nutrients for plant growth and to improve the quality of soil. Earthworms studied in agricultural fields where manure and biosolids were applied were found to contain organic chemicals from household products and farms. Earthworms continuously ingest soils and accumulated these soil contaminants into their bodies. The chemicals detected included the active ingredients commonly found in a variety of household products—including the disinfectant found in antibacterial soaps, fragrances used in perfumes, detergents, and an antibiotic. These results, published in the journal *Environmental Science and Technology*, build upon two recent studies that found that household chemicals were detected in biosolids and that pharmaceuticals were found in soil irrigated with reclaimed water. More information on these studies is available on the Internet at: <http://toxics.usgs.gov/highlights/earthworms.html>.

The Toxics program coordinates with and complements a range of other USGS programs by —

- Providing new methods and information to monitoring and assessment programs such as the NAWQA program and National Stream Quality Accounting Network (part of the Hydrologic Networks and Analysis program);
- Addressing environmental effects of resource development with programs such as the Energy Resources and Mineral Resources programs; and,

- Evaluating the connections between environmental contamination of toxicological effects in fish and wildlife with the Contaminant Biology program.

The goals of the Toxics program support the USGS Science Strategy primarily in four of six science directions: understanding ecosystems and predicting ecosystem change; energy and minerals for America's future; the role of the environment and wildlife in human health; and a water census of the United States. Program goals also support the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment. In conjunction with other USGS programs and an array of reimbursable projects funded by partner agencies, the Toxics program contributes to the performance measures shown in the table at the end of this section.

Toxics program activities over the next 5 years are being guided by *The U.S. Geological Survey, Toxic Substances Hydrology Program Five-Year Plan, 2007–2011*, which was developed with broad input from stakeholders and from other USGS programs.

More information about the Toxics program is available on the Web at <http://toxics.usgs.gov/>.

2010 Program Performance

Major components of the program for 2010 include:

Investigations of Subsurface, Point-source Contamination
(Estimates for 2008, \$4.9 million; 2009, \$5.0 million; 2010, \$5.1 million)

Interdisciplinary USGS research teams conduct long-term intensive field investigations of common types of subsurface contamination in a variety of hydrogeologic environments. These investigations provide fundamental knowledge of the processes that control contaminant-plume transport and persistence. This knowledge and new methods are applied to similar sites across the Nation. The Toxics program is the only USGS program with an organized research activity addressing subsurface contamination from point sources. It is viewed by those responsible for contaminated site cleanup as a unique provider of information and methods on issues such as contamination in fractured rock aquifers and long-term performance of monitored natural attenuation. This program component also includes development of laboratory and field methods. During 2010, research in this program component will complete a revised research strategy guided by a major planning activity conducted with participation of Federal stakeholders, including the EPA, the DOD, the DOE, and other Interior bureaus. In 2010, the program will contribute increased scientific knowledge and tools related to subsurface point-source contamination issues associated with —

- Hydrocarbons, fuel oxygenates, biofuels, and other petroleum-related contaminants,
- Mixed (radionuclide and conventional) waste disposal and contamination in arid environments,
- Contamination in fractured-rock aquifers, and
- Contaminant plumes with complex chemical mixtures, such as landfills and treated wastewater discharges.

For example, USGS Scientists continue to make significant contributions to the understanding of endocrine disruption in fish. Intersex, the presence of internal or external female characteristics in male fish, is being observed in a wide variety of stream sites across the

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Nation. Studies have demonstrated that exposure to chemicals that are endocrine active can cause these effects on a fish and can have catastrophic effects on fish populations. A study of endocrine disruption in fish in Boulder Creek, Colorado, demonstrated how a complex mixture of endocrine-active chemicals in wastewater effluents can have an additive effect on local fish. Another study documented complex effects of fish exposure to nonylphenol, a surfactant used in large quantities in commercial and household detergents. They found that behavior of exposed males versus those not exposed varied significantly with exposure level. Low doses “primed” the males for breeding competition, whereas higher exposures inhibited their breeding behavior. In still another study, scientists studying fish health and intersex in the Potomac River in Virginia and West Virginia documented intersex in smallmouth bass and are continuing to evaluate the potential linkage to endocrine-active chemicals. More information on these studies can be found on the Internet at http://toxics.usgs.gov/highlights/wastewater_fish.html.

Investigations of Watershed-scale and Regional-scale Contamination (Estimates for 2008, \$5.7 million; 2009, \$5.1 million; 2010, \$5.4 million)

Watershed-scale and regional-scale investigations address contamination problems typical of widespread land uses or human activities that may pose a threat to human and environmental health throughout a significant portion of the Nation. These investigations involve characterizing contaminant sources, investigating the mechanisms by which nonpoint-source contamination affects aquatic ecosystems, and investigating the processes that transform contaminants into different and possibly more toxic forms. This program component also includes development of laboratory and field methods. In 2010, the program will contribute increased scientific knowledge and tools related to regional- and watershed-scale contamination issues associated with —

- Hard-rock mining,
- Chemicals of emerging environmental concern (emerging contaminants),
- Mercury in aquatic ecosystems,
- Pesticide contamination in hydrologic environments, and
- Contaminant effects on the San Francisco Bay ecosystem.

A recent USGS report on emerging contaminants in the Nation’s streams received widespread acknowledgement for raising public awareness of the issue of pharmaceuticals, household chemicals and other emerging contaminants as an important new environmental issue [<http://toxics.usgs.gov/highlights/whatsin.html>]. The USGS published two follow up studies that collected baseline information on the environmental occurrence of pharmaceuticals, personal-care products, surfactants, flame retardants, naturally occurring sterols, and other organic contaminants commonly associated with human- and animal-waste sources in ambient groundwater and in untreated sources of drinking water (both from wells and at stream intakes). Forty seven wells in 18 States, and 74 sources of drinking water (25 wells and 49 streams) in 25 States were sampled.

Technical Support (Estimates for 2008, \$2.9 million; 2009, \$0.6 million; 2010, \$0.6 million)

The USGS has a long tradition of providing national technical support for its geographically distributed water resources studies. This support provides quality control to ensure the

technical excellence of water resources field programs and provides a structured way of transferring new technology to investigative and data activities that are primarily conducted in USGS Water Science Centers in each State. Technical support also includes a formal way of establishing priorities for water research by the USGS and provides a mechanism to make water resources information available to other agencies, the scientific community, and the public.

Goal Performance Table

Program Performance Overview

End Outcome Goal 1.4 Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 Pres. Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making									
X% of targeted contaminants for which methods are developed to assess potential environmental and human health significance (SP) (WRD)	20%	85%	41% (78/188)	33% (76/232)	48% (138/287)	33% (76/232)	33% (76/230)	0*	33% (Determined annually)
Comment	*The target list (denominator) for this performance measure is redefined each year based on the chemicals for which methods were developed in the previous year and additional chemicals that are added based on current priorities. The annual target of 33% of the annual list assures that significant progress toward measuring new and understudied environmental contaminants is achieved each year. The list of chemicals for which methods will be developed in 2010 will be defined in September 2009 following a reassessment of priorities and accumulation of input from other agencies.								

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program: Hydrologic Research and Development

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Hydrologic Research & Development (\$000)	15,423	13,421	+266	-1,465	12,222	-1,199
Total FTE	243	198	0	0	198	0

Summary of 2010 Program Changes for Hydrologic Research and Development

Request Component	(\$000)	FTE
• San Pedro River Partnership	-295	0
• Hood Canal Dissolved Oxygen Study	-270	0
• Long Term Estuary Assessment Group (LEAG)	-400	0
• U.S.-Mexico Transboundary Aquifer Assessment Act	-500	0
TOTAL Program Changes	-1,465	0

Justification of 2010 Program Changes

The 2010 budget request for the Hydrologic Research and Development (HR&D) Program is \$12,222,000 and 198 FTE, a net program change of -\$1,465,000 and 0 FTE from the 2009 Enacted level.

San Pedro River Partnership (-\$295,000/0 FTE)

This reduction eliminates congressional action related to the San Pedro River Partnership. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Hood Canal Dissolved Oxygen Study (-\$270,000/0 FTE)

This reduction eliminates congressional action related to the Hood Canal Dissolved Oxygen Study. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Long Term Estuary Assessment Group (LEAG) (-\$400,000/0 FTE)

This reduction eliminates congressional action related to the LEAG. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

U.S.-Mexico Transboundary Aquifer Assessment Act

(-\$500,000/0 FTE)

This reduction eliminates congressional action related to the U.S.-Mexico Transboundary Aquifer Assessment Act. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Program Overview

The HR&D program conducts long-term research on complex problems in the hydrologic sciences and supports the research and development needs of other water resource and USGS programs. HR&D program investigations integrate hydrological, geological, chemical, climatic, and biological science in addressing water resources issues. The program seeks to maintain an appropriate balance between high-risk high-reward research that leads to major scientific breakthroughs and future applications, and more applied research that helps keep the program relevant and focused on today's water resource issues. The efforts of the HR&D program are typically multidisciplinary in nature and require strong collaborative relations, both among scientists funded by the program and with scientists in other USGS programs, in Federal and State agencies, universities, and foreign countries.

The long-term goals of HR&D are —

- To understand ecological and biogeochemical processes in the hydrologic cycle and the role of natural and human-induced changes on these processes that can inform sound management of water quantity, quality, and biological resources,
- To understand chemical and biochemical processes affecting chemical constituents in aquatic systems to enable evaluation of water quality, helping managers make informed water-management decisions,
- To understand the physical processes controlling the distribution of the Nation's surface-water resources to mitigate floods and droughts,
- To understand the movement, availability, and transport of subsurface water in order to minimize further contamination of the Nation's groundwater, optimize aquifer remediation efforts, and ensure effective groundwater management,
- To understand stream-channel morphology and erosional processes governing the source, mobility, and deposition of sediment to improve management of rivers, dams, and reservoirs, and
- To understand long-term processes in small watersheds, including the effect of atmospheric and climatic variables, and provide water and land managers with information needed for water resources management.

National Research Program in the Hydrologic Sciences

A key component of HR&D is the USGS National Research Program (NRP). NRP scientists often take a lead role in the design and conduct of complex projects, bringing advanced scientific thinking and tools to the project. Areas where the NRP has provided expertise essential for making science-based decisions include —

- Everglades restoration,

- California-Federal (CALFED) and San Francisco Bay/Delta investigations,
- Grand Canyon environmental studies,
- Platte River management for wildlife habitat,
- Emerging contaminants in water supplies,
- Denitrification of agricultural sources of nitrogen, and
- Hydrologic system responses to climate change.

NRP scientists also provide leadership and scientific services such as —

- Teaching formal training courses for the USGS and cooperating agency staff,
- Participating in technology transfer,
- Consulting on USGS projects at the State level,
- Participating in reviews of USGS programs and Water Science Centers nationwide,
- Participating in the development of new programs, and
- Serving as scientific advisors for the USGS, as well as other Federal, State, and local agencies and for the public.

The goals of HR&D support the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment. HR&D activities directly support all six science directions outlined in the USGS Science Strategy. Research conducted by scientists in the HR&D Program will refine existing groundwater and watershed models and develop new modeling techniques to describe uncertainties and forecast changes in the hydrologic cycle in direct support of a water census. Ongoing research activities described in the program performance section have significantly contributed to our understanding of climate change impacts on water supply and our basic understanding of climate variability and change. Research in HR&D is conducted in conjunction with other USGS programs and an array of reimbursable projects funded by partner agencies.

2010 Program Performance

To fulfill their critical role in support of other USGS programs, HR&D scientists —

- Conduct research in collaboration with scientists in other USGS programs and provide training, workshops, reviews, and advice on water resource issues to respond to national, regional, and local needs,
- Provide specialized laboratory services, such as chemical and isotopic analyses and methods to characterize microbes,
- Develop new geophysical and geochemical techniques and numerical modeling tools, and
- Provide advice to USGS leadership on future program directions.

The program includes two components:

Long-term interdisciplinary research

(Estimates for 2008, \$15.4 million; 2009, \$12.3 million; 2010, \$12.2 million)

The long-term interdisciplinary research funded by the program provides core funding for the NRP, which draws from other USGS programs for about 57 percent of its appropriated funding and also leverages resources from other Federal and State agencies. These linkages ensure

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that research efforts are focused on developing new concepts and future techniques that are relevant to USGS programs and the Department. The NRP focuses on long-term investigations that integrate hydrological, geological, chemical, climatological, and biological information relating to water-resources and environmental problems. Study results provide the scientific basis that enables the USGS to tackle and resolve complex hydrologic problems.

The 5-Year Plan for HR&D was updated in 2007 to align with and increase focus on the USGS Science Strategy. HR&D scientists work in all six USGS Science Strategy science priority areas; however, there is particular emphasis on Ecosystems, Climate Variability and Change, and A Water Census of the United States. Several forms of internal and external reviews are used to evaluate progress in the HR&D program. Plans and accomplishments of each scientific project are internally reviewed on a yearly basis. In addition, in-depth reviews of projects and associated personnel are conducted to examine —

- The relationship of project work to the USGS mission,
- Productivity, relevance, and scientific impact,
- Plans and goals for the next 5 years, and
- The expertise and responsibilities of project personnel.

Climate Change Impacts on Water Supply — Climate change may create water supply shortages in the Southwest. Water managers in the Southwest have raised questions about the long-term sustainability of water supply in the region due to the increased demand for water, recent multiyear drought, and future projections of global warming.

In a recent study by the NRP, the potential effects of atmospheric warming on yearly streamflow were evaluated using a water-balance model within the context of long-term climate variability using tree-ring data. The results indicate that if warming continues and is not accompanied by increased precipitation, there is an increased probability that streamflow in the Colorado River basin will not meet the allocation requirements of the Colorado River Compact during multi-year droughts.

Yukon River Basin — Recent climate warming has accelerated permafrost thawing throughout the Yukon River basin. Thawing is making vast stores of frozen organic material available for hydrologic export to the Bering Sea or for decomposition and subsequent emission of carbon dioxide and methane to the atmosphere. In 2010, studies will continue in the Yukon basin and will focus on the total input of dissolved organic carbon to the Arctic Ocean, which appears to be 5-20 percent greater than previously reported and about 2.5 times greater than temperate rivers with similar watershed sizes and water discharge. Planned HR&D and Global Change program work will examine the groundwater contribution to total annual flow. Current work suggests that the increases in groundwater contributions may be largely due to enhanced infiltration brought about by permafrost thawing.

Drought and Water Resources — During recent decades, droughts of 1-3 years have affected some parts of the United States, but prolonged droughts of the magnitude experienced during the 1930s and 1950s have not occurred. To help the Nation prepare to face the potential effects of a prolonged drought, USGS scientists, along with colleagues in universities and other government agencies, have been studying regional, national, and global distribution patterns of drought. Coping with a prolonged drought is anticipated to be difficult, particularly in the arid and semi-arid West, where water demand has increased significantly and water supplies are likely to be insufficient for demand during dry periods. In 2010, USGS scientists and their

collaborators will publish studies examining historic and predicted streamflow in the Colorado River Basin, estimate impacts of 21st century warming on water availability, and develop projections based on climate change scenarios for the western U.S.

Integrated Modeling of Groundwater/Surface-Water Interactions — Traditionally, numerical models of groundwater and surface-water flow and transport have been conducted in isolation, at the expense of a proper description of their significant interactions and feedback effects. The USGS is conducting studies that integrate groundwater/surface-water interactions and will apply these models to a diversity of water resource management problems, including "whole-system" management of watersheds and assessments of the potential impacts of groundwater pumping on streamflow. This effort will extend the capabilities and impact of current USGS-developed numerical models, such as MODFLOW and the Modular Modeling System. These numerical models will be vital for evaluating the effects of various combinations of precipitation, climate, and land use on streamflow, sediment yield, and other components of the hydrologic system.

Enhancement of a General Surface Flow and Sedimentation Model — In cooperation with the National Streamflow Information Program, HR&D scientists are developing enhancements to a two-dimensional surface-water computer model as a precursor to increasingly complex models that will include features such as sediment transport, flow over dry areas, and dam-break flows. This work has a wide range of potential applications, ranging from the improved management of sediment transport in the Lower Mississippi to slow land loss and seawater encroachment in the wetlands, to the management or restoration of ecological environments in river systems.

Short-term Research

(Estimates for 2008, \$1.1 million; 2009, \$1.2 million; 2010, \$0 million).

Occasionally, HR&D is appropriated funds for short-term research on specific water issues. This portion of the program has included research to determine the causes of low dissolved oxygen and fish mortality in Hood Canal, WA; work to investigate the biogeochemical cycle of Gulf of Mexico hypoxia; and support for water availability assessment studies in the San Pedro and U.S.-Mexico Transboundary Aquifer. Funding for these short-term research activities is not requested in 2010.

Hydrologic Monitoring, Assessments, and Research

Program Performance Overview

End Outcome Goal 1.4 Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 Pres. Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures									
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making									
# of systematic analyses & investigations completed (Water)	35	32	77	67	67	76	76	0	75
Total actual/projected cost (\$000)	14,000	12,800	15,400	13,400	13,400	15,200	15,200	0	15,000
Actual/projected cost per scientific report or other product (whole dollars)	400,000	400,000	200,000	200,000	200,000	200,000	200,000	0	200,000
Comment	<p>Actuals for 2007 were higher than the target due to transition from the WRD Reports Tracking System to the new enterprise-wide Information Product Data System (IPDS), which tracks status of scientific products for the entire USGS. Authors must enter all scientific publications and other products into the system. Targets for 2008 were revised based on using IPDS in reporting completion of publications and other products. Utilization if IPDS allows for more cost effective and accurate accounting of per unit cost for reports and publications.</p> <p>Cost per scientific product is an average that includes the cost of writing, editing, peer review, and publication of each product, as well as the cost of the studies from which the products are derived. Reimbursements from other Federal agencies are included in the calculation.</p>								

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: National Streamflow Information Program

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
National Streamflow Information Program (\$000)	20,126	22,406	+326	+5,000	27,732	+5,326
Total FTE	47	46	0	0	46	0

Summary of 2010 Program Changes for the National Streamflow Information Program

Request Component	(\$000)	FTE
• Enhance the National Streamgauge Network	+5,000	0
TOTAL Program Changes	+5,000	0

Justification of 2010 Program Changes

The 2010 budget request for the NSIP is \$27,732,000 and 46 FTE, a net program change of +\$5,000,000 and 0 FTE from the 2009 Enacted level.

The proposed change includes an additional \$5,000,000 to enhance the National Streamgauge Network. This increase includes \$4,250,000 to re-establish recently discontinued streamgages and offset anticipated reduction in funding from State and local agencies to support the operation and maintenance of additional existing streamgaging stations essential to monitoring streamflow and variation in streamflow as a result of climate change. An additional \$750,000 will be used to implement advanced scientific methods for improving estimation of irrigation and thermoelectric power generation water withdrawals across the Nation in relation to climate variability.

Enhance the National Streamgauge Network (+\$5,000,000/0 FTE)

Streamgages are the essential monitoring tools used to track the flow of water and associated components in streams and rivers across the Nation. The USGS streamgauge network is funded in partnership with over 800 Federal, State, and local agencies. In recent years, funding for streamgages has been in jeopardy because of difficult economic conditions at the State and local level. This increase will support the re-establishment of discontinued streamgages and support the operation and maintenance of existing streamgages. A stable hydrologic monitoring network is also a cornerstone to understanding climate change – a key priority of this Administration. Experience has shown that analysis of streamflow information and synthesis with other hydrologic data will expand our knowledge of the hydrologic system and lead to improved hydrologic monitoring network design and operation. In order to fully understand the changes that climate variability exerts on our watersheds, we must understand the natural hydrologic system and how humans change that system through our movement and use of

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water. Further, our water use practices themselves are influenced by climate variability and it is vital that we understand these trends.

The USGS NSIP will –

- Provide funds to re-establish up to 50 recently discontinued streamgages and offset anticipated reduction in funding from State and local agencies to support the operation and maintenance of approximately 188 existing streamgaging stations. The National Streamflow Information and Global Change programs will collaborate on priorities for re-establishing discontinued streamgages with emphasis on those stations with the greatest potential to provide information in support of the Department's climate impacts monitoring effort.
- Provide annual information on thermoelectric power generation withdrawal data that is stratified by the various types of cooling technologies employed at the facilities. This information will allow for a better analysis on cooling water demands for the industry and the annual data will allow for future analysis of climate effects on cooling water needs.
- Provide analysis of irrigation withdrawals in relation to the affects of climate variability. Activities would include analysis of changes in demand for irrigation water due to changing irrigation practices and alignment of irrigation withdrawal assessments with other national databases of agricultural information.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Request	Program Change Accruing in 2010	Program Change Accruing in Out- years
% of proposed streamflow stations currently in operation that meet one or more federal needs (WRD)					0	1% (50/ 4744)	1%	3% (160/ 4744)
Total Actual/Project cost (\$000)					0	750	750	51,150
Actual/Projected cost per (whole dollars)					0	15,000	15,000	16,500
# of systematic analyses & investigations completed					0	1	1	4

Program Overview

The mission of NSIP is to provide the streamflow information and understanding required to meet national, regional, State, and local needs. To meet this mission, NSIP has five major objectives:

- Develop an enhanced streamgaging network that meets national needs for streamflow information that are fully funded by NSIP. This baseline network is supplemented by streamgages funded in partnerships to meet State, regional, and local needs.
- Improve the timeliness, reliability, and convenience of streamflow information delivery to users. This includes robust and redundant data delivery systems that ensure continued availability of data during catastrophic events and improved storage, retrieval, and data analysis abilities.
- Complete regional assessments of existing streamflow information to identify trends and to estimate streamflow at locations without streamgages. The trends would help identify the effects of land use, water use, and climate changes.
- Improve the understanding of floods and droughts through expanded measurements and analyses.
- Perform and fund research and development activities to advance equipment technologies and measurement and analysis techniques for greater accuracy and at a lower cost of providing streamflow information.

NSIP's Federal Needs for Streamflow Information

Five Federal goals have been identified as those that should be met by the core set of USGS-funded streamgages in NSIP.

Interstate and International Waters - Interstate compacts, court decrees, and international treaties mandate long-term, accurate, and unbiased streamgaging by the USGS at State-line crossings, compact points, and international boundaries.

Streamflow Forecasts - Real-time stage and discharge data are required to support flood and other streamflow forecasting by the National Weather Service and other Federal agencies across the country.

River Basin Outflows - Resource managers need to account for the contribution of water from each of the Nation's 350 major river basins to the next downstream basin, estuary, ocean or the Great Lakes.

Sentinel Watersheds - A network of streamgages is needed to describe the ever-changing status as it varies in response to changes in climate, land use, and water use in 800 watersheds across the country that are relatively unaffected by flow regulation or diversion and typify major ecoregions and river basins.

Water Quality - Streamgaging stations are needed to provide the streamflow information in support of the three national USGS water-quality networks: one that covers the Nation's largest rivers; the second for intermediate-sized rivers; and the third for small, pristine watersheds.

USGS flood hazard experts work closely with Federal, State, and local partners in pursuit of the national goals of reducing the toll of natural disasters and building disaster-resilient communities. The streamflow information produced by the USGS is crucial to the success of

the National Weather Service's (NWS) Advanced Hydrologic Prediction Services and the Federal Emergency Management Agency's (FEMA) floodplain map modernization initiative that began in 2003. Neither of these programs, which are designed to save lives and property from flooding, can be successful without the streamflow information provided by the USGS.

NSIP Federal streamgages reflect that portion of the national streamgaging network to be funded exclusively by the USGS and, therefore, that part of the network controlled fully by the USGS. NSIP is the Federal core of the national streamgaging program that helps to ensure stability of the national streamgage network and long-term data collection. In addition to NSIP funding, support for the network is supplied by other Federal agencies and by about 800 State, local, municipal, and Tribal partners through the Cooperative Water Program. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgage network in many States has experienced a decline in cooperator funding. It is important to note that the \$2 million increase for NSIP provided as a general increase to the program in 2009 has allowed the USGS to help stabilize the streamgage network. This NSIP increase provided much needed funds to Water Science Centers for the operation and maintenance of threatened streamgages.

The USGS streamgage network provides relevant, high-quality information to all potential users, for a wide variety of uses, at a reduced cost to the Federal Government. Data are collected using nationally consistent methods, which enable comparability of data across jurisdictional boundaries and acceptance of results by water management agencies and courts at all levels of government. Data collection and information management infrastructure are consolidated at the USGS which minimizes the cost of providing national streamflow information.

Hurricanes such as Katrina and Rita vividly demonstrated that storm surge can be as dangerous as riverine floods. To determine the timing, extent, and magnitude of hurricane-driven surge waters and waves, as part of NSIP the USGS designed and developed a network of rugged, inexpensive water-level and barometric-pressure sensors, called storm-surge sensors, which can be quickly installed in anticipation of a storm. The information from these sensors is used to calibrate the storm-surge models employed by forecasters along the Gulf and Atlantic Coasts and helps them provide improved forecasts of areas that will be inundated and to what depth in future hurricanes.

The goals of NSIP support the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment. The NSIP program is conducted in conjunction with other USGS programs and an array of reimbursable projects funded by partner agencies. The goals of the NSIP also strongly support five of six science priorities established by the USGS Science Strategy, including understanding ecosystems by providing streamflow information for organism life-cycle understanding and defining natural conditions; climate change by providing information on the changes in the hydrologic system due to changes in both precipitation and temperature; energy and minerals by providing information on streamflow for hydropower and for cooling needs; for hazards by defining expected hydrologic extremes for both floods and drought events; and the water census by helping to quantify water availability.

2010 Program Performance

The 2010 budget request for the NSIP is \$27,732,000 and 46 FTE.

Program activities fall into the following major categories:

Federal Network Operations

(Estimates for 2008, \$12.0 million; 2009, \$13.8 million; 2010, \$17.5 million)

This program component is dedicated to maintaining and operating a stable nationwide Federal-interest streamgaging network for measuring streamflow and related environmental variables (precipitation, temperature) reliably and continuously. With 2010 increases, it is anticipated that up to 50 critical recently discontinued streamgages will be reactivated. To help maintain stability in the streamgage network, up to 188 additional streamgages in danger of being discontinued will have their full operation and maintenance costs funded through NSIP.

Hydrologic Extremes

(Estimates for 2008, \$0.1 million; 2009, \$0.1 million; 2010, \$0.15 million)

This program goal is designed to improve the understanding of hydrologic extremes (floods and droughts) by more intensive data collection during and immediately following the event and analyses of the information collected. The amount available in 2010 could be used to summarize an extreme flood or drought event but would not cover additional data collection.

Regional Streamflow Assessments

(Estimates for 2008, \$0.5 million; 2009, \$0.5 million; 2010, \$0.6 million)

NSIP scientists provide regional assessments and interpretation of streamflow information to provide estimates of streamflow at ungaged locations and to identify trends in streamflow due to land use, water use, or climate change. These types of regional products directly support the USGS Science Strategy priority of a national water census to inform the public and decision makers about resource availability. As the effects of climate change on water resources are better understood, it is recognized that the existing streamflow information must be evaluated to identify trends in streamflow. This will enable water resource managers to plan more effectively for future water supplies. Climate change will potentially effect the location, frequency, and severity of floods and droughts. In 2010, methods and technologies will be investigated and developed for future applications.

Real-Time Information Delivery

(Estimates for 2008, \$2.4 million; 2009, \$1.8 million; 2010, \$2.1 million)

NSIP works with staff from NWIS, the NWIS Web application (NWISWeb), and the USGS Office of Surface Water to develop, implement, and maintain a highly reliable system for real-time streamflow information delivery to customers that includes data processing, quality assurance, storage, and easy access.

Development of Methods and Equipment

(Estimates for 2008, \$1.0 million; 2009, \$1.5 million; 2010, \$1.7 million)

NSIP funds the investigation, development, and implementation of new methodologies and equipment to more accurately, safely, and inexpensively obtain and deliver streamflow information. Recent examples include expanded and enhanced use of the Doppler phenomenon to measure river velocity and discharge; use of radar to measure streamflow directly without instrumentation in the river; and statistical evaluation involving the transfer of flow characteristics from locations with a streamgage to ungaged locations.

Program Coordination

(Estimates for 2008, \$0.5 million; 2009, \$0.5 million; 2010, \$0.6 million)

Critical to the continued success of NSIP are coordination efforts with other USGS programs, outside funding partners, and other interested parties. These efforts are central to the development and implementation of the short-term and long-term direction of the program and the approach to meet program goals.

Technical Support

(Estimates for 2008, \$3.0 million; 2009, \$3.5 million; 2010, \$3.8 million)

NSIP provides for technical support for geographically distributed USGS water resources studies and data collection activities, including mechanisms for quality control, technology transfer, priority setting, and method and technology standardization. Technical support is critical to the continued success and benefit of the program.

Integrated Multi-Hazards Demonstration Project

(Estimates for 2008, \$0.6 million; 2009, \$0.51 million; 2010, \$0.51 million)

In 2007, the USGS began an integrated Hazards Assessment and Mitigation Demonstration Project, focused on Southern California and the Gulf of Mexico coastal area. NSIP funding for that effort is used to support streamgages which provide data used in landslide predictions and tidal surges resulting from tropical storms and in the aftermath of wildfires.

Energy Efficiency and Climate Change Initiative

(Estimates for 2008, \$0; 2009, \$0; 2010, \$0.75 million)

These funds will be used to implement methods for improving estimates of irrigation and thermoelectric power generation water withdrawals across the Nation.

Program Performance Overview

End Outcome Goal 1.4: Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of river basins that have streamflow stations (SP) (WRD)	C	82% (1825/2223)	81% (1800/2223)	81% (1800/2223)	84% (1870/2223)	79% (1765/2223)	84% (1765/2102)	86% (1800/2102)	+2%	88% (1850/2102)
Total actual/projected cost (\$000)		23,725	24,300	24,300	26,180	24,710	26,475	27,732	+1,257	30,525
Actual/projected cost per streamgage (national average) (whole dollars)		13,500	13,500	13,500	14,000	14,000	14,500	15,000	+500	16,500
Comment	<p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgage network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgage network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p> <p>The measure "% of river basins that have streamflow information" assumes a single streamgage in each basin, where 2,102 basins are defined nationwide by 8-digit hydrologic unit codes; however, many basins require more than one streamgage to accurately assess conditions. This metric may never attain 100% because not all basins may require streamflow data (e.g., a basin with no population may not require any assessment of flood risk or land use changes).</p> <p>For 2009, the target was re-baselined to reflect the number of HUC units in the continental United States to provide for greater accuracy in reporting.</p> <p>It is possible that some decline in performance from that estimated from 2009 to 2010 may occur due to State and local funding partners budget issues; however, it is anticipated that USGS Water Science Centers will attempt to hold streamgage operation and maintenance costs level by controlling costs, within their Centers in order to maintain the stability of the streamgage network. It is important to note that any anticipated loss of streamgages may be exacerbated by the fact that the U.S. Army Corps of Engineers expects that funding for approximately 50 cooperatively funded streamgages in NY, MD, and PA will be discontinued in 2009 and additional streamgages discontinued in 2010.</p>									
X% of States with web based Streamflow statistics tools to support water management decisions (WRD)	C	10% (5/50)	14% (7/50)	18% (9/50)	26% (13/50)	28% (14/50)	34% (17/50)	34% (17/50)	0	40% (20/50)
Comment	Cooperative Water Program funding limitations have slowed progress on jointly funded streamstats projects at the State level. See http://water.usgs.gov/osw/streamstats/ssonline.html for current national status.									

Hydrologic Monitoring, Assessments, and Research

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of proposed streamflow stations currently in operation that meet one or more federal needs (WRD)	C	61% (2700/ 4425)	62% (2742/ 4425)	62% (2742/ 4425)	64% (2845/ 4425)	62% (2940/ 4744)	62% (2940/ 4744)	63% (2990/ 4744)	1%	65% (3100/ 4744)
Total Actual/Project cost (\$000)		35,100	36,450	37,017	39,830	41,160	42,630	44,850	+2,220	51,150
Actual/Projected cost per (whole dollars)		13,000	13,293	13,500	14,000	14,000	14,500	15,000	+500	16,500
Comment	<p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgauge network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgauge network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p> <p>The change in 2008 was a result of the increase for NSIP streamgauge operations and the increases for Hazards Assessment and Mitigation. The number of streamgages and the number of those gages that meet Federal needs can fluctuate from year to year as streamgauge funding is a cooperative endeavor with numerous Federal and non-Federal partners.</p> <p>During 2008 the denominator was re-baselined due to the reevaluation of requirements for the national network based on comments from external review by the National Research Council and changes to USGS water quality networks. This baseline increase of 319 streamgages makes the changes in 2009 and 2010 more difficult to assess, but the number of streamgages that will likely decrease is the best estimate available.</p> <p>This performance measure is very sensitive to losses of streamgages from the network. Streamgages identified to be fully funded by NSIP are sometimes targeted by funding partners to lose cooperative funds with the assumption that NSIP will replace the lost funds. There is a possibility that the number of streamgages losses could be less than estimated here for 2010. It is important to note that any anticipated loss of streamgages may be exacerbated by the fact that the U.S. Army Corps of Engineers expects that funding for approximately 50 cooperatively funded streamgages in NY, MD, and PA will be discontinued in 2009 and at least that number in 2010.</p>									
# of real-time streamgages reporting in NWIS-Web (WRD)	A	6,246	6,496	6,728	6,830	6,936	6,940	7,100	+160	7,200
Total actual/projected cost (\$000)		84,321	87,696	90,828	95,620	95,200	95,200	99,400	4,200	118,800
Comment	The number of streamgages reporting data in real-time will be enhanced by funds received under the American Recovery and Reinvestment Act as some older radio transmitters are being replaced with high data rate radio transmitters.									
X% of WRD streamflow stations with 30 or more years of record (WRD)	C	58%	59%	59%	58% (3970/ 6830)	60%	57% (4080/ 7200)	58% (4120/ 7050)	+1%	60% (4320/ 7200)
Total Actual/Project cost (\$000)		48,897	51,597	53,589	55,580	59,160	61,200	61,800	+600	71,280
Actual/Projected cost per (whole dollars)		13,500	13,500	13,500	14,000	14,500	15,000	15,000	0	16,500

National Streamflow Information Program

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	<p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgauge network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgauge network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p> <p>Decrease in 2007 and steady-state in 2008 are due to NSIP funding increases (reactivating existing or establishing new streamgages may cause a drop in % of streamgages with 30 years of record).</p> <p>The denominator changes every year because it reflects the number of streamgages reporting in real time in NWISWeb. For this measure, the denominator changes annually because the measure represents the number of streamgages with 30 or more years of record as a percentage of the total number of streamgages in operation. Since the total number of streamgages changes each year, the denominator must change if this measure is to reflect the state of the streamgaging network accurately.</p>									
X% of daily streamgages (streamflow stations) with data that are converted from provisional to final status within 4 months of day of collection (WRD)	C	10% (5/50)	20% (10/50)	24% (12/50)	29% (15/50)	28% (14/50)	29% (14/50)	32% (16/50)	+3%	35% (18/50)
Comment	The percentage is derived by dividing the numerator, which represents the number of states that successfully convert provisional data to final status within 4 months, by the denominator which is the total number of States, 50.									
Discontinued streamgages, cableways, and ground-water well remediated	A					0	0	0	0	0
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
# of streamgages upgraded with high data rate radios to increase frequency of radio transmission	C					4,500	4,900	5,300	+400	6,500
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
% of discharge measurements made with hydroacoustic instruments	C					35%	40%	45%	+5%	70%
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									

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Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Hydrologic Networks and Analysis

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Hydrologic Networks and Analysis (\$000)	30,537	30,128	+556	-643	30,041	-87
<i>Total FTE</i>	225	216	0	0	216	0

Summary of 2010 Program Changes for Hydrologic Networks and Analysis

Request Component	(\$000)	FTE
• A New Energy Frontier	+200	0
• Lake Champlain Basin Toxic Material Study	-343	0
• Hawaii Water Resources Monitoring	-500	0
TOTAL Program Changes	-643	0

Justification of 2010 Program Changes

The 2010 budget request for the HNA Program is \$30,041,000 and 216 FTE, a net program change of -\$643,000 and 0 FTE from the 2009 Enacted level.

A New Energy Frontier

(+200,000/0FTE)

The USGS conducts research on the environmental effects associated with biofuels development such as increased soil and wind erosion, water quality impairment associated with the use of agrochemicals, greater demand for irrigation and process water, sedimentation of wetlands and riparian areas, and the increased fragmentation of grasslands. The effects of land-use changes to increase biofuel production will potentially have far-reaching and long-term impacts on the continental landscape such as affecting existing and potential ecosystem goods and services, especially in areas that are important habitats for migratory birds and waterfowl or systems which now provide water quality protection or soil carbon sequestration. The proposed funding will document how biofuel production changes streamflow and water quality as well as ground-water availability in local and regional aquifers.

Lake Champlain Basin Toxic Material Study

(-\$343,000/0 FTE)

This reduction eliminates congressional action related to the Lake Champlain Basin Toxic Material Study. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact. Lake Champlain efforts underway will continue in the base funding of \$154,000.

Hawaii Water Resources Monitoring

(-\$500,000/0 FTE)

This reduction eliminates congressional action related to Hawaii Water Resources Monitoring activities. This project is not an Administration or USGS priority and does not address the Program's highest priority science needs. This reduction will allow the core Program to remain intact.

Program Overview

Data on the quantity and quality of water in the Nation's streams, lakes, and aquifers, as well as analytical studies, are necessary for the wise planning, development, utilization, and protection of the Nation's water resources. The Federal funds appropriated through the HNA program support three distinct water-quality networks described below, selected hydrologic analysis and modeling activities, and a small but vital portion of the overall information delivery activity of the USGS water resources programs.

The water-quality and hydrologic data and analytical information provided by this program are used by a variety of stakeholders, including other Interior bureaus (through the National Park Service (NPS) water quality partnership), EPA and USDA (both customers for water-quality information), the NWS (for real-time flood level information provided through NWIS), State and local governments (for both water-quality and flood level information), academia, consulting and advocacy organizations, industry, and private citizens.

The HNA program supports the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment. The HNA program is conducted in conjunction with other USGS programs and an array of reimbursable projects funded by partner agencies. The Program also supports the climate change and water census themes of the USGS Science Strategy.

2010 Program Performance

Plans are underway to revise the HNA 5-Year Plan to align with priorities outlined in the USGS Science Strategy.

Hydrologic Networks and Analysis includes four major components:

Hydrologic Networks

(Estimates for 2008, \$5.4 million; 2009, \$5.9 million; 2010, \$5.5 million)

This program component includes long-term national networks for the collection of data on water quality and acid precipitation, including the National Stream Quality Accounting Network, the Hydrologic Benchmark Network, and the National Atmospheric Deposition Program / National Trends Network. This program component also includes activities related to the new National Water Quality Monitoring Network, a multi-agency effort conducted under the auspices of the Ocean Action Plan. With additional funding provided by the Secretary's A New Energy Frontier initiative, the USGS will begin an effort to document how biofuel production changes stream flow and water quality as well as ground-water availability in local and regional aquifers.

The goals of this program component are to:

- Monitor the chemical quality of rain and snowfall,
- Monitor streamflow and the water quality of streams to fulfill USGS obligations for specific river basin compacts and treaties, and
- Monitor the water quality and trends of selected major rivers.

Hydrologic Analysis

(Estimates for 2008, \$11.1 million; 2009, \$10.0 million; 2010, \$10.1 million)

This program component includes studies of climate variability and change, watershed modeling activities in support of the Bureau of Reclamation, USGS water-quality partnership with the NPS, and support for the USGS NRP in the hydrologic sciences. In part, these efforts support the USGS Science Strategy priority for a National water census to inform the public and decisionmakers about resource availability. The goals of this program component are —

- Provide direct technical support to Interior bureaus for hydrologic concerns,
- Provide direct technical support to the NPS for water-quality concerns, and
- Develop decision-support systems for specific river basins in the western United States.

Information Delivery

(Estimates for 2008, \$4.3 million; 2009, \$4.4 million; 2010, \$4.7 million)

This program component includes delivery of results and water information beyond the immediate needs of funding agencies or programs (the USGS funds the delivery of basic hydrologic data directly as a part of the overall cost of the data collection). This activity has two products: publications and the computer-based NWIS. This component of the HNA program also supports activities of ACWI, a Presidential FACA, and its subcommittees. The goal of this program component is to maintain and enhance USGS data delivery systems to process and disseminate water data and study results.

Technical Support

(Estimates for 2008, \$9.7 million; 2009, \$9.8 million; 2010, \$9.7 million)

This program component includes national technical support for geographically distributed USGS water-resources studies, including quality control to ensure the technical excellence of water resources programs. Technical support also provides a structured way of transferring new technology to USGS investigative and data activities that are primarily conducted in the USGS Water Science Centers located in each State, and a formal way of establishing priorities for water-resources research by the USGS. In addition, this program component supports various bureau-level activities such as CALFED science coordination.

Program Performance Overview

End Outcome Goal 1.4 Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 Pres. Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making									
# of systematic analyses & investigations completed (Water)	65	64	155	144	143	198	198	0	195
Total actual/projected cost (\$000)	26,000	25,600	31,000	28,800	28,600	39,600	39,600	0	39,000
Actual/projected cost per scientific report or other product (whole dollars)	400,000	400,000	200,000	200,000	200,000	200,000	200,000	0	200,000
Comment	<p>Actuals for 2007 were higher than the target due to transition from the WRD Reports Tracking System to the new enterprise-wide Information Product Data System (IPDS), which tracks status of scientific products for the entire USGS. Authors must enter all scientific publications and other products into the system. Targets for 2008 were revised based on using IPDS in reporting completion of publications and other products. Utilization if IPDS allows for more cost effective and accurate accounting of per unit cost for reports and publications.</p> <p>Cost per scientific product is an average that includes the cost of writing, editing, peer review, and publication of each product, as well as the cost of the studies from which the products are derived. Reimbursements from other Federal agencies are included in the calculation.</p>								

Activity: Water Resources Investigations

Subactivity: Cooperative Water Program

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Cooperative Water Program (\$000)	62,849	64,078	+1,483	0	65,561	+1,483
Total FTE	709	692	-12	0	680	-12

Summary of 2010 Program Changes for the Cooperative Water Program

The 2010 budget request for the Cooperative Water (Coop) Program is \$65,561,000 and 680 FTE. There are no program changes requested for the Coop Program in 2010.

Program Overview

As the primary Federal science agency for water-resource information, the USGS monitors the quantity and quality of water in the Nation's rivers and aquifers, assesses the sources and fate of contaminants in aquatic systems, develops tools to improve the application of hydrologic information, and ensures that its information and tools are available to the public.

For more than 100 years, the Coop Program has been a highly successful cost-sharing partnership between the USGS and States, local governments, and Tribes. This partnership provides support for a majority of the USGS national hydrologic data network, including approximately 4,700 of 7,500 streamgages, 10,000 groundwater observation wells, and 2,500 water-quality monitoring sites. The Coop Program is successful because it —

- Combines Federal and non-Federal resources in addressing many of the Nation's most pressing water resource issues, resulting in shared benefits and cost savings to both the Federal Government and the States,
- Conducts studies across the Country in each of the 50 States, Puerto Rico, and U.S. Trust Territories, allowing the USGS to form a national picture of important water-resources issues and potential solutions,
- Uses standardized methods of data collection and analysis across the Country, so that information can be aggregated into national databases, results of studies are comparable from one State to another, and knowledge gained from one study has transfer value to understanding the hydrology in other parts of the country,
- Helps resolve inter-jurisdictional disputes by assessing conditions at State boundaries and by assuring all parties that the data and results of investigations are objective and are equally available to all parties, and
- Links State USGS offices with the larger national USGS infrastructure. This infrastructure includes the National Water Quality Laboratory, NWIS, NRP,

instrumentation testing facilities, a national quality assurance system, and the breadth of other expertise available throughout the bureau.

In addition to providing information responsive to State or local needs, the Coop Program provides information that supports the activities of many Federal agencies. Some of these activities are —

- Forecasting floods,
- Managing surface-water supplies,
- Monitoring hydroelectric power demand,
- Setting waste disposal limitations,
- Regulating industrial discharges,
- Designing highway structures,
- Measuring the downstream transport of pollutants or nutrients,
- Determining total maximum daily loads,
- Evaluating mine permits,
- Evaluating fish habitat,
- Quantifying Federal reserved water rights,
- Quantifying Indian water rights, and
- Managing interstate compacts and Indian water rights settlements.

The goals of the Coop Program support the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment. The Coop Program supports a wide range of activities that are aligned with the USGS Science Strategy, specifically the development of a water census of the U.S. to inform the public and decisionmakers about water resources availability. The Coop Program is conducted in conjunction with other USGS programs and an array of reimbursable projects funded by partner agencies.

This program effectively leverages Federal appropriations, working with State, local, municipal, and Tribal officials to develop a program that responds to both local and national needs and attracts more than two non-Federal dollars for each Federal dollar appropriated. As the result of a reduction in cooperator funding, there may be a decrease in FTE in 2010.

2010 Program Performance

The Coop Program includes three major components:

Data Collection Activities

(Estimates for 2008, \$34.1 million; 2009, \$34.8 million, 2010, \$35.6 million)

Cooperatively funded hydrologic data collection activities are underway in every State, Guam, Puerto Rico, and the U.S. Virgin Islands. Over the past few years, the Coop Program has provided sole support or partial support for over half of the sites where the USGS collects data on surface-water levels and flow, groundwater levels, and groundwater quality. In addition, the Coop Program supports collection of data on surface-water quality, which is becoming increasingly important to States as they implement total maximum daily loads (TMDLs), to comply with the requirements of the Clean Water Act.

These data provide resource managers with the information they need to determine the suitability of water for various uses, identify trends in water quantity and quality, and evaluate the effects of various stresses on the Nation's groundwater and surface water resources. The data collected at USGS monitoring sites is provided free of charge on the Internet. This includes historical data, as well as real-time data. The real-time data are used routinely by emergency management agencies, State and municipal agencies, businesses, irrigators, and recreational users.

Most USGS data collection stations serve multiple purposes and many are funded, wholly or in part, through joint-funding agreements. Normally, these stations, though funded by various organizations, are operated as part of an integrated network rather than as stand-alone entities, and comprise the majority of the USGS national hydrologic data network.

Interpretive Studies

(Estimates for 2008, \$22.7 million; 2009, \$23.1 million; 2010, \$23.6 million)

In addition to data collection activities, the Coop Program supports about 700 hydrologic studies each year. Water resource studies define, characterize, and evaluate the extent, quality, and availability of water resources. The results of these investigations are published and provided to cooperating agencies, which use them as the basis for managing the water resources for which they are responsible. Also, these investigations provide information that can be synthesized and applied to a variety of hydrogeologic and climatic settings across the Nation, greatly expanding the usefulness and transferability of USGS study results nationwide.

Technical Support

(Estimates for 2008, \$6.1 million; 2009, \$6.2 million; 2010, \$6.3 million)

The USGS has a long tradition of providing national and regional technical support for its geographically distributed water resources studies. This support provides quality control to ensure the technical excellence of water resources field programs and provides a structured way of transferring new technology to USGS investigative and data activities that are primarily conducted in Water Science Centers in each State. Technical support also includes a formal way of establishing priorities for water resources research by the USGS and provides a mechanism to make water resources information available to other agencies, the scientific community, and the public.

Topical areas of focus in 2010 include the following:

Water availability — The availability of water to meet the needs of growing communities, agriculture, energy production, and critical ecosystems continues to be a nationwide challenge. The Coop Program provides essential hydrologic information needed to assess the quantity of water available to communities to support water supply planning and allocation to a wide range of users and directly aligns with the USGS Science Strategy priority for development of a water census of the United States. In 2010, the Coop Program will support thousands of streamgages and groundwater observation wells that define the availability of surface and groundwater, and will conduct numerous hydrologic investigations needed to evaluate the quantity of available surface and groundwater.

Drinking water — Providing clean, safe drinking water to citizens is a high national priority. The Coop Program works with State and local governments to assess the quality of the Nation's

drinking water supply. With many partners, the USGS is developing an understanding of natural and human factors that affect groundwater quality, providing early indications of potential water-quality problems and contributing to the long-term management and protection of groundwater resources affecting one in eight Americans.

Ecosystem services — One of the most pressing ecosystem questions that the Nation faces is how to preserve and enhance the quality of aquatic and riparian ecosystems in the face of increasing pressure to withdraw surface water and groundwater. Through the Coop Program the USGS is working with State and local agencies to evaluate the instream flow requirements of aquatic ecosystems, which addresses a key issue of water use for environmental and wildlife needs. This effort entails the development of both new information and new techniques.

Hydrologic Hazards — Real-time streamflow information from streamgages funded through the Coop Program are used by the NWS to provide flood forecasts to local communities. Local emergency responders use this same information in evacuating at risk populations from flooded areas. In addition, flood-frequency analyses conducted as a part of the Coop Program interpretive studies serve as the foundation for the design of flood control structures and delineation of flood prone areas, an essential component of FEMA's National Flood Insurance Program.

Program Performance Overview

End Outcome Goal 1.4: Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of river basins that have streamflow stations (SP) (WRD)	C	82% (1825/ 2223)	81% (1800/ 2223)	81% (1800/ 2223)	84% (1870/ 2223)	79% (1765/ 2223)	84% (1765/ 2102)	86% (1800/ 2102)	+2%	88% (1850/ 2102)
Total actual/projected cost (\$000)		23,725	24,300	24,300	26,180	24,710	26,475	27,732	+1,257	30,525
Actual/projected cost per streamgage (national average) (whole dollars)		13,500	13,500	13,500	14,000	14,000	14,500	15,000	+500	16,500
Comment	<p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgage network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgage network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p> <p>The measure "% of river basins that have streamflow information" assumes a single streamgage in each basin, where 2,102 basins are defined nationwide by 8-digit hydrologic unit codes; however, many basins require more than one streamgage to accurately assess conditions. This metric may never attain 100% because not all basins may require streamflow data (e.g., a basin with no population may not require any assessment of flood risk or land use changes).</p> <p>For 2009, the target was re-baselined to reflect the number of HUC units in the continental United States to provide for greater accuracy in reporting.</p> <p>It is possible that some decline in performance from that estimated from 2009 to 2010 may occur due to State and local funding partners budget issues; however, it is anticipated that USGS Water Science Centers will attempt to hold streamgage operation and maintenance costs level by controlling costs, within their Centers in order to maintain the stability of the streamgage network. It is important to note that any anticipated loss of streamgages may be exacerbated by the fact that the U.S. Army Corps of Engineers expects that funding for approximately 50 cooperatively funded streamgages in NY, MD, and PA will be discontinued in 2009 and additional streamgages discontinued in 2010.</p>									
X% of States with web based Streamflow statistics tools to support water management decisions (WRD)	C	10% (5/50)	14% (7/50)	18% (9/50)	26% (13/50)	28% (14/50)	34% (17/50)	34% (17/50)	0	40% (20/50)
Comment	Cooperative Water Program funding limitations have slowed progress on jointly funded streamstats projects at the State level. See http://water.usgs.gov/osw/streamstats/ssonline.html for current national status.									

Cooperative Water Program

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
% of proposed streamflow stations currently in operation that meet one or more federal needs (WRD)	C	61% (2700/ 4425)	62% (2742/ 4425)	62% (2742/ 4425)	64% (2845/ 4425)	62% (2940/ 4744)	62% (2940/ 4744)	63% (2990/ 4744)	1%	65% (3100/ 4744)
Total Actual/Project cost (\$000)		35,100	36,450	37,017	39,830	41,160	42,630	44,850	+2,220	51,150
Actual/Projected cost per (whole dollars)		13,000	13,293	13,500	14,000	14,000	14,500	15,000	+500	16,500
Comment	<p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgauge network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgauge network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p> <p>The change in 2008 was a result of the increase for NSIP streamgauge operations and the increases for Hazards Assessment and Mitigation. The number of streamgages and the number of those gages that meet Federal needs can fluctuate from year to year as streamgauge funding is a cooperative endeavor with numerous Federal and non-Federal partners.</p> <p>During 2008 the denominator was re-baselined due to the reevaluation of requirements for the national network based on comments from external review by the National Research Council and changes to USGS water quality networks. This baseline increase of 319 streamgages makes the changes in 2009 and 2010 more difficult to assess, but the number of streamgages that will likely decrease is the best estimate available.</p> <p>This performance measure is very sensitive to losses of streamgages from the network. Streamgages identified to be fully funded by NSIP are sometimes targeted by funding partners to lose cooperative funds with the assumption that NSIP will replace the lost funds. There is a possibility that the number of streamgages losses could be less than estimated here for 2010. It is important to note that any anticipated loss of streamgages may be exacerbated by the fact that the U.S. Army Corps of Engineers expects that funding for approximately 50 cooperatively funded streamgages in NY, MD, and PA will be discontinued in 2009 and at least that number in 2010.</p>									
# of real-time streamgages reporting in NWIS-Web (WRD)	A	6,246	6,496	6,728	6,830	6,936	6,940	7,100	+160	7,200
Total actual/projected cost (\$000)		84,321	87,696	90,828	95,620	95,200	95,200	99,400	4,200	118,800
Comment	The number of streamgages reporting data in real-time will be enhanced by funds received under the American Recovery and Reinvestment Act as some older radio transmitters are being replaced with high data rate radio transmitters.									
X% of WRD streamflow stations with 30 or more years of record (WRD)	C	58%	59%	59%	58% (3970/ 6830)	60%	57% (4080/ 7200)	58% (4120/ 7050)	+1%	60% (4320/ 7200)
Total Actual/Project cost (\$000)		48,897	51,597	53,589	55,580	59,160	61,200	61,800	+600	71,280
Actual/Projected cost per (whole dollars)		13,500	13,500	13,500	14,000	14,500	15,000	15,000	0	16,500

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	<p>Although there is no increase in performance depicted in the table for NSIP performance measures, the \$2M increase to NSIP provided in 2009 allows USGS to help stabilize the streamgauge network. Because of budget constraints at the State and local government level, as well as other Federal agencies, the streamgauge network in many States has experienced a decline in cooperator funding. This NSIP increase has provided additional funds to Water Science Centers for the operation and maintenance of threatened streamgages.</p> <p>Decrease in 2007 and steady-state in 2008 are due to NSIP funding increases (reactivating existing or establishing new streamgages may cause a drop in % of streamgages with 30 years of record).</p> <p>The denominator changes every year because it reflects the number of streamgages reporting in real time in NWISWeb. For this measure, the denominator changes annually because the measure represents the number of streamgages with 30 or more years of record as a percentage of the total number of streamgages in operation. Since the total number of streamgages changes each year, the denominator must change if this measure is to reflect the state of the streamgaging network accurately.</p>									
X% of daily streamgages (streamflow stations) with data that are converted from provisional to final status within 4 months of day of collection (WRD)	C	10% (5/50)	20% (10/50)	24% (12/50)	29% (15/50)	28% (14/50)	29% (14/50)	32% (16/50)	+3%	35% (18/50)
Comment	The percentage is derived by dividing the numerator, which represents the number of states that successfully convert provisional data to final status within 4 months, by the denominator which is the total number of States, 50.									
Remediation of discontinued streamgages, cableways, and ground-water well	A					0	0	0	0	0
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
# of streamgages upgraded with high data rate radios to increase frequency of radio transmission	C					4,500	4,900	5,300	+400	6,500
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
% of discharge measurements made with hydroacoustic instruments	C					35%	40%	45%	+5%	70%
Comment	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									

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Activity: Water Resources Investigations

Subactivity: Water Resources Research Act Program

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Water Resources Research Act Program Subactivity (\$000)	6,304	6,500	0	0	6,500	0
Total FTE	2	2	0	0	2	0

Summary of 2010 Program Changes for Water Resources Research Act Program

The 2010 budget request for the Water Resources Research Act Program Subactivity is \$6,500,000 and 2 FTE. There are no program changes requested for the Water Resources Research Act Program in 2010.

Program Overview

The Water Resources Research Act of 1984 established a Federal-State partnership in water resources research, education, and information transfer through a matching grant program that authorizes State Water Resources Research Institutes at land grant universities across the Nation. There are currently 54 Institutes - one in each State, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam, which also serves the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands. The Institutes provide new opportunities for young people through their research and education efforts. Additionally, in 2008, the USGS collaborated with a number of Institutes from Colorado to New York in supporting student internships. These internships provide an invaluable and practical training experience for the next generation of hydrologic scientists and engineers. The internships afford students the unprecedented opportunity to participate in USGS projects while helping to influence their decision to pursue careers in water resources.

The Water Resources Research Act Program provides an institutional mechanism for promoting State, regional, and national coordination of water resources research, training and coordination and information and technology transfer. With its matching requirements, the program is also a key mechanism for promoting State investments in research and training. In fact, the Institutes have developed a constituency and a program that far exceeds that supported by their direct Federal appropriation. According to the results of a recent survey conducted by the National Institutes for Water Resources, in 2007, the Institutes collectively generated an additional \$17 in support for each dollar appropriated to them under the USGS program, with \$8 coming from other Federal sources and \$9 coming from non-Federal sources.

Each Institute operates a program of multi-year research, education, and information transfer projects focused on State and regional water resource priorities. In 2008, the Institutes supported 226 applied research projects utilizing Federal and matching funds. These projects were selected in response to priorities established by the Institutes' advisory committees and

through a competitive, peer-review process.

The following are examples of Water Resources Research Institute activities that have resulted in or are likely to result in increased water supplies or yields, advances in water infrastructure, and water quality improvements:

- Inland salinity management is an increasingly important responsibility for water managers in Arizona and the Southwest, as lower quality water resources are utilized for potable use. A series of pilot projects, supported in part by the Arizona Water Resources Research Center through the University of Arizona Water Sustainability Program, have demonstrated the effectiveness of innovative strategies and technologies to decrease energy use and increase water recovery from membrane desalination. Project successes led to collaborations with stakeholder partners: the U.S. Bureau of Reclamation, the Central Arizona Project, Tucson Water, and the Northwest Water Providers, a consortium of local water utilities, on an Arizona Salinity Management Laboratory concept currently under development.
- Groundwater pumping regulations in Hawaii have been based on models that assume a “sharp interface” between fresh and saline water. This results in rather conservative limits on pumping, to ensure against drawing non-potable sources. There is no precise well depth at which potable water turns saline. Instead there is a “zone of mixing” between the two water qualities. The Hawaii Water Resources Research Center has extended earlier models to account for the zone of mixing. The Hawaii Commission on Water Resources Management, which sponsored the work, is using this more sophisticated tool to set pumping limits in major aquifers.
- A multi-university panel called the Academic Advisory Committee based at the Virginia Water Resources Research Center is working with the Virginia Department of Environmental Quality (DEQ) to establish much-needed fresh water nutrient standards for the Commonwealth. Since 2005, the committee has studied levels of nitrogen and phosphorus in streams, rivers, lakes, and reservoirs. According to the EPA, high levels of nutrients such as nitrogen and phosphorus are a major cause of water quality impairment. Based on the Committee’s recommendations, the DEQ has recently amended the Virginia Water Quality Standards regulation to protect Virginia’s reservoirs from the impacts of excess nutrients. The effort is funded by DEQ and EPA.

2010 Program Performance

Funding in 2010 will allow the Institutes to continue their multi-year projects and other ongoing activities.

Program Performance Overview

There are no performance measures for this program.

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Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Biological Research and Monitoring (\$000)	141,275	146,416	+2,681	+8,668	157,765	+11,349
<i>FTE</i>	991	1,015	0	+11	1,026	+11
Biological Information Management and Delivery (\$000)	22,422	21,965	+231	0	22,196	+231
<i>FTE</i>	68	68	0	0	68	0
Cooperative Research Units (\$000)	16,174	16,949	+364	+2,000	19,313	+2,364
<i>FTE</i>	127	127	0	0	127	0
Total Requirements (\$000)	179,871	185,330	+3,276	+10,668	199,274	+13,944
Total FTE	1,186	1,210	0	+11	1,221	+11

Activity Summary

The 2010 budget request for the Biological Research Activity is \$199,274,000 and 1,221 FTE, which is a net program change of +\$10,668,000 and +11 FTE from the 2009 Enacted level. Additional information on program changes is provided in each subactivity section and in the Key Increases section beginning on page C-1.

The Biological Research Activity generates and distributes information needed in the conservation and management of the Nation's biological resources. This Activity serves as the Department of the Interior's biological research arm and continues the strong traditions for management-oriented research developed within the Department's land management bureaus. Core biological research capability at 17 research centers and associated field stations, one technology center, and 40 Cooperative Research Units supports research on fish, wildlife, and habitats that is used by Federal and State government and nongovernmental organizations.



USGS Scientists examining a fish.

The USGS works closely with its scientific and management partners and customers to support the needs of resource management organizations. Biologists work closely with scientists from other USGS programs to define priorities, develop science plans, conduct biological research and monitoring, and provide needed scientific information. Research and monitoring supplies critical understanding to evaluate problems and options for restoring fish and wildlife habitats and to make better resource-management decisions concerning Departmental Trust species. Information management specialists participate in global scientific standards-setting bodies to ensure data sharing, exchange and integration capabilities. Information generated by the Biological Research activity also helps to improve management of the Nation's water resources

Biological Research

and the natural hazards that threaten its land, coastlines, and population. The Biological Research Activity comprises three subactivities: Research and Monitoring, Information Management and Delivery, and Cooperative Research Units.

Science Strategy

The Biological Resources discipline supports the USGS Science Strategy and all of its themes. The ecosystem theme is informed by biological research on the state of the Nation's terrestrial, freshwater, and coastal and marine ecosystems, studies that address the causes and consequences of ecological change, and models that forecast the implications of natural and anthropogenic factors. The Biological Research Activity contributes to the climate element through investigations of the impacts of climate variables on species distribution and stressors, factors that affect biological carbon sequestration and other research. The energy and mineral development theme is informed by biological work on the effects of development of renewable energy on species and habitat, and the effects of contaminants in abandoned minelands. Biological information on wetland restoration improves societal response to natural hazards such as hurricanes. In the human health theme, biology is at the forefront of identifying wild-animal disease reservoirs, and maintains critical knowledge about exposure to humans from wild-animal disease and contaminants in fish and wildlife that may be consumed, pathogens in recreational beaches, and the use of wild animals as sentinels of human health. Lastly, biology supports the Water Census element by conducting work on the status and trends of freshwater fishery resources, helps to determine the environmental needs for water and forecasts aquatic-ecosystem health caused by changes in land use and land cover, natural and engineered infrastructure, water use, and climate variability. Additionally, central to all of USGS science themes, Biological Resources is a leader in the development of cyberinfrastructure in support of long-term data management, implementation of standards, development of tools for interacting with data, and provision of an authoritative data source for taxonomy.

Workforce Planning

Continued success in providing the Nation with outstanding biological science depends on developing and maintaining a flexible and skilled workforce that can take advantage of science and business opportunities of the future. The USGS Biology Research Grade Evaluation Office maintains a database that tracks the classification, research specialty and skills of all discipline Research Scientists. The Biology Discipline continually reviews these data along with retirement projections and periodic skills assessment exercises to identify workforce gaps and future skills needs. Comprehensive profiles of the current workforce and anticipated hiring needs are continually updated to ensure that the discipline and USGS can meet future science needs.

Within the Biological Resources Discipline, workforce planning is also exemplified by efforts in the Cooperative Research Units (CRU) program, which currently has vacancies in over 20 percent of its scientist positions. Working with program cooperators and partners, CRU has developed and now is implementing a strategy to reshape the workforce of natural resource professionals through strategic hiring, graduate and post-graduate training, and new emphases on experiential learning. CRU will continue efforts in each of these areas, and in particular will allocate its resources so as to enhance capacity for research and education in each of its university-based Fish and Wildlife Research Units.

Subactivity Overview

Biological Research is composed of three subactivities, Research and Monitoring, Information Management and Delivery, and the Cooperative Research Units.

Research and Monitoring — The USGS serves the biological science needs of Interior bureaus and others by providing scientific information through research, inventory, and monitoring investigations. Biological studies develop new methods and techniques to identify, monitor, and manage fish and wildlife, including invasive species, and their habitats. Scientists inventory populations of animals, plants, and their habitats; and monitor changes in abundance, distribution, and health of biological resources through time. Research and models relating to the impacts of contaminants, land use, climate and other factors help Interior land and resource managers to maintain the health, diversity, and ecological balances of biological resources while meeting public needs, such as game harvests and use of public lands and waters.

USGS specialists also help address resource management problems by providing technical assistance to Interior bureaus and other customers in applying the information, methodologies, and tools developed by the USGS. The USGS collaboratively engages users of scientific information in the identification and prioritization of their information needs during the research planning process. USGS contributes to adaptive management by Interior bureaus and other customers and partners, where appropriate, are involved in an adaptive process to find solutions and develop new methods by testing research results in the field.

For 2010, USGS is requesting an increase in this subactivity in the Secretary's A New Energy Frontier initiative for \$1.025 million and Tackling Climate Impacts initiative for \$5.0 million. These proposed increases are described in detail in the Key Increases section, which begins on page C-1.

Information Management and Delivery — Science-based decisionmaking is a Department of the Interior priority, particularly as it pertains to the conservation, management, and use of the Nation's natural resources. To facilitate this, the USGS is committed to making available the data and information that are critical to scientific discovery and application. Data sets, maps, and other information products are vital to achieve this goal. This subactivity supports the goal of ensuring availability of long-term environmental and natural resource information, data, and systematic analyses needed by land and resource managers for informed decision making.

The USGS works in cooperation with many organizations across the country to provide critical information to partners, stakeholders, customers, and the general public. Through electronic infrastructures, the USGS delivers relevant data and information faster and in more usable formats than in the past, leading to better stewardship of our natural resources.

Cooperative Research Units — This cooperative program allows government and nongovernmental entities with common interests and responsibilities for natural resource management to address biological resources issues collaboratively. Through this unique program, biologists from Federal and State governments and academia are able to work as a team and focus their expertise and creativity on the resolution of biological resources issues. This subactivity supports the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment.

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Federal support of the Cooperative Research Units program is matched with State and university contributions of expertise, equipment, facilities, and project funding. Through university affiliations, Federal scientists train future natural resource professionals.



Student and grass carp, Mississippi Cooperative Research Unit

Performance Improvement

Completed program assessments concluded that USGS needed to take steps to improve accessibility of research and monitoring products and that past program reviews have not been adequate. In response to the assessments USGS acquired an independent contractor to conduct a comprehensive and independent review of all biological research, monitoring and information management activities. This program review is expected to be completed in 2010 and will be used to improve program performance.

Meanwhile, USGS developed a comprehensive program plan to provide timely access to research, data, and reports on the status and trends of the Nation's biological resources. USGS identified barriers and piloted potential solutions to maximize timely delivery and developed shared performance measures with FWS to ensure that science is available to FWS for decisionmaking in support of their conservation of fish and wildlife populations. In order to further coordinate research with management needs, USGS is developing state of knowledge indices for avian focal species with completed FWS action plans and providing focused Web-based access to existing data and information of interest. USGS has also created a focus group to help refine the requirements for a website highlighting USGS microbiology activities. USGS has selected a new search engine to improve the search capacity and accuracy for finding USGS biology content and will incorporate Web 2.0 technologies on program Web sites where appropriate to ensure continued performance improvement.

Activity: Biological Research

Subactivity: Biological Research and Monitoring

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Biological Research and Monitoring (\$000)	141,275	146,416	+2,681	+8,668	157,765	+11,349
<i>Total FTE</i>	<i>991</i>	<i>1,015</i>	<i>0</i>	<i>+11</i>	<i>1,026</i>	<i>+11</i>

Summary of 2010 Program Changes for Biological Research and Monitoring

Request Component	(\$000)	FTE
• A New Energy Frontier	+1,025	+1
• Climate Impacts - Support for FWS Climate Change Activities	+5,000	+8
• Changing Arctic Ecosystems	+4,200	+8
• Sustainable Energy Development	+727	0
• Molecular Biology at Leetown Science Center	-800	-3
• San Francisco Salt Ponds	-500	-3
• NatureServe	-984	0
TOTAL Program Changes	+8,668	+11

Justification of 2010 Program Changes

The 2010 budget request for the Biological Research and Monitoring (BRM) subactivity is \$157,765,000 and 1,026 FTE, a net program change of +\$8,668,000 and +11 FTE from the 2009 Enacted level. Program changes associated with the Secretary's initiatives are described in section C, Key Increases.

A New Energy Frontier - Solar, Wind and Biofuels (+\$1,025,000 / +1 FTE)

In the A New Energy Frontier initiative the USGS will investigate an array of renewable energy sources, including geothermal, solar, wind and biofuels. Biology will provide the scientific base for understanding the impacts of wind, solar, and biofuels on ecosystems and wildlife populations. The initiative supports the President's and Secretary's priority of expanding the generation and transmission of energy using renewable resources. The USGS will engage the many partners participating in these complicated natural resource issues: other DOI agencies such as National Parks Service (NPS), Fish and Wildlife Service (FWS), Bureau of Land Management (BLM), and Minerals Management Service (MMS), other Federal agencies such as Department of Energy (DOE) and Department of Agriculture-Forest Service (USDA-FS), State agencies, industry consortia, and others. The initiative will build upon the multidisciplinary capabilities of USGS. Expertise in modeling and ecological and geological research will be

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used to synthesize information for decision-makers and develop analytical tools for evaluating and predicting outcomes of decisions on natural resources.

Climate Impacts - Support for FWS Climate Change Activities **(+\$5,000,000 / +8 FTE)**

USGS is requesting the increase to support FWS's need for a stronger scientific foundation to protect refuges and Trust Species as they manage for climate change. This scientific information will help FWS implement Strategic Habitat Conservation under conditions of climate change, including consequent sea level rise, and other stresses to ecosystems. The increase will be used to integrate USGS capabilities in modeling current and projected physical and biological change across extensive landscapes and aquatic systems and habitats with studies of ecosystem and population processes. This multi-scale approach is necessary to integrate large-scale global change information with more local information relevant to resource managers, thereby supporting adaptive management for fish and wildlife in the face of climate change. It will require strengthened population and ecosystem modeling capacities at the regional and local levels, better integration of remotely-sensed and other existing datasets, standardization of monitoring protocols, improved large-scale syntheses, and expanded analytical support for FWS and State and Tribal managers. The USGS will provide ecological and population modeling capacity to FWS Landscape Conservation Cooperatives and provide information to FWS for use in Strategic Habitat Conservation. The USGS-FWS collaboration will benefit other Interior, Federal, State, Tribal, academic and private ecoregional fish, wildlife and land conservation efforts by providing an integrated ecological and population modeling capacity across all national efforts.



Pacific Walrus with tag

Changing Arctic Ecosystems

(+\$4,200,000 / +8 FTE)

USGS has demonstrated that wide-spread loss of arctic sea ice and terrestrial permafrost-supported habitats has serious consequences for the polar bear and will be a significant long term challenge for a suite of other species and ecosystems under Department jurisdiction. The increase will support a strategic expansion of the physical-biological forecasting capacity that was successfully used to assess polar bear status. The refinement of the forecasting models made possible by this expanded effort will enhance information needed by several partners. The FWS and NPS will use the models in management decisions within the Arctic Strategies. The models will be used within the U.S.-Russia Bilateral Treaty for conservation of polar bears in the Chukchi Sea, and in permitting of oil and gas development in a new ice-reduced Arctic Ocean. Scientifically, the models will enhance the ability of USGS to predict the status of other Arctic species, such as Pacific walrus, and associated ecosystems, and enhance capacity to evaluate policy and management strategies. USGS will apply new molecular, physiological and other emerging technologies to better inform the Department's efforts to identify comprehensive conservation and mitigation actions for the broad suite of high latitude ecosystems and fish and wildlife species they support.

Sustainable Energy Development**(+\$727,000 / 0 FTE)**

This program represents the USGS partnership with other Interior bureaus, State and local agencies, industry and private land owners in the Wyoming Landscape Conservation Initiative committed to maintaining healthy landscapes, sustaining wildlife and preserving recreational and grazing uses while developing natural gas energy in the Green River Basin. The role of the USGS is to provide the science framework and information necessary for partners to use in making decisions on mitigation, restoration and conservation efforts. This increase will allow USGS to support field work required to maintain current data and implement scientific studies evaluating various habitat treatments and monitor at risk species such as sage grouse, song birds and pygmy rabbits. The landscape and habitats important for fish and wildlife population sustainability are undergoing rapid change in response to energy resource development and relying on aged data sets risks invalidating models and mitigation strategies. In 2010, we will build on 2009 accomplishments such as inventorying species and habitats, monitoring and assessing water resources, integrating energy resources and habitat data, and providing a robust data inventory and scalable climate change models.

NatureServe**(-\$984,000 / 0 FTE)**

NatureServe provides a private-sector, on-line biological information system. USGS contracted with NatureServe in 2007 and 2008 to improve the information archive of the Natural Heritage database and make its information more interactive and available to Interior bureaus. For example, NatureServe is updating existing species profiles, reconciling data in their database with other systems to make it more inter-operable and developing new information and range maps for pollinators. The USGS proposes to eliminate this funding in 2010, as USGS anticipates that this work will be completed in 2009. In the future, USGS will continue to collaborate with NatureServe on projects that are of mutual interest and priority.

Unrequested Congressional Actions**(-\$1,300,000 / -6 FTE)**

The reduction will end two unrequested congressional actions. These projects are not Administration or USGS priorities and do not address the highest priority science needs in biology research and monitoring. This will keep the core program intact while allowing the USGS to make the best use of resources. The specific projects are molecular biology at Leetown (-\$800,000), and San Francisco salt ponds studies (-\$500,000), which would eliminate lower priority studies that focus on managing and evaluating wetland restoration.

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Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
Increase long-term trend precision (decrease bias) for existing species monitored through the Breeding Bird Survey to enable a detection of 50% population decline of relevant species within 20 years (BRM)	0.008	0.008	0.008	0.008	0.008	0.008	0	0
Comments	Major advances in knowledge through research support for major areas that include several species (Birds Forever Initiative).							
% of North American migratory birds for which scientific information on their status and trends are available (SP) (BRM)	26%	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	0	+0.5% (2013 target: 27.1%)
% of focal migratory bird populations for which scientific information is available to support resource management decisionmaking (USGS in coordination with FWS) (BRM)	56.88%	57.02%	55.18%	55.22%	55.23%	55.23%	+0%	+0.05% (2013 target: 55.28%)
Comments	This performance measure is shared with the FWS. Changes are due to advances in knowledge through research on bird species identified by the Fish and Wildlife Service. Program performance is measured by quantifying contributions to science related to these species.							
Percent of targeted science products that are used by partners for land or resource decision making	86.9%	90.4%	90.4%	67%	68%	68%	+1%	+2% (2013 target: 70%)
Comments	This is quantitatively measured through customer surveys.							
% of studies validated through appropriate peer review	1,314/1,314 100%	1,093/1,093 100%	1,101/1,101 100%	869/869 100%	869/869 100%	833/833 100%	-36 0%	8/8 --

Biological Research and Monitoring

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of systematic analyses and investigations completed (BRM)	1,067	1,071	931	748	749	749	+1	-9 (2013 target: 740)
Total Projected Cost (\$000)	\$213,400	\$214,200	\$186,200	\$157,080	\$157,290	\$157,290	+210	-\$1,890 (2013 target cost: \$155,400)
Projected Cost per systematic analysis (whole dollars)	\$200,000	\$200,000	\$200,000	\$210,000	\$210,000	\$210,000	--	--
Comments	<p>Major change in 2009 is a net result of change in 2009 in the Global Change budget restructure (-24 SA) and a reduction of two SA for the \$500,000 decrease for wildlife. The numbers in the 2009 Plan above do not reflect this because the 2009 Plan has already been published with the number in the above table. However this would equate to a total reduction of 26 SAs in 2009, from 748 to 722. Changes in 2010 include PES coming into the Ecosystems Program, a decrease of one SA due to decreased funding for SF Salt Ponds, and an increase of two SAs due to the million dollar increase for the Birds Forever Initiative. Changes in 2013 result from proposed increases in A New Energy Frontier initiative, Climate Impacts-Support for FWS Climate Change Activities, Changing Arctic Ecosystems, and restoration to base for the Sustainable Energy Development Initiative. All of these would result in an increase of systematic analyses and investigations by 16 in 2013 for these new initiatives and restoration of funds.</p> <p>Systematic analyses, the product of research, require one to five years for completion. Some studies already underway in these areas will be completed in 2009 and 2010. The average unit cost for systematic analyses is approximately \$210,000 for the Resource Protection mission area which is a projected increase starting in 2009 due to increases in fuel, energy, and equipment costs and rising inflation.</p>							
# of formal workshops or training provided to customers	101	123	113	74	86	86	+12	+14 (2013 target: 100)
Total Projected Cost (\$000)	\$8,080	\$9,840	\$9,040	\$6,660	\$7,740	\$7,740	+\$1,080	+\$1,260 (2013 target cost: \$9,000)
Projected Cost per workshop (whole dollars)	\$80,000	\$80,000	\$80,000	\$90,000	\$90,000	\$90,000	--	--
Comments	<p>Change in 2010 is a net result new initiatives for (1) A New Energy,Frontier, and (2) Climate Impacts-Support for FWS Climate Change Activities, and a general increase for changing Arctic ecosystems related work, as well as a restoration of base to the Sustainable Energy Development activities, increasing the number of formal workshops or training provided to customers by 10 in 2010 and by 11in 2013. Additionally, in 2010, there was a decrease of one SA due to decreased funding for the SF Salt Ponds.</p> <p>For workshops, which support land managers in applying the science, and are a shorter term product, the USGS used the average unit cost of \$90,000 based on the technical assistance and proportional share of the science management work activity for 2007. Other Department goals will also accrue performance from workshops. This projected unit cost increase beginning in 2009 is based upon increases in fuel and energy costs.</p>							

Biological Research

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4: Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
<p>Note: Projected costs may not equal program change as these are full costs, which may include funds from other sources and (or) use averages.</p> <p>Column A: The level of performance and costs expected in 2009 at the 2008 level plus funded fixed costs. Reflects the impact of prior year funding changes, management efficiencies, absorption of prior year fixed costs, and trend impacts, but does not reflect the proposed program change.</p> <p>Column D: Out-year performance beyond 2009 addresses lagging performance — those changes occurring as a result of the program change (not total budget) requested in 2009. It does <u>not</u> include the impact of receiving the program change again in a subsequent out-year.</p>								

Program Overview

The Department manages vast Federal lands and the biological resources that inhabit them. Technical tools and scientific understanding of these lands and resources are critically important to the Department's land and resource management bureaus for wise and sustainable management. The BRM subactivity conducts research and monitoring that focuses on understanding how ecosystems (diverse communities of living organisms interacting with one another and with the physical and chemical environment) are structured, function, and provide "ecosystem services." This research and monitoring generates specialized information needed to effectively manage and conserve biological resources.

Partnerships - The USGS places a premium on partnerships at all levels of government and with non-governmental entities, including the private sector. The USGS works closely with its partners and customers in defining priorities, developing science plans and standards, and conducting biological research to support the science needs of research management organizations. The research and monitoring information is used adaptively to develop and refine management strategies. Key partners in many of these endeavors include Department bureaus, other Federal agencies, States, Tribes, and private organizations with regional and ecosystem-specific interests. Biological science also supports informed decision-making; industrial and agricultural corporations; scientists and academia; and the public. The following examples illustrate the roles that USGS plays in these partnerships.



Glen Canyon

The USGS is a leader in developing a national-level approach to managing biological and natural resource data and scientific information, which ensures the application of standards that foster opportunities for collaboration and cooperation. These partners use USGS-generated scientific data and information that contribute to the knowledge base, which then become available to Department land and resource managers, and to others.

USGS scientists have played a key role in fostering Departmental implementation of adaptive management, a system of sequential, objective-driven decisionmaking in which resource managers learn from and continually adapt their management strategies with new knowledge and findings. USGS scientists were lead authors in producing the Technical Guide for Adaptive Management for the Department. The Guide provides a general framework for adaptive management for Department agencies that can be further tailored as needed to specific agency resource responsibilities and institutional arrangements.

One example of the application of adaptive management is the Glen Canyon Dam Adaptive Management Program (GCDAMP). Established in 1996, the GCDAMP is an innovative effort to address the complex environmental management problems associated with the presence of a dam 15 miles upstream of Grand Canyon National Park. The GCDAMP creates a mechanism to cooperatively engage stakeholders in efforts to assess and revise dam operations to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established. The USGS Grand Canyon Monitoring and Research Center provides targeted scientific information about the status and recent trends of downstream resources to inform decision-making. USGS responsibilities include conducting experiments such as the 2008 high-flow release from Glen Canyon Dam and monitoring population trends for the federally endangered humpback chub.

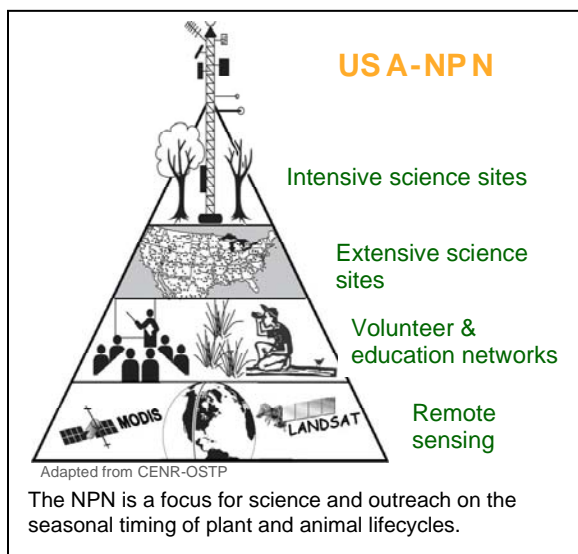
USGS is strategically positioned to provide managers with new tools and techniques for restoring the Great Lakes with biological stations located throughout the basin, water science centers in each Great Lakes State, and expertise in coastal geology and geospatial technology. This breadth of scientific expertise enables USGS to address a wide range of issues throughout the Great Lakes. USGS conducts research that complements the work of other agencies and organizations in the Great Lakes with whom USGS collaborates. USGS maintains numerous long-term monitoring datasets that are crucial for monitoring biological, hydrological, chemical, and land use changes within the Great Lakes and for predicting future system changes related to global climate change or other factors. In 2010, USGS is working with in the Great Lakes restoration effort with EPA in the Great Lakes initiative. Additional information on this interagency initiative can be found in the Key Increases section beginning on page C-1.

White Nose Syndrome (WNS) is a disease of bats that was first seen in New York in the winter of 2006. Since then, over 100,000 bats have died: affected populations at surveyed caves have declined by more than 75 percent. USGS is working closely with the FWS, State natural resource agencies, State public health departments and non-governmental organizations (NGOs) to investigate the die-offs, identify the likely cause, track the spread of disease and develop strategies for managing the situation. USGS microbiologists have linked a previously undescribed fungus to WNS but have not ruled out other factors that may be causing bats to die. WNS is radiating outward from the original site; it is now believed to have spread to at least eight States. Before the identification of WNS, mass mortality events in bats as a result of disease were very rare. Worldwide, bats play critical ecological roles in insect control, plant pollination and seed dissemination. The decline of North American bat populations could have far-reaching ecological consequences.

USGS coordinates with the FWS, State and Tribal wildlife agencies, and Canadian and Mexican Federal wildlife agencies, to establish annual harvest limits of gamebirds, such as waterfowl. USGS scientists have developed the population models that are the foundation for these decisions. Migratory bird research includes projects on individual species, communities, habitat relationships, and applied work for effectively managing bird populations.

Climate

The National Phenology Network (NPN) established in 2007, has launched a new website to expand the involvement of the public as partners in gathering data about the timing of seasonal changes such as flowering, fruiting and other seasonal events. Scientists and resource managers use these observations to track impacts of climate change on the Earth's life-support systems. Phenology is the study of periodic plant and animal lifecycle events that are influenced by environmental changes such as seasonal temperature and precipitation cycles. This information is very useful in the development of ecological forecast models for agricultural production, invasive species management, and drought monitoring. The NPN allows for effective input, reporting, and use of phenological observations on plants and animals for management decisions across the United States.



The following table displays program-funding estimates for three fiscal years for the BRM subactivity.

Biological Research and Monitoring Program Areas (Dollars in Millions)			
Program	2008 Actual	2009 Estimate	2010 Estimate
Status and Trends	21.5	22.4	22.6
Contaminant Biology	8.7	9.2	9.4
Fisheries: Aquatic and Endangered Resources	23.7	23.9	23.5
Wildlife: Terrestrial and Endangered Resources	44.2	45.1	50.8
Terrestrial, Freshwater, & Marine Ecosystems	32.7	35.0	40.5
Invasive Species	10.6	10.8	11.0
Total Biological Research & Monitoring	141.4	146.4	157.8

The following sections describe the BRM subactivity by program area of which all support the Department's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary science.

Status and Trends of Biological Resources

http://biology.usgs.gov/status_trends/

(Estimates for 2008, \$21.5 million; 2009, \$22.4 million; 2010, \$22.6 million)

To protect and conserve the living resources entrusted to their care, Federal land and resource managers must first understand the condition, or status, of those resources: what they are (inventory), where they are located (distribution), how many there are (abundance), and how they change over time (trend)—information only long-term, scientifically sound monitoring can produce. The USGS Status and Trends of Biological Resources program measures, predicts, assesses, and reports the status and trends of the Nation's biological resources to advance research, facilitate resource management and stewardship, and promote public understanding and appreciation of the Nation's living resources, with emphasis on Federal lands.

Program goals, as outlined in the program's 5-year plan, are to:

- Facilitate integrated monitoring from a variety of sources at multiple spatial and temporal scales to describe and track the abundance, distribution, productivity, and health of the Nation's plants, animals, and landscapes,
- Develop and evaluate inventory and monitoring methods, protocols, experimental designs, analytic tools, models, and technologies to measure biological status and trends,
- Collect, archive, and share critical, high-quality monitoring data in cooperation with partners to determine the status and trends of biological resources, and
- Produce and provide analyses and reports that synthesize information on the status and trends of the Nation's flora, fauna, and ecosystems and be responsive to the needs of the scientific community, land and resource managers, policymakers, and the public.

Sustainable Energy Development — This program represents the USGS partnership with other Interior bureaus, State and local agencies, industry and private land owners in the Wyoming Landscape Conservation Initiative committed to maintaining healthy landscapes, sustaining wildlife and preserving recreational and grazing uses while developing natural gas energy in the Green River Basin. The role of the USGS is to provide the science framework and information necessary for partners to use in making decisions on mitigation, restoration and conservation efforts.

Adaptive Management — By tracking useful measures of system response, well designed monitoring programs facilitate evaluation and learning through adaptive management. Monitoring provides data for four key purposes: 1) to evaluate progress toward achieving objectives; 2) to determine resource status in order to identify appropriate management actions; 3) to understand resource dynamics by comparing predictions against survey data; and 4) to enhance and develop models of resource dynamics as needed and appropriate.

National Park Monitoring — USGS scientists assist national parks with inventory and monitoring protocol development and other monitoring-related research needs such as assistance with monitoring planning and design, statistical data analysis, and review or revision of existing protocols. USGS scientists and technical specialists address priority issues, identified by NPS, that typically involve and benefit several parks and require multiyear efforts.

Park-Oriented Biological Support —The USGS and the NPS, through the Natural Resource Preservation Program, jointly support biological projects that provide exploratory research and technical assistance to national parks.

National Wildlife Refuge Monitoring — The Status and Trends of Biological Resources program is partnering with the National Wildlife Refuge System of the FWS to improve science-based management on refuges. Initially, this project is focused on developing monitoring

Biological Research

programs, national protocols, databases and adaptive management studies that address regional and system-wide refuge needs.

Bird Banding Laboratory — Bird banding is a universal technique for studying the movement, survival, and behavior of birds. The Bird Banding Laboratory (BBL) provides high-quality banding data in a timely manner for use in developing effective bird conservation and management strategies throughout North America. A Federal Advisory Committee report to the Department and USGS in 2008 helps to guide the future direction of the BBL.

Breeding Bird Survey — The North American Breeding Bird Survey (BBS) was launched in 1966, utilizing 600 roadside routes to obtain range-wide population data on breeding birds in the United States and Canada east of the Mississippi River. Today, the BBS provides the foundation for non-game, land bird conservation in North America with over 3,200 skilled volunteer participants sampling 3,000 routes annually across the continental United States and southern Canada. In cooperation with the FWS, USGS received a \$1.0 million increase in 2009 for new and increased research and monitoring capacity to better understand large scale drivers of migratory bird population and habitat change. This initiative has resulted in improved and enhanced monitoring efforts in such activities as the BBS, Strategic Habitat Conservation, and other priority migratory bird monitoring activities critical to the FWS and other partners.

Great Lakes — In coordination with the Fisheries: Aquatic and Endangered Resources program, USGS scientists conduct a regional deepwater science, large vessel program that complements other Department activities with large-scale multiyear strategic investigations. The program provides long-term, consistent, lake-wide assessment of forage fish stocks that support sport and commercial fish species, monitor invasive species for protection and restoration of the Great Lakes, and provide scientific and technological monitoring tools for aquatic species assessment and conservation in the Great Lakes.

Standards and Protocols — USGS scientists develop statistically valid, efficient, and feasible protocols that are relevant to the needs of resource managers for monitoring the abundance, distribution, productivity, and health of the Nation's plants, animals, and ecosystems. The USGS has been an active participant in the development of and support for the Natural Resource Monitoring Partnership (NRMP), a collaborative effort by the natural resource management community to improve monitoring efforts to support effective evaluation and decision-making. Current participants include State, Federal, and Canadian natural resource management agencies, nongovernmental organizations, and academic institutions. To foster coordination and sharing of monitoring efforts, the NRMP provides two collaborative, internet-based tools (<http://nrmp.nbio.gov>):

- **Monitoring Protocol Library** — An internet-accessible, searchable database that provides information on monitoring protocols and resource assessment methodologies organized to facilitate reference and use.
- **Monitoring "Locator"** — An internet-based, GIS application that allows users to identify what natural resource monitoring is being conducted within a particular area (e.g., State, province, county or other selected geographical area).

National Fish Habitat Action Plan (NFHAP) — Scientists are investigating research and monitoring issues of highest priority to the NFHAP. Initially, scientists are investigating fish-habitat relationships, including human impacts and their variation at different scales; and standardizing sample design, methodology and monitoring for data analysis.

Sagebrush Ecosystem Research — Populations of the greater sage-grouse has declined significantly in recent decades as a result of habitat loss. The USGS research model indicates that sage-grouse populations are more likely to persist in areas characterized by low population density in 1950 and a higher proportion of sagebrush habitat, and where populations are less isolated. Conversely, birds disappear from areas that lack sagebrush habitat and are closer to the edge of their range. Higher human density, greater agricultural development, and drier conditions also favor disappearance of sage grouse. These results suggest that conservation efforts focused on maintaining large expanses of sagebrush habitat, enhancing the quality of existing habitat, and increasing habitat connectivity would be beneficial to maintaining healthy sage-grouse populations. This information will assist Federal resource management agencies assess the status of this species and address conservation needs as they decide whether to list the greater sage-grouse under the Endangered Species Act.

Contaminant Biology

<http://biology.usgs.gov/contaminant/>

(Estimates for 2008, \$8.7 million; 2009, \$9.2 million; 2010, \$9.4 million)

The Contaminant Biology program provides information on the effects of environmental contaminants in the Nation's biotic resources and, in particular, the trust resources of the Department. Toxicology and chemistry expertise, research, information, scientific assessments, monitoring tools, and models are used by the Department and other agencies to determine exposure and effects of emerging and legacy contaminants on fish and wildlife. This information helps managers to prevent contamination; manage, protect, and restore contaminated lands and trust resources of the Department; and fulfill recreational, statutory, and regulatory responsibilities.

As resources permit, USGS is increasing its involvement in the environmental health and safety aspects of nanotechnology. Other areas of special interest include endocrine disruption, immunotoxicology and other sublethal effects on fish and wildlife populations; health and safety of species of concern; and tools to determine the causes of impairment in multiple stressor situations.

Program goals, as outlined in Contaminant Biology's 5-year plan, are:

- Toxicology and Chemistry — determine the causes, fate, exposure and effects of environmental contaminants. Develop and standardize biomarkers, molecular biology methods and techniques and other analytical and toxicological methods,
- Contaminated Habitats — develop the scientific basis for assessment, restoration, and monitoring of habitats that are contaminated by mining, agriculture, urban wastewater, industry, and chemical control agents. Develop the toxicological basis to remediate and prevent contamination effects of chemical controls for invasive species, fire, and other hazards, and
- Integration of Ecological Stressors — improve the scientific basis for evaluating the effect of multiple stressors, at all levels of biological organization and at multiple temporal or spatial scales.



Male sturgeon with eggs

Endocrine, Immune, and Reproductive Effects — Scientists examine the exposure and effects of contaminants that affect immune response, alter reproduction, and influence the endocrine system of fish and wildlife. Such information also helps to inform human health issues, a part of the USGS Science Strategy.

Nanoparticles and Other Emerging Contaminants — The program is conducting research on the environmental effects of nanoparticles in fish and aquatic environments, in a public/private sector partnership. USGS participates in the interagency coordination mechanisms of the National Nanotechnology Initiative related to nanotechnology research.

Contaminated Lands and Waters — Contaminant Biology research enables Federal land managers to restore and assess damages on contaminated lands. Scientists determine safe levels and document injury to Federal Trust species and Federal lands at sites that are contaminated with mine waste, pesticides, industrial chemicals, mercury and other substances. Improving scientific understanding of safe levels of contamination in the environment enables agencies to make more efficient use of limited resources for protecting trust species while establishing reasonable, protective, and cost effective cleanup levels. In 2008, USGS continued to conduct laboratory and field investigations on the potential impacts of coalbed methane production on aquatic resources in the Powder and Tongue River basins in Montana and Wyoming. The data from these studies will be used by EPA and the State of Montana to develop water quality standards.

Imperiled Species — To protect and restore imperiled species, Contaminant Biology develops test methods for groups of species such as mollusks, for which methods and data are very limited. Information on their sensitivity to contaminants helps to improve reliability of criteria and standards for protecting aquatic species of concern. Research on species-specific sensitivity to contaminants improves targeting of safety factors required to assess risk, choose restoration options, and assess factors that contribute to population declines. USGS is currently doing research to assess the effects of copper on threatened or endangered populations of white sturgeon in the Columbia and Kootenai Rivers. Copper is a contaminant associated with mining, mineral extraction and smelting activities. The results indicated that early lifestage sturgeon are highly sensitive to copper at concentrations below water quality criteria.

Fisheries: Aquatic and Endangered Resources

<http://biology.usgs.gov/faer/>

(Estimates for 2008, \$23.7 million; 2009, \$23.9 million; 2010, \$23.5 million)

The Fisheries Program conduct USGS biological and ecological research on aquatic species and habitats to determine factors affecting the growth, health, diversity, and survival of fish and other native aquatic fauna, aquatic community structure and function, and aquatic habitats. USGS science on the genetics, life history, behavior, and habitat requirements of aquatic organisms provides the information and methods for aquatic resource managers to restore and manage aquatic populations and their required habitats. High-quality scientific information about the distribution and habitats of species of concern and the biological integrity of multi-jurisdictional



USGS scientist sampling for fish

aquatic systems are provided to resource managers to support adaptive management of the Nation's aquatic species and habitats. High priority is given to studies that directly assist other Department agencies and national, international, State, and Tribal efforts to manage inter-jurisdictional fishery and aquatic resources in the face of climate change and hazards. The Fisheries Program and the Status and Trends Program support the National Fish Habitat Action Plan, a multi-agency and multi-organization partnership whose goal is to protect, restore, and enhance the Nation's aquatic habitats for fish and other aquatic communities through partnerships that foster fish habitat conservation and improve the quality of life for the American people.

Program goals, as outlined in the program's 5-year plan, are to:

- Provide scientific information about the diversity, life history and species interactions that affect the condition and dynamics of aquatic communities,
- Provide scientific information about factors and processes that affect aquatic organism health in support of survival, protection, conservation and recovery,
- Quantify and describe functional relationships among aquatic species and habitats to provide information to conserve or restore aquatic community structure, function and sustainability,
- Provide science support for natural resource managers by investigating the factors that contribute to the conservation and recovery of aquatic species at risk,
- Develop research and technology tools to provide the scientific basis for developing adaptive management strategies and evaluating their effectiveness for restoration efforts to sustain aquatic resources, and
- Provide research support and technical assistance to Department bureaus, other Federal and State government agencies, Tribes, and non-governmental organizations to support natural resource management problem solving and decisionmaking.

Klamath Basin — Biological Resources and Water Resources disciplines are collaborating in the Klamath Basin to determine the effects of changing water availability, water quality, climate, and management actions on population dynamics and required aquatic habitat of important endangered fishes, and on ecological responses in wetlands and the watershed. USGS has documented the continued lack of reproduction and recruitment of young endangered suckers into populations in the upper Klamath Basin and been instrumental in developing methods to understand fish disease issues in the Klamath Basin.

High Priority Fisheries Research for FWS — USGS continues to address critical research needs of the FWS in support of imperiled and at-risk species, inventory and monitoring programs, the National Fish Habitat Action Plan, fish passage programs, and fisheries and aquatic resources management. High priority fisheries research for the FWS provided in part by the science support partnership is determined annually by FWS science needs.

Fish Habitat Restoration — USGS has provided science and data leadership for the NFHAP through coordination of the first national assessment of fish habitat in the United States. In collaboration with Status and Trends of Biological Resources program, USGS develops techniques to identify and understand the components necessary for healthy fisheries habitat, tools and approaches for protection and restoration of fisheries habitat, and techniques to monitor recovery of fisheries habitat.

Endangered Fish and Aquatic Species — USGS endangered species research provides biological information for restoring currently listed populations, for supporting delisting where

possible, or for precluding future listings by clarifying species' status or suggesting preventive actions. USGS has developed watershed-scale identification of Atlantic salmon stocking locations in the Connecticut River using genetic markers. Using these results, USGS found that northern stocking locations produced more young fish, but very few adult Atlantic salmon return to northern locations as compared to southern stocking locations.

Fish and Aquatic Species at Risk — Species-at-Risk activities lead to conservation options and actions that reduce the need for listing species as threatened or endangered. USGS scientists led a team of international fisheries biologists in completion of an updated assessment of the conservation status of North American freshwater and diadromous fishes.

Fish Passage and Ecological Flows — Fish passage projects focus on the physiological, behavioral, and hydraulic phenomena that determine the successful navigation of barriers by fish and other at-risk aquatic species and the efficiency of artificial structures designed to allow passage through or around obstacles. Ecological flows projects focusing on determining the quantity, quality and timing of water needed to ensure properly functioning aquatic ecosystems. USGS scientists have developed a hydroecological integrity assessment process for Missouri streams that can be used by management agencies to properly manage freshwater systems.

Great Lakes — In coordination with the Status and Trends program, USGS scientific research, supports interjurisdictional management of the Great Lakes fish and aquatic resources, and facilitates information transfer across jurisdictional boundaries. This information enables ecosystem level adaptive management, conservation, and restoration in the Great Lakes basin. Studies focus on genetics, life history, trophic interactions, health, habitat requirements, and ecology of deepwater and near shore fisheries and aquatic resources in the Great Lakes and its tributaries. In 2008, the USGS conducted fish monitoring and assessment surveys on each of the Great Lakes and provided important scientifically valid data on the status of fish communities for resource managers to understand and effectively manage the fisheries on each of the Great Lakes. Analyses and findings give managers a better understanding of changing prey fish communities, invasive species impacts, decreasing fish populations, and other ecosystem changes affecting this \$7.0 billion per year fishery. In 2010, USGS is working with EPA in the Great Lakes restoration effort within the EPA Great Lakes initiative.

Coastal Fisheries — USGS scientists study how coastal and estuarine fish and other aquatic species are affected by changes in their habitat and interactions with other resident and migratory species to provide aquatic resource managers with information needed to conserve and restore important aquatic resources. USGS is studying the causes for the decline of groundfish and prey fish in the Puget Sound.

Fish Biology — USGS fishery research program examines the biology, genetic diversity, and health, all phases of the life cycles of fish and other aquatic organisms, and their habitat requirements to assist fishery managers who are developing techniques to restore fish populations. USGS has discovered possible interactions among gene expression, intersex characteristics and fish health problems in the Shenandoah River and other rivers in the Potomac River watershed.

Fish Genetics — Research in fish and aquatic organism genetics characterizes the diversity, variability, and taxonomic status of individuals, stocks, strains, and populations to enable managers of aquatic resources to identify native, cultured, introduced, and invasive fish and aquatic organisms to develop science-based conservation and restoration strategies.

Fish Disease — Fish disease research focuses on development of new techniques for the detection and identification of emerging pathogens and causative agents, disease resistance and immunology, and understanding the role of stress and environmental factors upon disease outbreaks, severity, and cycles. USGS scientists are leading technical assistance efforts to Federal, State and local agencies on viral hemorrhagic septicemia virus (VHS), considered to be the most important viral disease of finfish worldwide and is listed as reportable by many nations and international organizations. VHS has caused major fish kills in the Great Lakes and could threaten fisheries through the United States.

Native Mussels — USGS determines the life histories, hosts, distribution and abundance of native mussels, and identifies how invasive species and degradation of streams, rivers, and lakes are affecting mussel populations.

Large Rivers — USGS research related to water availability and the unique aquatic resources and conditions found in America's large rivers, such as the Colorado, Missouri, Mississippi, and Columbia, is providing vital information on fish community structure and function, aquatic community dynamics and function, critical habitat, hydrology and hydraulics of the rivers, sediments, and water quality. For example, USGS scientists have confirmed that shovelnose sturgeon spawning locations are distributed throughout the Missouri River, and that larval sturgeon can drift for several hundred kilometers. Data collected on shovelnose sturgeon show that the spawning occurs in many places along the 811 miles of the Lower Missouri River.

Wildlife: Terrestrial and Endangered Resources

<http://biology.usgs.gov/water/>

(Estimates for 2008, \$44.2 million; 2009, \$45.1 million; 2010, \$50.8 million)

Research conducted at USGS focuses on meeting the wildlife-related information needs of the Department's natural resource management bureaus and other partners as authorized by law. This program supports investigations to determine factors influencing the distribution, abundance, and condition of wildlife populations and communities. Studies also focus on developing the tools and methods needed to prevent and manage disease in free-ranging wildlife and to evaluate the effects of disease on wildlife populations. Through investigations that link physical, chemical, and biological factors that impact biodiversity and its resilience, the USGS provides land and resource managers with the tools needed to address these issues. USGS imperiled species research supports recovery of species already having legal status under the Endangered Species Act of 1973, as amended, as well as those whose populations are declining but are not currently listed. To help managers achieve the goals of recovery plans, USGS scientists investigate the life history of listed species, the factors limiting their populations, and the efficacy of restoration actions. Better knowledge of requirements and limitations is needed for managers to act effectively to restore populations.

Cooperative studies among USGS, the Southeastern Cooperative Wildlife Disease Study, State natural resource agencies, and the Association of Fish and Wildlife Agencies are now underway to determine causes and impacts of wildlife diseases such as avian influenza, West Nile Virus, and chronic wasting disease. In addition, efforts have begun to examine interactions between wildlife and human diseases. This work is being conducted in partnership with other Federal agencies, such as the Department of Health and Human Services and the U.S. Department of Agriculture.

Biological Research

Program goals, as outlined in the program's 5-year plan, are to:

- Provide the scientific foundation for the conservation of terrestrial plants, wildlife, and habitats by developing the basic biological information that partners need to formulate adaptive management strategies,
- Provide tools and techniques for effective science-based management, such as predictive models, decision support systems, and expert systems,
- Identify the factors that contribute to or limit the conservation and recovery efforts for terrestrial plant and wildlife species-at-risk,
- Institute an adaptive science approach to support the adaptive management of terrestrial plants and wildlife and provide technical assistance to natural resource managers, and
- Continue to build additional research capabilities, expertise, and to meet the emerging needs of USGS partners as wildlife issues take on new importance in today's society.

High Priority Wildlife Research for FWS — The USGS develops tools and technologies to assist wildlife refuges to measure the effects of land management practices on habitats of declining and at-risk species, and to determine the needs for habitat conservation planning. The USGS also conducts two complementary subprograms to provide research or technical assistance support to the FWS on priority emergent issues. Studies undertaken by these subprograms involve short-term, scientific research and provide critical information required for making credible and effective resource management decisions:

- **FWS Science Support Partnership** — USGS Science Centers and Cooperative Research Units work collaboratively with the FWS to address FWS mission-critical science needs.
- **Quick Response Program** — This activity addresses short-term research and technical assistance needs requested by the FWS.

Endangered Wildlife and Terrestrial Species — USGS endangered species research provides biological information needed to restore currently listed populations, support delisting wherever possible, or preclude future listings by clarifying species' status or suggesting timely preventive actions.

Wildlife and Terrestrial Species at Risk — Species-at-Risk activities lead to conservation options and actions that reduce the need for listing species as threatened or endangered.

Migratory Birds — USGS research efforts on migratory birds are international in scope and are coordinated with the FWS, State and Tribal wildlife agencies, and Canadian and Mexican Federal wildlife agencies. Migratory bird research includes projects on individual species, communities, habitat relationships, and applied work for increasing the number and diversity of birds.

Natural Resource Preservation Program (NRPP) — USGS biologists conduct short-term, tactical research to meet the natural resource management needs of the NPS. NRPP funds help fill gaps in applied biological research in the Nation's national parks and allow the USGS to address research needs significant to park resource managers.

Geospatial Tools for Bird Conservation Planning — USGS scientists have developed a series of statistical models for predicting and mapping habitat associations across entire ecoregions for avian species at risk such as the cerulean warbler (*Dendroica cerulea*). Based on these models, maps and interactive decision support tools are being produced to help

resources managers better understand the location and population of bird species, particularly those associated with FWS refuges. Resource managers can use the models and maps to identify and prioritize species and habitats for conservation actions and future monitoring.

For more information, please visit

http://www.umesc.usgs.gov/terrestrial/migratory_birds/bird_conservation.html

Wildlife Disease — Managing wildlife losses and minimizing disease outbreaks depends on effective diagnostic and technical support, knowledgeable guidance, and timely intervention. The USGS has a unique mission to provide information, technical assistance, and research on State, national, and international wildlife health issues such as highly pathogenic avian influenza, West Nile Virus, and chronic wasting disease. The infrastructure and interagency partnerships being developed and maintained through current USGS activities serve as a critical foundation and a template for emergency disease response activities for future emerging zoonotic diseases of wildlife. USGS will continue to work with its partners to develop appropriate strategies for protecting human, wildlife and domestic animal health.

- **Highly Pathogenic Avian Influenza** — In response to the growing threat to human health and wildlife populations presented by the highly pathogenic form of the avian influenza virus, the USGS has initiated an early detection effort in partnership with FWS, NPS, USDA Animal and Plant Health Inspection Service, the Centers for Disease Control and Prevention, and State agencies. The USGS conducts sampling of live birds, hunter-taken birds, and environmental materials for the virus, as well as increasing its response and analytical capability associated with migratory bird mortality events. At the request of the White House Policy Coordinating Committee for Pandemic Influenza Preparedness, USGS, along with its partners, established the Highly Pathogenic Avian Influenza Early Detection Data System (HEDDS), a national database for use by all agencies, organizations and policymakers. HEDDS is being maintained by the Wildlife Disease Information Node, housed at the USGS National Wildlife Health Center. All of these activities are being conducted as part of a coordinated, interagency program to provide agricultural, wildlife, and human health officials with advance warning to the presence of highly pathogenic avian influenza in North American wild bird populations.
- **West Nile Virus** — The USGS assists the Centers for Disease Control and Prevention and State and Federal agencies in the national West Nile Virus Surveillance program through viral testing of wildlife specimens, primarily birds, at diagnostic laboratories. USGS also collaborates with these agencies to document the geographic spread of the virus across the United States and to increase the understanding of the U.S. epidemic since it was first discovered in New York City in 1999. USGS produces semiweekly maps documenting the number of cases or infections in people, wild birds, mosquitoes and domestic animals. Federal agencies use these maps for predicting disease outbreaks and developing mitigation strategies. Concurrently, the USGS is working cooperatively with State and Federal natural resource and wildlife agencies to investigate regional wildlife mortality events (die-offs) potentially associated with West Nile Virus.
- **Chronic Wasting Disease** — The USGS, along with USDA and a number of State and Federal agencies, are involved in critical research and information sharing on chronic wasting disease (CWD). CWD is a fatal disease affecting elk and deer and belongs to the same family as mad cow disease in cattle and scrapie in sheep. Originally observed in only captive animals, it has recently been discovered in wild deer populations in ten

States. States are looking to the USGS to provide research, technical assistance, and other forms of support to combat CWD. To help meet the need, USGS scientists are investigating how CWD is transmitted, what conditions lead to disease outbreaks, and how to manage outbreaks once they occur. In addition, the Disease Information Node of National Biological Information Infrastructure has developed a CWD Data Clearinghouse that provides a means for State and Federal agencies to share CWD-related data quickly and securely.

Amphibian Research and Monitoring — USGS leads a coordinated effort extending beyond Department bureaus to include other Federal, State, and academic partners, to determine the status of amphibian populations nationwide and investigate potential causative factors for their decline. Amphibians are sensitive to environmental changes, so changes to their populations can serve as “canaries in the mine” about ecological stressors that could ultimately impact people, wildlife, and ecosystems. Scientists are conducting research on the impacts of climate change, effects of agricultural practices, invasive species, drought, and the pathogenic fungus (*Batrachochytrium dendrobatidis*) on amphibian populations on public lands.

In 2010, the activities of the Secretary’s A New Energy Frontier-Wind and Solar initiative and the Changing Arctic Ecosystems increase will be carried out in the Wildlife: Terrestrial and Endangered Resources program.

Terrestrial, Freshwater, and Marine Ecosystems

<http://biology.usgs.gov/ecosystems/>

(Estimates for 2008, \$32.7 million; 2009, \$35.0 million; 2010, \$40.5 million)

The USGS ecosystems research program is focused on providing information, models, and tools that managers and others can use to understand how management alternatives will affect ecosystems and the services they provide under a variety of climate, land use, and other change scenarios. Informed forecasting requires that we understand factors controlling the structure, function, composition, and condition of terrestrial, freshwater, and marine ecosystems; their variability in space and time; and the services they provide to benefit human communities and economies. Research results provide the basis for the adaptive management of ecosystems and natural resources, development of forecasting models and decision support tools that integrate ecological knowledge with management options, and development of frameworks and approaches for restoring ecosystems impaired by natural hazards and human actions to sustainable levels. Research activities also focus on understanding ecosystem sensitivity to change and vulnerability to specific stressors, and providing information to mitigate adverse effects on ecosystems and biological communities.

Scientific approaches include studies of ecosystem productivity, food-web relationships and energy flow, cycling of nutrients and other biogeochemical processes, and the diversity of biological communities. Topical areas include the ecology of various ecosystems; disturbances and landscape ecology; modeling ecological systems and quantifying ecosystem services; restoration ecology; fire ecology; and global change. In addition to the scientific community, customers of USGS ecosystem science include land and resource managers and decision and policymakers within the Department and other Federal, State, and Tribal land management and regulatory agencies, as well as NGOs and the public.

The goals of the Ecosystems program include:

- Provide science to sustain and restore ecosystems. In collaboration with others, USGS will quantify, map, and understand ecosystem components and processes, and functions that sustain and restore them across broad spatial and temporal scales.
- Synthesize ecosystem information. USGS will work to make data from its own scientists and partner organizations accessible for adaptive management and forecasting.
- Evaluate ecosystem status and trends. Local and regional monitoring is essential for successful implementation of adaptive management. USGS scientists will strengthen that linkage by tying monitoring tools and efforts to management options and design.
- Forecasting ecosystem change and its consequences. USGS scientists will improve methods to forecast ecosystem consequences of climate change, land-use change, chemical contamination, invasive species, fire, altered disturbance regimes, hydrologic alteration, resource extraction, energy development, biodiversity change, and water availability and use.
- Science support to resource management and planning. USGS will develop tools, techniques and interpretive products for managers to protect, restore, evaluate and manage habitats and species using an adaptive approach.

The Ecosystems research program includes the following collaborative areas:

Science on the Landscape — The Science on the Landscape initiative continues to be a successful collaboration between each USGS region and regional Departmental offices. The Department's bureaus have collaborated with USGS in project planning and implementation by leveraging funds or in-kind services to make this venture a true partnership. Although issues vary among regions and Department bureaus, the common theme among all projects is recognition of the Department's priority needs and quick response in providing information to answer questions and issues posed by Departmental bureaus.

Climate Change — The USGS climate change program is an interdisciplinary research program that seeks to develop understanding of the consequences of global change, including climate change and variability, on ecosystems and their component biota and processes. Studies, funded for 3-5 years based on a competitive review process, seek to determine the response of ecosystems and their biological communities to climate change and to assess future global climate and the impacts of climate change on ecosystem services.

Coastal Habitats, Wetlands, and Adjacent Uplands — USGS scientists conduct research to investigate coastal (including the Great Lakes) wetland structure and function to assess the resilience of wetland functions and the ecosystem services they provide to natural hazards and human activities, to predict changes in functions and ecosystem services in response to future environmental changes, to determine restoration and sustainable management practices for these systems, and to evaluate the effectiveness of current management actions.

Fire Ecology — The USGS conducts fire ecology research to understand the effects of wildland fire on ecosystem structure and function, and on other ecological attributes such as wildlife habitat. Research is also directed at understanding fire history and fire regimes; interactions of fire with invasive species (e.g., cheatgrass) and climate variability; fire relations with vegetation structure and effectiveness of fuels treatments; and development of guidelines for restoring and rehabilitating fire-impacted ecosystems and watersheds.

Outer Continental Shelf Marine Environmental Studies — USGS research supports the needs of MMS for information on long-term ecological effects of offshore oil and gas exploration

and production, including effects of active and decommissioned production platforms, of sand and gravel dredging activities for beach nourishment, on fish and deep sea corals, and on the condition, composition, and vulnerability of biological communities in areas of potential or new production or dredging.

Coral Reefs — USGS conducts research on issues facing resource managers, including understanding conditions needed for productive and healthy reef communities, effects of land use on reef health and disease in support of the Coral Reef Task Force, and evaluating management options for human activities and how they influence reef integrity and biodiversity.

Rangelands and Grasslands — USGS conducts studies on native grasslands and managed rangelands to assess ecosystem condition, determine spatial patterns of rare plants, and evaluate native plant diversity and species richness as impacted by past management, invasive species, and climate change.

Deserts and Arid Lands — In the Southwest, USGS scientists are investigating the history and effects of changes in patterns of temperature and precipitation on desert grasslands and shrublands, and mountainous ecosystems. Investigations of the effects of natural and human disturbances on discrete soil units and the biota they support are studied in the context of current and predicted large-scale changes.

Prairie Wetlands — USGS researchers are investigating factors influencing the use of restored wetlands by birds, amphibians, and macroinvertebrates, and quantifying recovery of non-wildlife functions such as sedimentation, greenhouse gas emissions, and the role of prairie pothole wetlands in sequestering carbon. Research is also conducted at a landscape scale on wetland processes, including the interactions of wetland biota with hydrology, geochemistry, and sedimentation in fragmented grassland landscapes.

Forested Wetlands — USGS research focuses on wetland regeneration and restoration in the southeastern United States, including site selection and preparation; forest mix and biodiversity enhancements; planting and community structure; management procedures and monitoring providing information for managing forested wetland flora and fauna and to quantify the role forested wetlands play in nutrient cycling and retention and in carbon sequestration.

Forest Ecosystems in the Pacific Northwest — USGS research focuses on healthy forest management in the Pacific Northwest, including understanding forest systems, sustaining biodiversity and ecosystem function, developing resource management options, recovery of sensitive and status species, supporting management of aquatic forest habitats, conducting landscape scale assessments, and addressing forest stressors such as climate change, fire, and pathogens.

Priority Ecosystems Science in Biological Research & Monitoring — One of the major components of the Ecosystem Program is Priority Ecosystem Science (PES). Research in PES is aimed at improving the understanding of the rates, causes, and consequences of natural and human-induced processes that shape and change the landscape over time and to provide comprehensive information needed to understand the environmental, resource, and economic consequences of landscape change. Through PES, USGS provides integrated science support to better understand the interactive nature of resources and the environment. Additional information can be found in the Science on the Landscape section beginning on page G-1.

In 2010, the activities of the Secretary's A New Energy Frontier-Biofuels and Climate Impacts-Support for FWS Climate Change Activities initiatives will be carried out in the Terrestrial, Freshwater and Marine Ecosystems program.

Invasive Species

<http://biology.usgs.gov/invasive/>

(Estimates for 2008, \$10.6 million; 2009, \$10.8 million; 2010, \$11.0 million)

Non-indigenous invasive plants and animals cause increasing harm to native species and significant economic losses by reducing productivity and diminishing opportunities for beneficial uses of forests, croplands, rangelands, and aquatic resources. Many species introduced decades ago have begun to spread rapidly in U.S. ecosystems and pose increasing threats to lands and waters managed by the Department of the Interior. They harm native ecosystems and are contributing factors in the listing of 40 percent of threatened and endangered species. The economic costs associated with invasive species exceed \$100 billion per year.

USGS plays an important role in Federal efforts to combat invasive species in natural and semi-natural areas by providing information on early detection and assessment of newly established invaders, monitoring invading populations, improving understanding of the ecology of invaders and factors in the resistance of habitats to invasion, and development and testing of prevention and alternative management and control approaches.

USGS plays a significant role in implementing the National Invasive Species Management Plan (Plan), developed by the National Invasive Species Council (NISC), as called for in the Presidential Executive Order on invasive species. To meet the goals of the Plan, the USGS Invasive Species program provides management-oriented research and delivers information needed to prevent, detect, control, and eradicate invasive species and to restore impaired ecosystems. USGS researchers are leading or cooperating in efforts to integrate the capabilities of the USGS and partners, including Federal and State resource agencies, to help provide the information, methods, technologies, and technical assistance needed for effective responses to terrestrial and aquatic invaders threatening U.S. ecosystems and native species. An important focus is on developing forecasting and predictive modeling tools by synthesizing and disseminating data and research to help detect and predict the effects of harmful invasive plants and animals. Researchers are also developing strategies and techniques to facilitate the restoration of native species and habitats in areas invaded by species such as tamarisk, cheatgrass, leafy spurge, Chinese tallow, buffelgrass and yellow star thistle.

Program goals, as outlined in the program's 5-year plan, are to:

- Conduct research and develop methods and technologies to prevent the introduction of invasive species,
- Identify and report new invasions and assess risks to natural areas and waters,
- Assess changes in populations and distribution of established invaders,
- Determine effects of invasive species and susceptibility of habitats to invasion,
- Provide approaches to contain, reduce, and eliminate populations of invasive species and restore habitats and native species, and
- Provide and coordinate the collection, synthesis, and accessibility of invasive species information.

The Department is also continuing its participation in an interagency performance budget on invasive species that is coordinated through the NISC. The Department's bureaus work in

Biological Research

partnership with other Federal agencies, State, local, and tribal governments, and private sources to conduct activities related to prevention, early detection and rapid response, control and management, restoration, and organizational collaboration.

To ensure the strategic allocation of resources to combat invasive species, the NISC, co-chaired by the Secretary of the Interior, the Department of Agriculture, and the Department of Commerce, developed the first interagency example of a performance-based budget. Based on common goal statements, strategies, actions, and performance measures, the NISC selected priority topical and geographical areas of focus, and member agencies developed coordinated budget requests to address these. The Department participates in the development of this interagency performance budget on invasive species which links spending levels with levels of performance.

Hawaiian Invaders — USGS research focuses on the ecology and control of highly invasive plants (e.g., miconia, faya tree, strawberry guava, Kahili ginger), including exploration and testing for biological control agents; animals (e.g., Argentine ant, mouflon, brown tree snake on Guam); wildlife disease organisms; and methods for reducing the impacts of invasive species on the region's unique native flora and fauna.

Weeds in the West — The USGS is conducting a multiscale, integrative program for mapping infestations and accurately monitoring the spread of invasive plants (i.e., weeds) in western forests and rangelands, improving methods for predicting areas most vulnerable to invasions, and assessing the effects of management practices and natural disturbances on invasions. The USGS is assessing the effects of invasions on ecosystems and native species (e.g., fire ecologists are determining how invasive species alter the frequency and intensity of wild fires) and providing improved methods for reducing the adverse impacts of invasive weeds and for restoring public range lands affected by weed invasions.

Invasives in the East — The USGS conducts research on invasive species that threaten ecosystems and native species in the eastern United States including terrestrial and aquatic surveys of non-indigenous species in eastern parks and wildlife refuges, studies of pathways for establishment and spread of invasive species, research on the impacts of invasive species and factors in invasions, and development of methods to control or eliminate invasive species to promote healthy native communities that are resistant to invasion.

Great Lakes Invaders — USGS research supports cooperative efforts in the Great Lakes region to prevent and control the spread of invasive fish, such as the round goby and sea lamprey, reduce the pervasive impacts of zebra mussels on U.S. waterways, and manage or mitigate the adverse ecological and economic impacts of the invaders.

2010 Program Performance

The USGS serves the biological research needs of Department bureaus and others by providing scientific information through research, inventory, and monitoring investigations. Biological studies develop new methods and techniques to identify, observe, and manage fish and wildlife, including invasive species, and their habitats; inventory populations of animals, plants, and their habitats; and monitor changes in abundance, distribution, and health of biological resources through time.

Short Courses for Natural Resource Managers — Recognizing the need for in-service training for natural resource managers who often do not have travel funds to attend in-person

training, the USGS Status and Trends of Biological Resources Program developed a series of free online courses open to all natural resource professionals. Participants listen to the presentations using either Voice over IP (VoIP) and their computer speakers and microphone, or by calling a phone bridge long distance. They view live PowerPoint presentations and demonstrations over the Web. A companion Website provides notes, handouts and audio/visual recordings of the presentations. Over 1,300 people have signed up for courses, including Natural Resource Monitoring Survey Design, Structured Decision Making and Adaptive Management, the R statistical package, and Species Occurrence and Occupancy Modeling. One participant commented, "I was pessimistic about the conference-call and PowerPoint format, but I found that it worked very well. I would gladly use this format again. I value personal interactions that come from real meetings, but given travel restrictions, costs, limited time for training (away from our daily tasks), I think this worked very well." Another said, "This was great! Thanks for making this opportunity available, and in these times of reduced funding, the conference call method was the only way I would have been able to attend the class."

Discerning the Chemical Fingerprints in Environmental Toxicology Research —

Determining the exposure to chemicals is a key to resolving contaminant problems. Analytical chemistry research devises methods to measure previously unquantifiable chemicals in sediment, biological tissues, and other matrices, reduce costs for analysis, and increase accuracy, precision and scope of measurement. In recent examples, improved analysis of complex chemical mixtures is a critical component of studies allowed for better identification of emerging contaminants that cause endocrine disruption in Lake Mead and Chesapeake Bay tributaries. New methods for analysis of novel chemicals helped identify algal toxins in Klamath Lake and quantify polycyclic aromatic hydrocarbons (PAH) metabolites in decommissioned oil rigs. Adaptations in chemical methods in studies of recreational snowmobile and jet ski emissions in National Parks and chemical exposures to the Penobscot Indian Nation have had advanced understanding of human health risks in backyard birds. These improvements enabled USGS provide more accurate and comprehensive assessments to a wide variety of partners. Research on analytical chemistry in 2010 will continue to improve separation of complex chemical contaminant mixtures and detection of persistent organic pollutants through development of better methods and models for chemical analysis.

Viral Pathogen Among Marine and Anadromous Fishes — Viral hemorrhagic septicemia virus (VHSV) is one of the most important viral pathogens of finfish in the Pacific and Atlantic Oceans, where it has been associated with substantial mortality among both wild and cultured fish. In 2008, VHSV was isolated from more than 25 species of fish found in Lake Michigan, Lake Huron, Lake St. Clair, Lake Erie, Lake Ontario, St. Lawrence River and from inland lakes in New York, Michigan and Wisconsin. Recent USGS findings suggest that VHSV was introduced relatively recently into the Great Lakes, probably as a single event within the past 5-10 years. USGS is continuing to provide critically needed information to understand the origins and the spread of the various strains of this virus, and its effects on the health of native fish populations. In 2009 and 2010, USGS will continue to work closely with Canadian and European colleagues on the molecular epidemiology of VHSV in the Great Lakes. USGS will also determine its sensitivity to temperature, improve methods for virus detection and start to develop a vaccine. Findings from USGS research are widely shared among the international community to manage specific populations of fish. Fish managers are also using the USGS' research findings to develop policy on trade restrictions to protect valuable stocks of native fish.

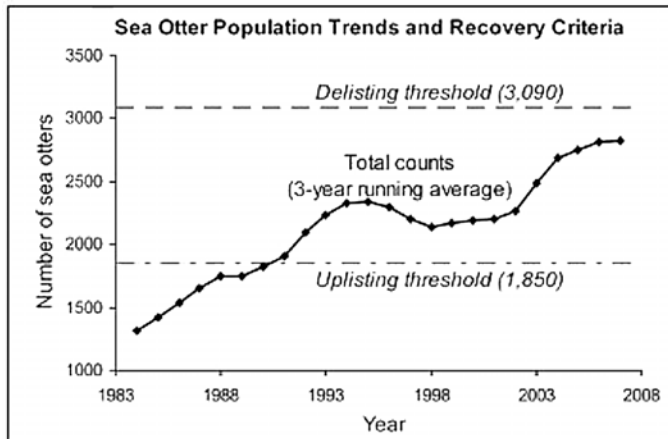
America's Ancient Fish, Protecting Sturgeon for Tomorrow — Sturgeons, once commonly found in the United States are among the longest lived and largest fishes in North America. Changes to habitat within river systems and overharvest have contributed to the imperilment of these North American giant fish. Two imperiled sturgeon species, shortnose and Atlantic, are found in the Atlantic drainage basin of North America. Successful development of a recovery and management plan for this species rests on the ability to determine distinct population segments. In 2008, USGS geneticists delineated distinct population segments in Atlantic and shortnose sturgeon during recent Endangered Species Act-mandated Status Reviews. A USGS geneticist served on both Department of Commerce-led Status Review Teams and was instrumental in establishing guidelines for management of distinct population segment designation. In 2009 and 2010, USGS will continue to evaluate the physical characteristics of the rivers in relation to the biological requirements of Atlantic sturgeon. Where possible, areas of optimal sturgeon habitat will be identified for specific life history requirements. Additionally, a geodatabase will be constructed that include the physical and spatial attributes of the shortnose sturgeon study area. This database will be used to identify and map the environmental factors associated with shortnose sturgeon along the eastern seaboard.

Polar Bear Survival in a Vanishing Sea Ice Environment — Changes in the amount of sea ice in Alaska have raised concerns that U.S. polar bear populations will be adversely affected. USGS scientists have already documented one change in polar bear behavior—a shift in maternal dens from pack ice to land. Working with Canadian scientists, they also have documented declines in the survival rates and population size of polar bears in western Hudson Bay in connection with the melt of sea ice in that region, an event that now occurs three weeks earlier than in past years.

USGS assembled an international team of scientists to conduct a series of analyses to help inform the Secretary's decision about listing polar bears under the Endangered Species Act. In 2008, the USGS team produced nine technical reports within six months to assist the Secretary in finalizing his decision. The studies project a decline in polar bear populations throughout their range during the 21st century; however, the severity of the decline will depend on local sea ice conditions. In areas like Alaska where sea ice recedes far north of the continental shelf each summer and fall, models predicted possible extinction by mid-century. Polar bears are predicted to persist longer in areas of northern Canada and Greenland where sea ice is expected to be more stable. USGS is continuing its long-term studies of polar bears to evaluate and test the models it developed in the nine reports. This work is continuing in 2009 and 2010 as seasonal sea ice continues to recede at unprecedented rates in the Arctic.

Pacific Walrus — FWS is reviewing the status of the Pacific walrus pursuant to a petition to list the species under the Endangered Species Act. In response to their need for information, the USGS is enhancing its long-term research program on Pacific walrus, another species dependent on Arctic sea ice. Walrus rest on sea ice between dives to the sea floor to feed on invertebrates. USGS research is focused on understanding how changes in sea ice will influence foraging behavior, movements and ultimately survival and population status. After winters spent in the Bering Sea, males move to terrestrial haulouts while females and calves remain on the ice as it recedes northward into the Chukchi Sea. A major concern for Pacific walrus is that receding sea ice will increase the use of terrestrial haulouts, and thus heighten competition for food and increase human/walrus disturbances, placing additional stress on the population. During 2009 and 2010, USGS plans to develop modeling approaches similar to those used on polar bear, to understand and forecast future changes in the status of Pacific walrus.

California Sea Otters — The southern sea otter of California, a threatened population on the Endangered Species list, continues to recover, but the rate of recovery appears to have slowed. In 2008, USGS studies showed that the latest 3-year average (2,826 sea otters) was 0.3 percent higher than last year's 3-year average, representing a slower rate of increase than they have seen in recent averages. For southern sea otters to be considered for delisting, the 3-year running averages would have to exceed 3,090 for 3 continuous years. Differences in weather conditions, otter distribution and other factors contribute to the year-to-year variance in survey numbers. In 2009 and 2010, ongoing collection and analyses of demographic data by USGS scientists are aimed at understanding the underlying reasons for the sluggish rate of recovery and variable population trends.



The spring 2008 California sea otter survey was conducted over about 375 miles of California coast. The population is expanding to the south faster than it is to the north. The census is a cooperative effort of the USGS, California Department of Fish and Game's Marine Wildlife Veterinary Care and Research Center, Monterey Bay Aquarium, and many experienced and dedicated volunteers. The information gathered from spring surveys is used by Federal and State wildlife agencies in making decisions about the management of sea otters. More information can be found at <http://www.werc.usgs.gov/otters/ca-surveys.html>

Dying Bats in the Northeast — White Nose Syndrome of bats, was first seen in New York in the winter of 2006. The name refers to the striking white fungal growth on muzzles, ears, and/ or wing membranes of affected bats. Since 2006, over 100,000 bats have died and populations at surveyed caves have declined by more than 75 percent in northeastern United States. Bats play critical ecological roles in insect control, plant pollination and seed dissemination, and population declines could have far-reaching consequences. In a 2009 article in Science Magazine, USGS scientifically described the fungus that causes this disease. In 2009 and 2010, USGS will continue to work closely with FWS, State natural resource agencies, State public health departments and NGOs to investigate die-offs, determine how the disease spreads between affected and healthy bat colonies, and develop strategies for controlling the disease.



Little brown bat with White-Nose Syndrome

Horseshoe crab harvest models — The red knot annually migrates from southern Argentina and Chile to the Arctic and back. To replenish itself during this extraordinary journey, the

shorebirds depend on an abundance of eggs of the horseshoe crab when the bird stops at Delaware Bay. Eggs of horseshoe crabs are prized by bait fishermen, and the blood of adult crabs is used in medical tests. Populations are in decline. In order to resolve the conflict between human and wildlife needs, USGS is working with stakeholders and other researchers to formulate objectives, management alternatives, and models to predict the ecological consequences of different management scenarios on the horseshoe crab and red knot populations. During 2009 and 2010, USGS will continue to work with partners to compute optimal decisions and inform technical committees and management boards as they make resource management decisions. By comparing predictions from competing models to observations from monitoring, the adaptive management framework will result in a more complete understanding of the relationship between horseshoe crab and shorebird populations. Through this work, biologists have created a direct link between research findings and landscape level management decisions.

Invasive Species Early Detection and Forecasting - USGS is developing models that can be used to predict distribution of native and invasive species across the landscape. USGS and NASA scientists have used their combined expertise in software engineering, earth observations, and high-performance computing with satellite and biological field data to develop the Invasive Species Modeling and Assessment System. This system combines NASA satellite data with field surveys to analyze past and present distribution of non-native plants and predict their future spread. In 2009, USGS will test some of these model applications to determine suitability for automation and develop a pilot of an Enterprise web application for Interior land managers. USGS scientists will also continue efforts in 2009 and 2010, to develop predictive models to create on-demand, regional-scale assessments of invasion patterns, vulnerable habitats, potential distribution of specific invaders, and how all of these may be impacted by changing climate. These efforts provide the means for delivering advanced decision support capabilities that can be used in a wide range of management applications. The system has successfully been tested in Wildlife Refuges, National Parks, and in research areas of other USGS researchers.

Fire Science — In 2008 and 2009, as part of an overall resource strategy to document and track land treatments on Federal lands, USGS developed a sampling approach for monitoring effectiveness of land treatments that are intended to reduce erosion and encroachment of invasive species on recently burned land. BLM is using this tool in developing their overall resource monitoring strategy. Monitoring data are used to identify areas that have undergone significant changes in land cover and to determine underlying causes. The database also permits scientists to determine factors that may be causing declines of sage grouse and other populations of concern. Spatial data contained on this site also will be a critical component guiding decision processes for restoration of habitats in the Great Basin.

In 2009 and 2010, USGS will continue to gather legacy land treatment data in conjunction with developing tools to efficiently gather and track data on new land treatments. Data will be displayed on Web-based maps for quick and accurate determinations of treatment areas and evaluation of treatment effectiveness. Web-based data entry process will be integrated into land treatment planning, approval, and implementation processes, which will further increase efficiencies in data gathering and reporting on land treatments. These tools will aid fire and land managers in selecting defensible lands for fire control, evaluating the success of land treatments, and determining the most effective treatments for post-fire rehabilitation.

South Bay Salt Pond Restoration Project — The success of the South Bay Salt Pond Restoration Project depends on reliable science and monitoring led by USGS, which is helping

to inform adaptive restoration actions of the management agencies. A key uncertainty in the restoration project is the effect of restoration on the estuarine shoals that support most of the region's migratory birds and fishes. In advance of restoring the first salt pond on FWS's San Francisco Bay National Wildlife Refuge, the USGS science team completed the first phase of sampling and instrumentation in 2008. Pond construction began in February 2009 with restoration to the Bay within a year. In addition, USGS established baseline waterbird surveys and conducted behavior scans; captured shorebirds and sampled isotopes to determine diet; and sifted cores to enumerate invertebrates along an elevation gradient. These coordinated studies will be linked to monitoring stations within the newly restored pond. This comprehensive effort should provide detailed science support for management of the restoration and its future phases. The scientific studies will continue with detailed real-time monitoring as the pond is restored.

Program Performance Overview

BRM addresses the Department of the Interior's goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment and by providing the science information that resource managers need. The following table highlights important performance measures for BRM:

End Outcome Goal 1.4: Improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment

End Outcome Goal End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
% of targeted science products that are used by partners for land or resource management decision making (SP)	A	60%	86.9%	90.4%	65%	90.4%	67%	68%	+1%	70%
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
% of North American migratory birds for which scientific information on their status and trends are available (SP) (BRM)	A	26%	26%	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	26.6% (173/650)	0	27.1% (176/650)
% of targeted fish and aquatic populations for which information is available regarding limiting factors (SP) (BRM)	A	31%	31%	38.66% (46/119)	41% (49/119)	41% (49/119)	41% (49/119)	41% (49/119)	0	43% (51/119)
X% of focal migratory bird populations for which scientific information is available to support resource management decisionmaking (USGS in coordination with FWS) (BRM)	A	UNK	56.88%	57.02%	57.16%	55.18%	55.22%	55.23%	+0.01%	55.28%
Comments	This performance measure is shared with the FWS. Changes are due to advances in knowledge through research on bird species identified by the FWS. Program performance is measured by quantifying contributions to science related to these species.									

Biological Research and Monitoring

End Outcome Goal End Outcome Measure / Intermediate Measure / PART Efficiency or other Outcome Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
X% improvement in detectability limits for selected, high priority environmentally available chemical analyses (BRM)	A	UNK	6%	12%	19%	19%	26%	33%	+7%	40%
Comments	Detectability limits will be improved through development of ultraclean procedures with higher-quality reagents.									
Increase long-term trend precision (decrease bias) for existing species monitored through the Breeding Bird Survey to enable a detection of 50% population decline of relevant species within 20 years (BRM)	A	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0	0.008
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
% of studies validated through appropriate peer review (SP)	A	100% 1283/ 1283)	100% (1067/ 1067)	100% (1071/ 1071)	100% (843/ 843)	100% (931/ 931)	100% (748/ 748)	100% (749/ 749)	0	100% (740/ 740)
Efficiency and Other Output Measures										
Average cost per sample for selected, high priority environmentally available chemical analyses	A	\$700	\$680	\$680	\$650	\$660	\$640	\$621	-\$19	\$600
Projected Cost per sample (whole dollars)		700	680	680	650	660	640	621	-19	600
Comments	Average cost per sample decrease as a result of developing new methods for analysis, adoption of computerized chromatographic or other automated techniques, and improvements in instrumentation. Increase is partially offset by increased costs of reagent chemicals for analyses due to increases in costs of manufacturing petrochemical products and costs of shipping.									
# of systematic analyses & investigations completed	A	1283	1067	1071	843	931	748	749	+1	740
Total Projected Cost (\$000)		256,600	213,400	214,200	168,600	186,200	157,080	157,290	+210	155,400
Projected Cost per systematic analysis (whole dollars)		200,000	200,000	200,000	200,000	200,000	210,000	210,000	--	210,000

Biological Research

End Outcome Goal End Outcome Measure / Intermediate Measure / PART Efficiency or other Outcome Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Comments										
# of formal workshops or training provided to customers	A	233	101	123	62	113	74	86	+12	100
Total Projected Cost (\$000)		18,640	8,080	9,840	4,960	9,040	6,660	7,740	+1,080	9,000
Projected Cost per workshop (whole dollars)		80,000	80,000	80,000	80,000	80,000	90,000	90,000	-	90,000
Comments										

Activity: Biological Research

Subactivity: Biological Information Management and Delivery

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Biological Information Management and Delivery (\$000)	22,422	21,965	+231	0	22,196	+231
<i>Total FTE</i>	<i>68</i>	<i>68</i>	<i>0</i>	<i>0</i>	<i>68</i>	<i>0</i>

Summary of 2010 Program Changes for Biological Information Management and Delivery

The 2010 budget request for the Biological Information Management and Delivery (BIMD) subactivity is \$22,196,000 and 68 FTE. There are no program changes requested for BIMD in 2010.

Program Overview

The BIMD mission is to create the informatics framework, provide scientific content (data and information products) from scientifically credible sources, and develop the public and private partnerships needed for the understanding and stewardship of our Nation's biological resources. BIMD provides access to data and information for science-based decisionmaking, particularly as it pertains to the conservation, management, and use of the Nation's natural resources. In addition, the program develops and makes available tools, models, visualizations, and applications to aid policy and resource managers in the analysis and synthesis of scientific data to support decisionmaking. The program works in cooperation with many organizations throughout the United States and the world to provide biological information to partners, stakeholders, customers, and the general public. Through electronic infrastructures, the program delivers relevant data and information faster and in more integratable formats than in the past, leading to better stewardship of the Nation's natural resources.

The USGS plays a vital role in making biological data and information more accessible and useable. USGS performance in this area is reflected in the availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making.

Program Components

The interdependent components of BIMD have been specifically designed to integrate information across geographic and political scales (local to global) and biological levels of organization (genomes to biomes).

The following are the major objectives of the BIMD subactivity:

Biological Research

- *Landscapes, Stewardship, and Species Distributions.* The Gap Analysis Program (GAP) generates databases on native vertebrate species distributions and natural land cover types to provide State, regional, and national conservation assessments. In addition, Vegetation Characterization activities are performed on public lands (national parks) using a consistent methodology supported by national standards.
- *Biosystematics and Nomenclature.* The Integrated Taxonomic Information System (ITIS) is being developed as an authoritative source of species names and their hierarchical classification. The completed portions serve as a taxonomic standard for other program components and the global community, enabling the comparison of biodiversity data sets at all biological levels. Recently, a framework document outlining the potential use of ITIS as a Department-wide standard was accepted by the Department, to be incorporated in a blueprint for the Department's Biological Data Line of Business.
- *Genomes to Biomes.* The NBII continues development to provide the biological community and others with a fully digital, interactive, distributed system that provides scientifically reliable biological data and information and a suite of tools for analysis, synthesis, and forecasting. Network-wide methods and standards for organizing content to enhance the retrieval, integration, and use of information are key components of the NBII.

The Biological Informatics Program's goals, as outlined in the program's 5-year plan (<http://internal-int.er.usgs.gov/director/planning/docs/BIO5yrPlan2005-2009.pdf>) are:

- Content: Increase the availability and usefulness of biological resources data and information,
- Tools: Implement technologies and tools to integrate, analyze, visualize, and apply biological information to natural resource issues,
- Infrastructure: Develop, apply, and promote the adoption of standard practices, protocols, and techniques to enhance knowledge discovery and retrieval from various resources,
- Research: Facilitate information science research that supports the advancement of biological informatics capabilities, and
- Customers: Apply innovative technologies and best practices to improve the development, description, and dissemination of biological information to customers.

The USGS national-level approach to managing biological and natural resource data and scientific information ensures the application of standards that foster opportunities for collaboration and cooperation. The USGS places a premium on partnerships at all levels of government and with nongovernmental entities, including the private sector. These partners use USGS-generated scientific data and information that contributes to the knowledge base, which then becomes available to Interior land and resource managers, and others.

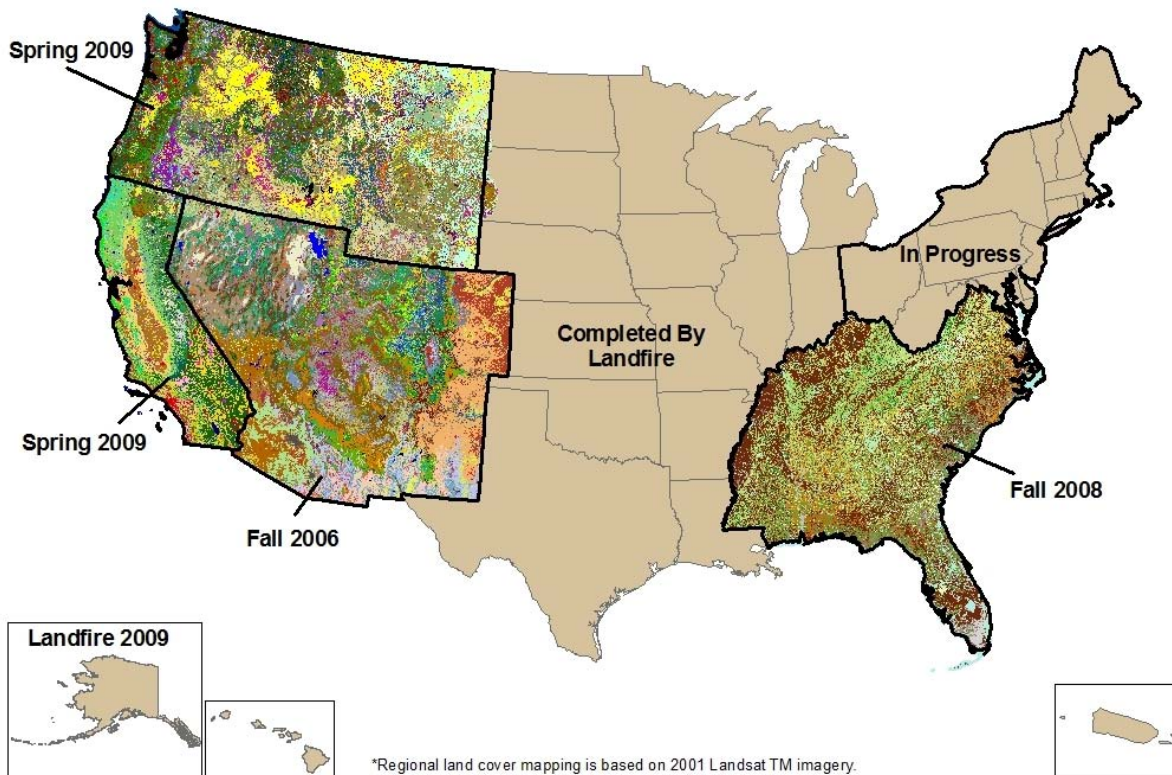
The program works collaboratively with others to ensure that it is building a store of high quality data and information that can be used to address resource management issues. To that end, the program engages USGS science centers and other USGS programs, other Federal agencies, non-governmental organizations, museums, universities, international organizations, and other partners in the creation of data content and resources to address resource management needs.

For example, each focus area of the NBII is developed through the collaboration of the partners and customers involved with that area. All together, NBII has over 250 partner organizations and agencies that help define the direction both of individual focus areas and of the NBII as a whole.

The objectives and goals of the BIMD subactivity are accomplished through work performed in the following core program components:

Gap Analysis — GAP provides broad geographic information on the status of species and their habitats and identifies the degree to which native animal and plant species are represented in the present-day mix of conservation lands (those species not adequately represented constitute conservation "gaps"). Currently, GAP products are available for most of the Country. These products include digital databases describing State- or region-wide land-cover assemblages, distributions of mammals, birds, reptiles, and amphibians, and characterizations of land

Progress of Gap Analysis Program Land Cover Mapping



stewardship. The current emphasis of the program is on updating statewide data through regional projects with state-of-the-art methods and technologies, and developing partnerships with data users to facilitate use of GAP information in land-management decisions.

The USGS continues to emphasize GAP research and the development of applications to better serve the needs of Interior's land management bureaus, including FWS, BLM, and other agencies such as USFS. New mechanisms being implemented to facilitate access to GAP

Biological Research

products include regional views, species information at regional and national scales, and user-defined online mapping.

Vegetation Characterization — USGS scientists assist NPS in inventorying and monitoring with efforts focused on creating national vegetation standards, technologies, and products. This activity enables delivery of national-scale descriptions of vegetation to meet specific information needs identified by NPS with additional cooperative projects for FWS and BLM. Products are aimed at monitoring efforts such as planning and designing monitoring protocols, performing statistical data analyses, and achieving efficiencies such as dovetailing protocols for invasive species inventory and fire fuels related to vegetation to ensure integrated field data collection protocols. The BIMD Vegetation Characterization activity has also taken a lead role in the revision and on-going implementation of the Federal Geographic Data Committee's National Vegetation Classification Standard efforts, including long term preservation and archiving of historically significant aerial photography at the EROS data center.

Integrated Taxonomic Information System (ITIS) — USGS leads and works with other Federal agencies (including EPA, USDA Agricultural Research Service, USDA Natural Resources Conservation Service, NOAA, Smithsonian Institution, NSF, FWS, and NPS), organizations, institutions, and taxonomic specialists across the United States and internationally to develop and operate the largest taxonomic thesaurus and database of its kind in the world. ITIS provides an accepted scientific name (with a unique Taxonomic Serial Number) as the "common denominator" for accessing information on such topics as biodiversity, invasive species, declining amphibians, migratory birds, fishery stocks, pollinators, agricultural pests, and emerging diseases. The ITIS supports the development of the only comprehensive national taxonomic database that provides free access (directly over the Internet) to standard scientific names for all U.S. plant and animal species.

National Biological Information Infrastructure (NBII) — The NBII is a tool for making biological data, information, and associated tools and technologies more accessible for customers and partners to use in making informed decisions regarding resource management, environmental considerations, disease vectors, control of invasive species, and other issues.

The USGS works with many public and private partners in implementing the NBII to:

- Develop a nationwide network of NBII focus areas that are geographically and thematically targeted,
- Expand the overall content of the NBII, and
- Develop and apply new information tools, standards and technologies.

The NBII is a networked series of regional and thematic focus areas supported by common infrastructure. Regional focus areas provide services within a particular geographic area of the country. Within a region, activities address broad biological themes and issues that are high priority to stakeholders in that region. Currently, NBII has initiated eight regional focus areas.

The thematic focus areas of NBII are responsible for coordinating data and information within the scope of their assigned scientific themes at a national level. In doing so, they both initiate data gathering activities and coordinate relevant local data sets from the regions. They also place a high priority on developing tools to allow users to interact with data from diverse

"Great website!"

A wonderful resource for folks interesting in monitoring and information."

Jane Ledwin
Fish and Wildlife Biologist
FWS – Columbia, MO
November 4, 2008

sources. Currently, NBII has initiated four thematic focus areas, and has supported a number of high-profile projects, such as the challenges to and impacts of declining numbers of pollinators.

In addition to regional and thematic focus areas which approach the task of making data and information accessible from geographic and topical perspectives, effort also is aimed at developing the infrastructure that underlies the data and information network. This infrastructure consists not only of the hardware and software required to make the network run, it also consists of the standards that must be implemented to make network-wide interoperability, data sharing and decision-making possible. As this structure grows, a robust infrastructure becomes more and more critical so that necessary products and services may be provided to all focus areas and not duplicated at multiple locations. This infrastructure enables network-wide search, access, and retrieval, and sharing of tools.

"[NBII] has encouraged a love and respect for [butterflies] in my daughter (now 7 yrs). ... She catches them, ... looks up what they are ... takes them back outside ... and has a picture taken before they fly away. Which is what she calls "the best part". After using your site she was inspired to have a butterfly garden. Thanks to her research here we have a large 26' X16' butterfly garden that attracts many varieties and offers things for both adults and larvae. Thanks so much!"

Tracy A. DiNezza 1/27/2009

2010 Program Performance

In 2010, BIMD expects to deliver to its customers 12 systematic analyses and investigations and 15 formal workshops or training courses. The training sessions and workshops support a variety of organizations, including State and Federal, in the areas of data management, interoperability, standards, and decision-making. BIMD provides access to data and information for science-based decision-making, particularly as it pertains to the conservation, management, and use of the Nation's natural resources. In addition, the program develops and makes available tools, models, visualizations, and applications to aid policy and resource managers in the analysis and synthesis of scientific data to support decisionmaking.

In 2009 and 2010, the BIMD subactivity, through the NBII, will continue to develop content needed by the Department of the Interior's and other resource managers for decision making related to high priority issues such as pollinator decline, and U.S.-Mexico border environmental impacts. In addition, the NBII will dedicate resources to the amassing content related to the development of renewable energy resources and its impact on ecosystems and species.

NBII, an example of the work done in these high profile areas, began in 2007 and continuing to the present, has been working with partners to help fill a critical void in access to data and information about North American bee species. Globally, many bee species are experiencing sharp population declines, significantly reducing pollination. Without bees, many of the world's plants and crops would simply disappear. In fact, more than 66 percent of the world's 1,500 crop species require visits by bees (Roubik, 1995), and bees are in some way required for 15 to 30 percent of the worldwide food production (McGregor, 1976). In North America, crop pollination is accomplished by managed honeybees, wild honeybees, and native bees (Michener, 2000; McGregor and Levin, 1970). Research in Europe and the Americas indicates that bee populations are declining, presaging a potentially disastrous situation, and concludes that more bee population monitoring data are needed. Bees are particularly difficult to monitor, as they are small, quick and challenging to mark or tag and identify. Specifically, the NBII has partnered with others to help develop and make available online identification keys for 65 bee genera found east of the Mississippi River. This important work will continue into 2010.

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Partners including FWS, the Ambrose Monell Foundation, the Polistes Foundation, the North American Pollinator Protection Campaign, the Inter-American Biodiversity Information Network, and bee taxonomists from throughout North America would be impacted by having to expend more resources and perform more work to fill the void in the role currently performed by NBII.

Gap Analysis Program (GAP) — GAP generates national-level databases on native vertebrate species distributions and natural land cover types, and identifies the degree to which native animal and plant species are represented in the present-day mix of conservation lands; those species not adequately represented constitute conservation "gaps". This provides State, regional, and national organizations with the data on which to base conservation assessments, conservation planning, reserve design, and species modeling. In 2009 and 2010, GAP will continue updating land cover and species distribution data in two regions of the United States, the Northwest and Northeast. The regional focus of the GAP will also allow State conservation and land management agencies and Federal land managers to better plan land use across State boundaries. In 2009, this activity will remain on target in support of the program measure "% of U.S. land with land characterization and species distribution information available for resource management decision-making updated in the last 5 years." Due to the 5-year qualifier in this measure, GAP data will drop out of consideration as it ages, and new data are added each year. Hence, the percentage of coverage across the U.S. will fluctuate from year to year. By the end of 2009, GAP expects to have coverage less than 5 years old for 40 percent of the U.S. That number will remain the same in 2010, as projects will be in progress but not yet completed during that time.

Vegetation Characterization — USGS scientists assist NPS with inventorying and monitoring with efforts focused on creating national vegetation standards, technologies, and products. This activity enables delivery of national-scale descriptions of vegetation to meet specific information needs identified by NPS with additional cooperative projects for FWS and BLM. Products are aimed at monitoring efforts such as planning and designing monitoring protocols, performing statistical data analyses, and achieving efficiencies such as dovetailing protocols for invasive species inventory and fire fuels related to vegetation to ensure integrated field data collection protocols. In the 2009-2010 timeframe, the Vegetation Characterization activity will begin work with FGDC and its Vegetation Subcommittee's partners to implement the newly revised National Vegetation Classification standard across Interior and the Federal community, and continue efforts to digitize and archive program photography with EROS and serve newly completed NPS park project data. An interagency coordination office has been established.

Integrated Taxonomic Information System (ITIS) — Now nearing 600,000 entries, ITIS is the premier automated and authoritative source for scientific names for North America and the World. ITIS has become the de facto taxonomic authority in the United States, Mexico, and Canada and, with its partner, Species 2000, has produced the de facto world authority in the Catalogue of Life. In 2008, ITIS added more than 64,000 new or updated scientific names to its database and reached a content level of nearly 600,000 names. ITIS now has current taxonomic and geographic information for all North American vertebrate groups (mammals, fishes, reptiles, amphibians, and birds). In addition, several groups with worldwide treatment have been added, including amphibians, fishes, and several invertebrate groups. In 2009 and beyond, ITIS will continue to work toward its goal of providing current scientific names for all North American species, and will continue efforts with its global counterparts for worldwide coverage of 1.8 million species by 2011. ITIS is under consideration for adoption as a Interior-wide taxonomic standard. Key partners and collaborators include the Smithsonian Institution, EPA, NOAA, USDA, NSF, NPS, Conabio (Mexico), Agriculture and Agri-foods Canada, Species 2000, and the Global Biodiversity Information Facility. Key customers include resource

managers, scientists, libraries, museums and the public. ITIS is readily available through NBII, and the Catalogue of Life is available on CD.

National Biological Information Infrastructure (NBII) — The NBII continues development to provide the biological community and others with a fully digital, interactive, distributed system. This system provides scientifically reliable biological data and information and a suite of tools for virtual collaboration, analysis, synthesis, and forecasting. Network-wide methods and standards for organizing content to enhance the retrieval, integration, and use of information are key components of the NBII. The NBII currently assists scientists and decision-makers in the areas of resource management, environmental considerations, disease vectors, control of invasive species, and other issues. The NBII uses the capabilities of the Web and other advanced technologies to establish a distributed "federation" of biological data and information sources through which users can find biological information, retrieve it, and apply it to resource management questions. Partners and customers taking part in this effort include government agencies at all levels, private sector organizations, natural history museums, libraries, local land trusts, academic institutions, international scientific organizations, and the public.

The 2009 Enacted funding level will allow the NBII to meet all projected targets for measures including: "% of focal migratory bird populations for which species pages are available through the NBII;" "# of systematic analyses and investigations completed;" and "Amount of fire-related data and information available online via the NBII, to assist land managers in fire management decision making." By the end of 2010, NBII expects to continue delivery of approximately 12 systematic analyses per year, and to provide access to nearly 40 gigabytes of fire-related data and information.

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Program Performance Overview

Biological Information Management and Delivery addresses the Department of the Interior goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment and by providing the science information that resource managers need. The following table highlights important performance measures for Biological Information Management and Delivery:

End Outcome Goal 1.4: Improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment

End Outcome Goal End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making										
X% of US land with land characterization and species distribution information available for resource management decision-making updated in the last 5 years (BIMD)	c	23.3%	42.3%	34%	36.4%	37%	40%	65%	+25%	65%
Amount of fire-related data and information available online via the NBII, to assist land managers in fire management decision making (BIMD)	c	1.5gb	15.42gb	23.3gb	30gb	35gb	35gb	40gb	+5gb	45gb
Comments	Measure is cumulative; target reflects normal growth									
# of Natural History Museum specimen data records available online via the NBII, to assist researchers in identifying and addressing threats to human and animal health (BIMD)	c	20 million	57.6 million	59.3 million	60 million	60 million	79 million	61 million	-18 million	63 million
Comments	Much work in this area suspended in 2009 due to budget cuts. No records actually lost.									
Amount of invasive species data and information available online via the NBII, to assist in modeling and forecasting the spread of invasives (BIMD)	c	800 mb	1,127 mb	1,441 mb	1,441 mb	1,542 mb	2,400 mb	1,750 mb	-650 mb	2,050 mb
Comments	Some work in this area slowed in 2009 due to budget cuts. No records actually lost.									
# of NBII Clearinghouse metadata records (BIMD)	c	n/a	n/a	29,170	41,000	41,000	41,500	42,000	+500	43,500
Comments	Measure is cumulative; target reflects normal growth									
% of focal migratory bird populations for which species pages are available through the NBII (BIMD)	c	n/a	n/a	8%	15%	15%	22%	29%	+7%	51%

Biological Information Management and Delivery

End Outcome Goal End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
X% of US federally-listed threatened and endangered fish species for which species profiles, occurrence data and maps are available through the NBII (BIMD)	C	n/a	n/a	17.5%	20%	20%	20%	20%	0%	23%
PART Efficiency and Other Output Measures										
# of systematic analyses and investigations completed (BIMD)	A	52	44	17	12	20	21	12	-9	12
Total Projected Cost (\$000)		10,400	8,800	3,400	2,400	4,000	4,200	2,400	-1,800	2,400
Projected Cost per systematic analysis whole dollars)		200,000	200,000	200,000	200,000	200,000	210,000	210,000	0	210,000
Comments	Lower targets reflect budget reductions.									
# of formal workshops or training provided to customers (BIMD)		23	23	19	19	20	19	19	0	15
Total Projected Cost (\$000)		UNK	UNK	UNK	86	86	86	40	-46	40
Projected Cost per workshop/training (whole dollars)		UNK	UNK	UNK	4,500	4,500	4,500	5,000	+500	5,000
# of gigabytes managed and distributed cumulatively (BIMD)		791	1,134	931	1,000	710	750	790	+40	900
Average cost per gigabyte of data available through servers under Program control (BIMD) (whole dollars)		63,000	17,155	3,794	3,794	3,794	3,794	3,794	0	3,794

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Science Centers and Field Stations Summary

(2010 Greenbook Updates – BRM & BIMD)

Center Name	Location	2008 ^{1/} Estimate (\$000)	2009 ^{1/} Estimate (\$000)	2010 ^{1/} Estimate (\$000)
Center for Biological Informatics	Lakewood, CO	5,874	5,639	5,639
Program Description: The Center facilitates access to and use of biological data and information through leadership in establishing standards, developing information products, and using information technologies. The Center supports such programs as GAP Analysis, the USGS/National Park Service Vegetation Mapping, and the National Biological Information Infrastructure.				
Upper Midwest Environmental Science Center	LaCrosse, WI	3,638	3,638	3,638
Program Description: The Center provides scientific leadership in a variety of areas including river ecology, restoration of degraded habitats, development of chemicals for fishery management, declining species, invasive aquatic species impacts and control, contaminants, and development of decision support models. The Center has lead responsibility for the Upper Midwest Amphibian Research and Monitoring Initiative and the Long Term Resource Monitoring Program on the Upper Mississippi River. Scientists at the Center anticipate emerging problems and information gaps and provide the leadership and the commitment to action needed for effective resource management.				
Field Stations: N/A				
Leetown Science Center	Leetown, WV	7,773	7,773	7,773
Program Description: The Center conducts research to provide land and resource managers information needed to restore, enhance, maintain, and protect biological resources and their supporting systems.				
Field Stations:				
Aquatic Ecology Laboratory	Leetown, WV	2,110	2,110	2,110
Fish Health Research Laboratory	Leetown, WV	1,506	1,506	1,506
Southern Appalachian Field Laboratory	Knoxville, TN	426	426	426
Great Smoky Mountain Field Station	Gatlinburg, TN	35	35	35
Northern Appalachian Research Laboratory	Wellsboro, PA	1,163	1,163	1,163
Conte Anadromous Fish Research Laboratory	Turners Falls, MA	1,687	1,687	1,687
Orono Field Station	Orono, ME	125	125	125
Columbus Field Station	Columbus, OH	147	147	147
Restoration Technology Laboratory	Leetown, WV	396	396	396
Directorate/Information Resources Management	Leetown, WV	178	178	178
National Wildlife Health Center	Madison, WI	4,449	4,449	4,449
Program Description: The Center provides national and international leadership for addressing health issues involving wildlife resources under Interior's stewardship and to foster partnerships with others to address wildlife health as a component of ecosystem health.				
Field Stations:				
Honolulu Field Station	Honolulu, HI	240	240	240

Biological Research

Center Name	Location	2008 ^{1/} Estimate (\$000)	2009 ^{1/} Estimate (\$000)	2010 ^{1/} Estimate (\$000)
Patuxent Wildlife Research Center	Laurel, MD	13,301	13,301	13,301
Program Description: The Center focuses on wildlife research and management, specializing in wildlife conservation, especially in such areas as waterfowl harvest management, wildlife habitat improvement, the effects of environmental contaminants, endangered species conservation, migratory bird management, and wildlife population analysis.				
Field Stations:				
Orono	Orono, ME	169	169	169
Athens	Athens, GA	966	966	966
Vicksburg	Vicksburg, MS	355	355	355
Narragansett	Narragansett, RI	507	507	507
Smithsonian	Washington, DC	1,515	1,515	1,515
Syracuse	Syracuse, NY	142	142	0
Blacksburg	Blacksburg, VA	164	164	164
Biological Science Office of the Florida Integrated Science Center (formerly the Florida Caribbean Science Center)				
Biological Science Office of the Florida Integrated Science Center (formerly the Florida Caribbean Science Center)	Gainesville, FL	4,738	4,833	4,833
Program Description: The Center provides natural resource managers with scientific information needed for effective conservation with emphasis on biological resources of the Florida peninsula, the Southeastern States, and the Caribbean region. The Center focuses on coastal and marine ecology, ecosystems restoration ecology, invasive species, and biological diversity.				
Field Stations:				
Northeast Laboratory	Gainesville, FL	0	0	0
South Florida Field Stations	Miami/Homestead/ Ochopee, FL	874	891	909
Virgin Islands Field Station	St. John, U.S. Virgin Islands	179	183	187
Center for Coastal Geology and Regional Marine Studies	St. Petersburg, FL	591	603	615
Great Lakes Science Center				
Great Lakes Science Center	Ann Arbor, MI	8,001	8,001	8,001
Program Description: The Center meets the Nation's need for scientific information for restoring, enhancing, managing, and protecting the living resources and their habitats in the Great Lakes Basin Ecosystem. This mission is accomplished with scientific knowledge gained through quality research, inventory and monitoring, and information transfer.				
Field Stations:				
Lake Superior Biological Station	Ashland, WI	906	906	906
Lake Ontario Biological Station	Oswego, NY	751	751	751
Lake Erie Biological Station	Sandusky, OH	469	469	469
Cheboygan Vessel Base	Cheboygan, MI	263	263	263
Munising Biological Station	Munising, MI	156	156	156
Lake Michigan Ecological Research Station	Porter, IN	362	362	362
Hammond Bay Biological Station	Hammond Bay, MI	38	38	38
Tunison Lab. of Aquatic Science	Cortland, NY	705	705	705

Science Centers and Field Stations

Center Name	Location	2008 ¹⁷ Estimate (\$000)	2009 ¹⁷ Estimate (\$000)	2010 ¹⁷ Estimate (\$000)
Fort Collins Science Center	Fort Collins, CO	8,800	8,800	8,800
Program Description: The Center conducts research and develops technical applications to assist land managers in understanding and managing biological resources, habitats and ecosystems. The Center is home to the National Institute of Invasive Species Science. The Center conducts research related to species & habitats, aquatic systems, riparian ecology, global change, fire ecology, and herbivore ecosystems in support of Department of the Interior bureaus and the International Center for Applied Ecology.				
Field Stations:				
Arid Lands Field Station	Albuquerque, NM	600	600	600
Jemez Mountain Field Station	Los Alamos, NM	154	160	160
Northern Prairie Wildlife Research Center	Jamestown, ND	4,476	4,476	4,476
Program Description: The Center develops research information on the quantitative ecological requirements for sustainable wildlife populations primarily in grasslands and wetlands, determines the distribution of flora and fauna, and identifies consequences of habitat loss, management, and restoration.				
Field Stations: N/A				
Columbia Environmental Research Center	Columbia, MO	6,359	6,500	6,500
Program Description: The Center provides scientific information and data needed to address national and international environmental contaminant issues, and effects of habitat alterations on aquatic and terrestrial ecosystems.				
Field Stations:				
Texas Gulf Coast	Corpus Christi, TX	406	419	431
Texas Gulf Coast	College Station, TX	142	0	0
Padre Island Field Station	Padre Island, TX	0	0	0
International Falls Field Station	International Falls, MN	98	0	0
Yankton Field Station	Yankton, SD	107	110	113
Jackson Field Station	Jackson, WY	133	137	141
National Wetlands Research Center	Lafayette, LA	4,850	4,850	4,850
Program Description: The Center conducts research to address loss of wetlands in coastal systems, the changes in fresh and estuarine systems because of changes in water quality, and the resulting effects on birds.				
Field Stations:				
Corpus Christi Field Station	Corpus Christi, TX	90	90	90
Baton Rouge Field Station	Baton Rouge, LA	106	106	106

Biological Research

Center Name	Location	2008 ¹⁷ Estimate (\$000)	2009 ¹⁷ Estimate (\$000)	2010 ¹⁷ Estimate (\$000)
Northern Rocky Mountain Science Center	Bozeman, MT	2,776	2,595	2,624
Program Description: The Center conducts research to provide land and resource managers information needed to restore, enhance, maintain, and protect natural resources of the Rocky Mountain ecosystems.				
Field Stations:				
Glacier Field Station	West Glacier, MT	630	612	392
Missoula Field Station	Missoula, MT	131	156	163
Western Fisheries Research Center	Seattle, WA	3,706	3,818	3,818
Program Description: The Center provides scientific research and technical assistance to support the best possible stewardship of the natural resources, emphasizing fish populations and aquatic ecosystems of the West.				
Field Stations:				
WFRC Seattle Lab	Seattle, WA	1,990	1,990	2,050
Columbia River Research Lab	Cook, WA	402	402	414
Reno Field Station	Reno, NV	327	327	337
Dixon Field Station	Dixon, CA	236	236	243
Klamath Falls Field Station	Klamath Falls, OR	552	595	613
Marrowstone Marine Station	Nordland, WA	156	156	161
Biological Science Office of the Alaska Science Center	Anchorage, AK	6,555	6,620	6,620
Program Description: The Center provides biological information and research findings to resource managers, policymakers, and the public to support sound management of biological resources and ecosystems in Alaska. The Center's research focuses on arctic and subarctic ecosystems, marine mammal ecology, migratory birds, and terrestrial mammal ecology. The Center has duty stations in various locations that do not have independent budgets.				
Pacific Island Ecosystems Research Center	Honolulu, HI	3,000	3,000	3,000
Program Description: The Center conducts research to provide managers of terrestrial and marine resources information needed to restore, enhance, maintain, and protect biological resources and their supporting ecosystems in the Pacific Basin.				
Field Stations:				
Kilauea Field Station	Hawaii National Park, Hawaii, HI	1,884	1,978	2,000
Haleakala Field Station	Makawao, Maui, HI	343	360	365
Manoa Field Station	Honolulu, Oahu, HI	48	50	52
Western Ecological Research Center	Davis, CA	6,832	6,968	6,968
Program Description: The Center provides biological information and research findings to resource managers, policymakers, and the public to support sound management of biological resources and ecosystems in California, Nevada, Arizona, and Utah. The Center's research focuses on work related to endangered species, waterfowl, amphibians, fire ecology, global change, and other ecological issues.				
Field Stations:				
Santa Cruz Field Station	Santa Cruz, CA	660	673	686
Dixon Field Station	Dixon, CA	843	860	877
Davis Station	Davis, CA	184	188	191

Science Centers and Field Stations

Center Name	Location	2008 ^{1/} Estimate (\$000)	2009 ^{1/} Estimate (\$000)	2010 ^{1/} Estimate (\$000)
Western Ecological Research Center Field Stations (continued):				
San Diego Field Station	San Diego, CA	1,237	1,262	1,287
Channel Island Field Station	Ventura, CA	287	293	298
Point Reyes Field Station	Point Reyes, CA	249	254	259
Redwood Field Station	Arcata, CA	153	156	159
Sequoia-Kings Station	Tree Rivers, CA	584	596	607
Yosemite Field Station	Portal, CA	385	393	400
San Francisco Bay Field Station	Vallejo, CA	460	469	478
Box Springs Field Station	Riverside, CA	214	218	222
Las Vegas Field Station	Las Vegas, NV	953	972	991
Forest and Rangeland Ecosystem Science Center				
	Corvallis, OR	6,117	6,117	6,117
Program Description: The Center provides scientific understanding and technology to support sound management and conservation of forest and rangeland ecosystems in the Pacific Northwest and Intermountain West.				
Field Stations:				
Regional Ecosystem Office	Portland, OR	0	0	0
Corvallis Research Group	Corvallis, OR	2,259	2,019	2,220
Olympic Field Station	Port Angeles, WA	606	468	515
Snake River Field Station	Boise, ID	1,468	1,828	2,011
University of Washington Field Station	Seattle, WA	135	183	201
Southwest Biological Science Center				
	Flagstaff, AZ	2,128	2,234	2,234
Program Description: The Center conducts research and provides technical support to assist land managers with resource management and stewardship throughout the Southwest. Research focuses on arid-lands ecology, invasive species, ecosystem restoration, climate change, endangered species, wildlife-human interactions, inventory and monitoring, and other ecological issues. The Center also includes the Grand Canyon Monitoring and Research Station, which studies the effects of the operation of Glen Canyon Dam on downstream resources within the Colorado River Ecosystem under the framework of adaptive management.				
Field Stations:				
Grand Canyon Monitoring and Research Center	Flagstaff, AZ	0 <small>(funded by receipts from power revenue)</small>	0 <small>(funded by receipts from power revenue)</small>	0 <small>(funded by receipts from power revenue)</small>
Sonoran Field Station	Tucson, AZ	650	650	650
Colorado Plateau Field Station	Flagstaff, AZ	846	846	846
Canyonlands Field Station	Moab, UT	632	632	632

^{1/} Science Center and Field Station funding are estimates and do not include cyclical funds.

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Activity: Biological Research

Subactivity: Cooperative Research Units

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Cooperative Research Units (\$000)	16,174	16,949	+364	+2,000	19,313	+2,364
<i>Total FTE</i>	<i>127</i>	<i>127</i>	<i>0</i>	<i>0</i>	<i>127</i>	<i>0</i>

Summary of 2010 Program Changes for Cooperative Research Units

Request Component	(\$000)	FTE
<ul style="list-style-type: none"> General Increase for CRU 	+2,000	0
TOTAL Program Changes	+2,000	0

Justification of 2010 Program Changes

The 2010 budget request for the Cooperative Research Units (CRU) subactivity is \$19,313,000 and 127 FTE, a net program change of +\$2,000,000 and 0 FTE from the 2009 Enacted level.

General Increase for CRU (+2,000,000 / 0 FTE)

The 2010 President’s Budget includes an increase of \$2.0 million to the Biological Resources Discipline, CRU program. This increase will enable the program to fill 23 vacant research scientist positions located in Units across the country. Research conducted at Cooperative Units is critical to the Nation’s interests in balanced energy development, climate change, invasive species, infectious diseases, and threatened fish and wildlife conservation. The restoration of science capacity in CRU will enhance and expand graduate education and science training as mandated in the Cooperative Units Act, contributing to the science expertise that will be needed to meet future natural resources challenges on issues of national priority. The increase also will be used to fully leverage the funding and material support provided by the States, host universities, the Wildlife Management Institute, and partner agencies including the FWS. Finally, the funding increase will enable CRU scientists to more effectively engage in development of science-based decisionmaking and adaptive management strategies with natural resource managers to address priority needs.

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Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4 Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of systematic analyses and investigations completed	517	249	280	205	205	210	+5	335
# of formal workshops and training provided to customers	41	25	31	13	13	20	+7	30
<p>Note: Projected costs may not equal program change as these are full costs, which may include funds from other sources and (or) use averages.</p> <p>Column A: The level of performance and costs expected in 2010 at the 2009 level plus funded fixed costs. Reflects the impact of prior year funding changes, management efficiencies, absorption of prior year fixed costs, and trend impacts, but does not reflect the proposed program change.</p> <p>Column D: Outyear performance beyond 2010 addresses lagging performance — those changes occurring as a result of the program change (not total budget) requested in 2010. It does <u>not</u> include the impact of receiving the program change again in a subsequent out-year.</p>								

Program Overview

The CRU program is a unique cooperative relationship among the USGS, State fish and wildlife agencies, host universities, and the Wildlife Management Institute. The FWS is a formal cooperator, as well, to most of the individual Units. Since 1935, this cooperative relationship has provided a strong connection between the USGS, State and Federal management agencies, and the national university community. The individual resources of each cooperator are leveraged to deliver program outcomes that far exceed what any one cooperator could achieve alone.

The goals of the CRU program are to sustain and maintain:

- A cost-effective, national network of Federal, State, and university partnerships pursuant to the Cooperative Research Units Act of 1960, with a legislated mission of research, education, and technical assistance focused on fish, wildlife, ecology, and natural resources.
- A customer-oriented network of expertise for research, teaching, and technical assistance that is responsive to the information needs of State and Federal resource agencies.
- Science capabilities responsive to resource management needs of Interior bureaus.
- A premiere program for graduate education and training of future natural resources professionals having skills to successfully serve the broad natural resources management community.

The CRU program is comprised of 40 CRUs located at universities in 38 States, with a headquarters office in Reston, VA. The program is designed to leverage cooperative partnerships with Federal and State agencies to address mutual needs of all partners in a cost effective manner. The USGS stations Federal scientists at universities to: (1) help identify and respond to natural resource information needs through the pooling of resources among agencies; (2) participate in the advanced scientific training of university graduate students; and (3) provide Federal and other natural resource managers access to university expertise and facilities. Federal support of the CRUs is multiplied by State and university cooperator contributions of expertise, equipment, facilities, and project funding, thereby enhancing the program's cost-effectiveness. Through university affiliations, CRU scientists train future natural resource professionals and provide opportunities through graduate education to diversify the Federal workforce.

Each CRU is directed by a Coordinating Committee of Federal, State, university, and a representative from the Wildlife Management Institute. Each Coordinating Committee establishes the goals and expectations for its unit within the program's mission of research, education, and technical assistance. The mix of priorities is established locally and is updated annually based on the needs of the cooperators and the available funding. Program accountability measures, performance standards, and oversight of Federal scientists are used to ensure that research and the resulting scientific information products support the goals of the USGS and the Department.

University and State agency contributions to the program remain strong, as does Federal, State, and local government reimbursable funding for research and technical assistance. Regular cooperator-focused satisfaction surveys continue to indicate a very high rate of satisfaction (>95%) with the CRU program's execution of the education and science mission at local units. The program's appropriated dollars continue to be matched by State, university, and Federal partners, and other entities' contributions at a ratio of approximately three matching dollars to each appropriated dollar.

2010 Program Performance

To meet future natural resource management challenges, the program will continue to investigate new approaches to more effectively engage its cooperators in science-based decisionmaking. In addition, the program will seek to find new ways for the Units and their cooperators to work together across State and regional boundaries. CRU has embarked on an initiative to improve the integration of research, education, and technical assistance with conservation and management, by enhancing the program's expertise in structured and adaptive decisionmaking. In 2009, CRU identified strategic actions to expand the application of structured decisionmaking and adaptive management with program cooperators. Thus far in 2009, CRU has: (i) provided training to CRU staff and State cooperators; (ii) developed pilot projects for collaborative decisionmaking with both State and Federal cooperators; (iii) provided technical assistance to partners by leading resource problem-based workshops; and (iv) developed academic curricula for graduate programs in science-based decision support to train future natural resource professionals. These efforts, designed to more closely knit science and management, will continue through 2010 with selected pilot projects with Federal partners in joint ventures and with State partners focused on State Wildlife Action Plan implementation. Through 2010, CRU will create a virtual Center of Excellence (a network of expertise) to support the use of decision support systems within the Department, State agencies, and the conservation community.

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Plans to develop new ways of working across State and regional boundaries have been incorporated as a key goal of this initiative. This transboundary collaboration is currently being initiated in 2009 to address climate change, the most pressing challenge natural resource managers are facing. Several examples of transboundary collaboration are ongoing, including work the Alabama and North Carolina Cooperative Fish and Wildlife Units have initiated with State and Federal cooperators on downscaling climate models for migratory bird management in the Southeastern United States. Transboundary collaboration will also tap CRU's formidable expertise in climate change research.

Through 2009 and 2010, CRU is poised to support the Nation's and the Department's interests in balanced energy development, climate change, and threatened fish and wildlife conservation. The continuing effort to restore science capacity in CRU will ultimately lead to the enhancement and expansion of graduate education and science training as mandated in the Cooperative Units Act, and, thereby contribute to the science expertise needed to meet future natural resources challenges on issues of national priority.

Climate change is the most pressing boundary-independent challenge natural resource managers are currently facing. CRU cooperators continue to support broad-scale research projects aimed at understanding mechanisms affecting species and habitats at unprecedented scales. CRUs work in climate change research directly supports and is aligned with the Department's and USGS's strategic science vision.

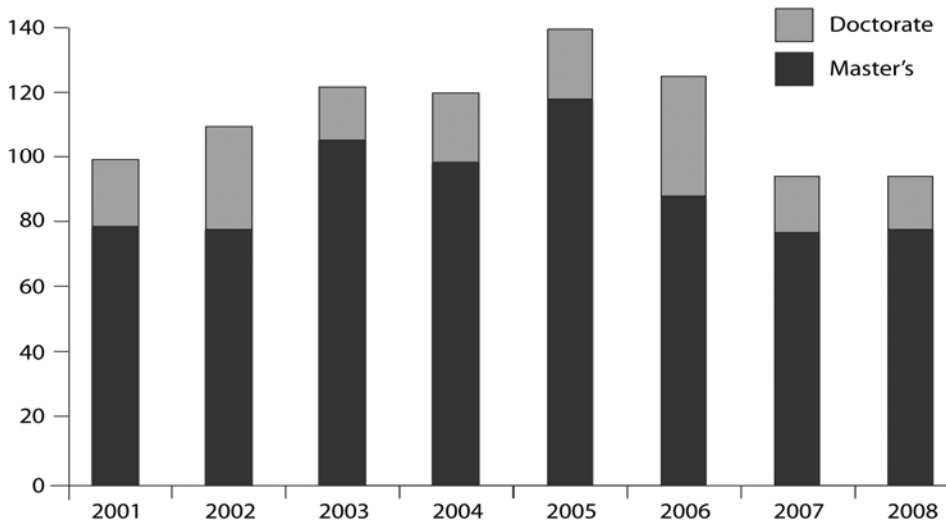
2008 in Review - Achieving the Unit Mission

In 2008, Unit scientists and their cooperators advanced the mission of the CRU Program through joint research, education, technical assistance, and science support. Unit scientists continued to be very productive in 2008, completing a number of projects for Federal (94) and State (135) partners. Unit scientists and their students remained actively engaged in service to professional societies delivering over 600 presentations. Many of these presentations were invited seminars, indicating that Unit scientists and their research are held in high regard by the scientific and management communities. CRU's service to university cooperators continued to be strong, with 75 academic classes taught in 2008 and an additional 46 workshops and short courses delivered to partners and cooperators.

Productivity Summary for 2008	Number
Peer reviewed publications	316
Invited Seminars	79
Workshops and Short Courses	46
Projects for Federal agencies	365
Projects for State agencies	489
Papers Presented	607
Academic Courses Taught	75
Total number of students	619
Master's degrees awarded	76
Doctoral degrees awarded	16

Each year, over 600 students are actively engaged in graduate education and training in natural resources conservation in the CRU program. About 15 percent of these students matriculate each year and enter the natural resources management workforce as employees of State and Federal agencies, non-governmental organizations, and universities. In 2008, of the 619 students directly advised by Unit scientists, 76 were awarded master's degrees and 16 completed their doctoral program in 2008. The number of advanced graduate degrees awarded to Unit students in 2008 was consistent with the long-term trend.

Graduate Degrees Awarded



In 2009, the CRU continues to provide strong leadership in climate change research, particularly as it relates to supporting the Department's management bureaus in forecasting effects of climate change on trust species, such as migratory birds and threatened and endangered fish and wildlife. In 2009, CRU scientists are involved in research on land cover modeling to support conservation of migratory birds in the southeastern U.S.; carbon dynamics to understand factors affecting the net transport of carbon dioxide to the biosphere; and biodiversity modeling to predict how habitat availability will change in the future due to land use and socio-economies.

In 2009, CRU is advancing the initiative to develop new collaborations in science-based decisionmaking. This initiative to improve the connection of science and management has focused in 2009 on sponsoring training for CRU staff and State cooperators, delivering technical support on problem-based workshops, and developing pilot projects with States to implement Wildlife Action plan objectives. This focus on structured decisionmaking and adaptive management will poise CRU and its cooperators to put into action meaningful science-based management actions to deal with complex environmental changes brought by climate change.

The +\$2,000,000 program change will be used to restore science capacity in 2010 by rehiring research scientists to fill the approximately 23 existing vacant positions. CRU has traditionally invested over 90 percent of program funding in scientists salaries, with all funding for research projects coming from program partners. Therefore, improvements in program performance in the form of increased publications, presentations, courses taught, and other product-oriented elements of scientific outreach will occur over the subsequent years after science staff are hired

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and initiate their research programs. Reinvesting in science capacity to fully staff vacant Unit positions will have a direct and near immediate benefit in improving the numbers of students the program can support, with an attendant 15 to 20 percent increase in numbers of M.S. and PhD students graduated within 5 to 7 years.

The CRU program will remain highly productive in science, education, and outreach, through the network of State, university, and Federal cooperators and partners associated with the CRUs. The program will continue to sponsor undergraduate and graduate education programs for minorities that are underrepresented in the Federal workforce.

The following table lists CRUs by State:

Cooperative Research Unit Locations

Alabama	Auburn University
Alaska	University of Alaska
Arizona	University of Arizona
Arkansas	University of Arkansas, Fayetteville
California	Humboldt State University
Colorado	Colorado State University
Florida	University of Florida
Georgia	University of Georgia
Hawaii	University of Hawaii
Idaho	University of Idaho
Iowa	Iowa State University
Kansas	Kansas State University
Louisiana	Louisiana State University
Maine	University of Maine
Maryland	University of Maryland, Eastern Shore
Massachusetts	University of Massachusetts
Minnesota	University of Minnesota
Mississippi	Mississippi State University
Missouri	University of Missouri
Montana	Montana State University (Fish Unit) University of Montana (Wildlife Unit)
Nebraska	University of Nebraska, Lincoln
New Mexico	New Mexico State University
New York	Cornell University
North Carolina	North Carolina University
Oklahoma	Oklahoma State University
Oregon	Oregon State University
Pennsylvania	Pennsylvania State University
South Carolina	Clemson University
South Dakota	South Dakota State University
Tennessee	Tennessee Tech University
Texas	Texas Tech University
Utah	Utah State University
Vermont	University of Vermont
Virginia	Virginia Polytechnic University
Washington	University of Washington
West Virginia	West Virginia University
Wisconsin	University of Wisconsin, Stevens Point (Fish Unit) University of Wisconsin, Madison (Wildlife Unit)
Wyoming	University of Wyoming

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Program Performance Overview

The Cooperative Research Units addresses the Department of the Interior strategic goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment and by providing the science information that resource managers need. The following table highlights important performance measures for the Cooperative Research Units:

End Outcome Goal 1.4: Improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment

End Outcome Goal End Outcome Measure / Intermediate Measure	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures									
Ensure availability of long-term environmental and natural resource information, data and systematic analyses needed by land and resource managers for informed decision making									
# of students complete degree requirements for MS, PhD, and post doctoral program under the direction and mentorship of Unit Scientists (CRU)	100	103	95	90	83	90	90	0	120
X% of CRU students that work on subsequent fish and wildlife science advance degrees or obtain employment in the fish and wildlife or other natural resources field, within targeted dates post-graduation (CRU)	UNK	95%	95%	95%	95%	95%	95%	0	95%
Intermediate Outcome Measures and Bureau and Outcome Measures									
Ensure the quality and relevance of science information and data to support decision making									
% of studies validated through appropriate peer review (SP)	100% (236/236)	100% (517/517)	100% (249/249)	100% (205/205)	100% (280/280)	100% (205/205)	100% (210/210)	0	100% (335/335)
Efficiency and Other Output Measures									
# of systematic analyses & investigations completed	236	517	249	205	280	205	210	+5	335
# of formal workshops or training provided to customers	25	41	25	13	31	13	20	+7	30

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Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-) ^{a/}	Program Changes (+/-)	Budget Request	
Enterprise Information Security and Technology (\$000)	24,514	25,176	+1,087	0	26,263	+1,087
<i>FTE</i>	99	99	0	0	99	0
Enterprise Information Resources (\$000)	16,775	17,478	+228	+2,000	19,706	+2,228
<i>FTE</i>	115	114	0	+25	139	+25
National Geospatial Program (\$000)	69,082	69,816	-69,816	0	0	-69,816
<i>FTE</i>	306	295	-295	0	0	-295
Total Requirements (\$000)	110,371	112,470	-68,501	+2,000	45,969	-66,501
Total FTE	520	508	-295	+25	238	-270

^{a/} The USGS proposes to move the National Geospatial Program from the Enterprise Information Activity to the Geography Activity. The adjustment includes -\$69,816 and -295 FTE for this restructure. See Section F for more details.

Activity Summary

The 2010 budget request for the Enterprise Information (EI) Activity is \$45,969,000 and 238 FTE, which is a program change of +\$2,000,000 and +25 FTE from the 2009 Enacted level. Additional information on program changes is provided in each subactivity section and in the Key Increases section beginning on page C-1.

Since its inception in 2000, the USGS Geospatial Information Office (GIO) has had a breadth of responsibilities making information available that is reliable, scalable, and can sustain growth in an environment that has data rich holdings. It is the focal point for the bureau's information-related resources and activities: information technology infrastructures (networks, hardware and software); information and communications policies and standards; peer review processes; and information services (such as libraries, information centers, and the USGS presence on the Internet). A well-designed information architecture and comprehensive information security plans are critical aspects of a robust USGS integrated information environment. Diverse and distributed USGS databases and information are accessed and used seamlessly by scientists, collaborators, customers, and the public to address complex natural science issues.

The EI Activity ensures the integrity and availability of the USGS computer infrastructure to provide efficient, secure, uninterrupted dissemination of USGS information. The vigilant efforts of USGS have succeeded in blocking increasing amounts of SPAM and viruses – 2008 monthly statistics averaged over 100 million SPAM incidents blocked and 4,000 virus attacks denied.

The label “enterprise” applied to the business activities of the GIO means that the USGS has consolidated its large Information Technology (IT) and information systems, applications, and core functions and designed them to enable best practices and services to support the entire bureau.

The GIO plans and monitors the bureau's investment in IT, information security and management, information policy and standards, and information science. The duties, functions, and responsibilities of a Chief Information Officer are fulfilled in USGS by the Geospatial Information Officer, who also serves administratively as the Associate Director for Geospatial

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Information. The GIO is responsible for overall policy direction, management, and oversight of natural science information, database, and coordination; computing systems acquisition, development, and integration; IT capital planning and investment management; information security; human capital for managing information resources; E-Government initiatives and innovation; strategic planning for information resources; enterprise architecture and advancing the Federal Enterprise Architecture; records management; privacy; enterprise publishing; and information collection, dissemination, access, and delivery. This suite of responsibilities is consistent with those of other Federal government agencies and leading private-sector entities in its comprehensive approach to information assets and is in accord with recommendations of the Government Accountability Office (GAO).

Enterprise Information supports and furthers the Department's goal of managing the Department to be highly skilled, accountable, modern, functionally integrated, citizen-centered and result-oriented. To implement this goal, the USGS Enterprise Information Security and Technology efforts track intermediate outcomes to optimize efficient IT management (including maturation of capital asset planning and investment control as guided by the GAO's IT Investment Management Maturity Model), and ensure that the bureau follows best management practices for its science data and information records compliant with National Archives and Records Administration regulations. The USGS Enterprise Information Resources efforts ensure compliance with OMB's Data Quality guidelines and Peer Review Requirements.

Integrated Information Environment (IIE) — The EI component supports USGS strategic science objectives by establishing an integrated and accessible digital environment for its vast resources of past and future science data. The IIE is the infrastructure, standards, systems, and methodology needed to integrate the tremendous amounts of data and metadata required by USGS scientists. To assist the bureau's scientists with the new and challenging scientific questions emerging from environmental and climate change issues facing the world, EI is implementing delivery and hosting technologies, developing data and metadata standards, collecting and organizing data stores, and designing application toolkits. Integrating data within the USGS is also a prerequisite for joining multi-scale worldwide science collaborations to address these challenges at a global scale. The requirement of integrating data across traditional discipline boundaries, spanning decades of data collections and at national or global scales will present significant new challenges for the organization. In 2010, USGS will have a finalized Data Integration Plan in line with the vision of the USGS Science Strategy for 2007 to 2017; an active Data Modeling Community of Practice working on data modeling standards for the bureau; a published controlled vocabulary for USGS data types and terms; and an enhanced ability to support science projects with an array of data management services.

EI Activity Contribution to Department Working Capital Fund Accounts — Each year the Department invests millions of dollars on enterprise IT initiatives that aim to improve network security and privacy and reduce costs. These initiatives are funded by a process in which the Department collects bureau appropriated funds through centralized and directly billed accounts to manage enterprise-wide activities at the Department level. The following table shows USGS appropriated funds sent to Department Working Capital Fund accounts to manage enterprise IT operations on behalf of the USGS:

(Dollars in Thousands)

Department WCF IT- related Accts.	2008 actual	2009 est.	2010 est.
USGS Centralized Bill	5,687	5,651	6,142
USGS Direct Bill	6,175	4,555	5,141
Total	11,862	10,206	11,283

Workforce Planning

In 2010, the EI will continue to undergo workforce re-engineering and analysis to identify and support future needs. Over the previous two years EI conducted skills assessments and will continue to evaluate employee skills for publishing, information management, and information technology. Voluntary Separation Incentive Payments, and Voluntary Early Retirement Authority (VSIP/VERA) will be used to implement these future needs.

From 2004 through 2010, the USGS has used a High Performing Organization model to significantly restructure its science publishing workforce and business processes into a regionally-based Enterprise Publishing Network. The Publications staff was gradually reduced from 254 employees in 2004 to 153 in 2009. The long-term restructure is streamlining the publishing technical and business functions to improve operational efficiencies and reduce the number of publishing cost centers.

Subactivity Overview

The 2010 EI Activity comprises two subactivities:

Enterprise Information Security and Technology supports USGS information security and technology efforts. The information security component ensures compliance with all Federal information technology mandates and is responsible for the electronic security of and access to all USGS data and information assets. The telecommunications and computing infrastructure components support enterprise services network, directory services, technical support, enterprise architecture, capital asset planning and investment control activities, email, and e-authentication.

Enterprise Information Resources guides and manages bureau-level systems and activities in information policy, information integration and delivery, and science education. The information integration and delivery component provides direction, coordination, and strategic planning of scientific data integration and management relating to Web-Internet services, science publishing, libraries, information centers, and enterprise-level coordination of educational activities. The information resource management component supports coordination of Geographic Information System software use in the bureau and the Department.

In 2010, the USGS proposes to move the National Geospatial Program to the Geographic Research, Investigations, and Remote Sensing Activity. See Section F for more details.

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Activity: Enterprise Information

Subactivity: Enterprise Information Security and Technology

	2008 Actual	2009 Enacted	2010			Change from 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Enterprise Information Security and Technology (\$000)	24,514	25,176	+1,087	0	26,263	+1,087
<i>Total FTE</i>	<i>99</i>	<i>99</i>	<i>0</i>	<i>0</i>	<i>99</i>	<i>0</i>

The 2010 budget request for the Enterprise Information Security and Technology (EIS&T) Subactivity is \$26,263,000 and 99 FTE. There are no program changes requested for EIS&T in 2010.

Program Overview

The EIS&T Subactivity supports the USGS and the Department of the Interior (Department) information security and information technology (IT) efforts. The Information Security component ensures compliance with all Federal IT mandates and is responsible for the electronic security of and access to all USGS data and information assets. The telecommunications and computing infrastructure components support directory services, technical support, enterprise architecture, email, e-authentication (smartcards), the Department's Enterprise Services Network (ESN), and implementation of the Department "Big 9" IT security initiatives – Networx, Trusted Internet Connections, Logging Extracts of Data Bases, Encryption/Data At Rest, Two-Factor Authentication, Radio Program Infrastructure, Department Enterprise Infrastructure Project Management Office, IT Security Threat Management, and Active Directory Optimization.

The USGS continues to mature its procedures and processes for Capital Planning and Investment Control (CPIC), following Government Accountability Office's IT Investment Management Maturity Model. The objectives are to maintain compliance with CPIC requirements from the Office of Management and Budget (OMB) and the Department, to ensure that the bureau's overall IT investment portfolio supports strategic goals and priorities, and to ensure that the USGS IT Investment Review Board (IRB) follows established, repeatable processes for major IT investment selection, control, and evaluation.

This USGS subactivity:

- Increases efficiency, consistency, and integration of IT infrastructure and operations across the bureau, including the use of "green" computing standards, products, and practices;
- Facilitates greater oversight, accountability, transparency, and performance measurement relating to the management of the bureau's information investments;
- Enhances data sharing and integration across USGS science disciplines and programs through greater reliance on common IT infrastructure and support services; and

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- Increases USGS' ability to respond rapidly and comprehensively to new governmentwide information directives and mandates for information security.

For details on changes to performance measures, see the end of this section.

By 2010, the USGS will have created an integrated information environment for its science information assets and established a robust science data modeling capability, a comprehensive science data catalog, and an enterprise data hosting infrastructure to support the retention, archive, and dissemination of USGS science data sets in accordance with open standards. The Enterprise Hosting Platform (EHP) will serve as the foundation for hosting USGS services and applications by creating a standardized environment that includes processes, IT service management, facilities, communications, workforce, security, applications, and servers. The goal of the EHP is to establish an efficient, reliable, and cost-effective hosting infrastructure for USGS enterprise services and applications that supports the USGS science strategy.

2010 Program Performance

EIS&T includes the following components:

Information Security

(Estimates for 2008, \$5.9 million; 2009, \$6.0 million; 2010, \$6.1 million)

The Information Security component ensures compliance with all Federal information technology (IT) mandates and regulatory requirements. Staff in this area is responsible for the IT security of and access to all USGS data and information assets as well as the management and operation of the USGS IT Security Program, including compliance with the Federal Information Security Management Act (FISMA) and other Federal laws directing IT security. This component is responsible for IT security policy, compliance, and operations to ensure the confidentiality, integrity, and availability of USGS data and information assets.

The USGS IT Security Program implements IT security through policy enforcement and oversight of common security controls based on the National Institute of Standards and Technology Special Publication series. Ensuring the security and reliability of USGS information assets and ensuring that USGS networks and systems are secure and protected from malicious attacks is a top priority. Two additional priorities are (1) streamlining and maintaining certification and accreditation (C&A) of critical information systems, and (2) maintaining robust IT security operations during increased security challenges and continuously improving the efficiency and effectiveness of security controls.

A managed approach to IT security and operations is vital to enabling efficiencies and providing a robust security posture. By acquiring, managing, and overseeing evolving IT security technologies and procedures, the return on investment is high; however, escalating costs and operational difficulties in a dispersed IT environment such as that of the USGS pose significant challenges. As a baseline for IT security, the USGS continues to maintain compliance with FISMA and other mandates for establishing and keeping the USGS IT infrastructure secure and protected from internal and external threats.

For the past several years, the USGS IT Security Steering Committee (ITSSC) has served as the central point for overseeing policy review and development, the ITSSC works to ensure policies are consistently applied across the USGS IT environment. The ITSSC also makes

certain that IT security requirements are applied in a manner to maintain a balance between IT security settings and the technology needs of USGS science activities.

Operationally, the IT Security Program continues to focus on the implementation of technical security controls including patch management compliance reporting, vulnerability management, malicious code protection, and Web application security. Through the deployment of enterprisewide projects that cover all USGS IT computing assets, efficiency and value are added at reduced costs to the science centers, while Federal and Departmental mandates are fulfilled using a standardized and consistent approach. Threat management through the deployment of both technical and operational controls is a high priority while enhancing and strengthening the USGS C&A program and supporting infrastructure.

IT Security Certification and Accreditation — C&A requirements implementing FISMA state that all high risk Federal IT systems must be reviewed for IT security compliance on a periodic basis. EIS&T provides for re-certification and accreditation of program specific IT systems. In addition to the required re-certification and accreditation of USGS systems (usually every three years), in 2010, all USGS systems will continue to be monitored to maintain C&A status, as required by OMB and to ensure ongoing compliance with FISMA mandates. Contingency plans, part of the C&A package for an IT system, are in place for all C&A systems and are tested annually in accordance with FISMA and OMB Circular A-130, Appendix III. All C&A packages are in compliance with OMB requirements, Departmental policy and standards, and of Standards and Technology (NIST) standards and guidelines. In 2010, an annual security self-assessments will be performed for all C&A systems and security programs in accordance with FISMA (3544(b) (5) (A)).

In 2009, the USGS is integrating C&A activities, including system security plans and risk assessments, into operations throughout USGS. The USGS is establishing processes and procedures that refine and simplify the application of NIST Special Publication 800-53, Recommended Security Controls for Federal Information Systems, including a plan for consolidating into fewer assets, and developing and applying new technologies and training methods to effectively lead and guide USGS system administrators and field managers throughout the C&A process. The long-term initiative will also include recommendations for eliminating deficiencies in the NIST Special Publication 800-53 controls. A team will review mission and science systems that have unique security needs and determine methods to effectively isolate these from other USGS systems, and document and accept the risks as appropriate. Security controls outlined in NIST Special Publication 800-53 will be implemented. The USGS is maintaining the C&A status of systems.

Common Security Controls — In 2010, the USGS will begin to implement phase 2 of the Common Security Controls initiative to further enhance C&A processes and operational security. In 2009, the USGS is completing phase 1 of the Common Security Controls initiative geared towards enhancing both certification and accreditation processes and operational security. Common security controls are controls identified in the National Institute of Standards and Technology 800-53 managed by a single USGS program that are deployed and implemented by all USGS systems based on guidance and standard operating procedures. They apply to all organizational information systems, a group of information systems at a specific site, or common information systems, subsystems, or applications deployed at multiple operational sites. The benefits realized by the USGS will include (1) assessing common security controls at the organization level, (2) enhancing the efficiency of the security C&A conducted by organizations and significantly reducing security program costs, (3) consistently applying security controls across the organization at large, and (4) realizing a significant savings

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in the security C&A process. Examples of the initial set of common security controls include incident response, improving patch compliance reporting, and enterprise anti-virus protection.

IT Security Operations — In 2010, an enterprise technical solution and standard operating procedures for applying and tracking compliance with required Security Technical Implementation Guides (STIGs) will be developed and implemented. STIGs are critical components of operational IT security and will be implemented for IT systems and platforms based on categories in OMB policies.

In 2009, USGS continues to increase deployment of both technical and operational security controls to proactively address IT system vulnerabilities and threats throughout USGS. Each security point of contact will have access to centrally managed systems at no cost to the Science Center in areas of vulnerability management, malicious code protection, and patch compliance reporting. The Enterprise Vulnerability Management System is currently operational but will see enhancements to include STIG compliance and more robust, granular system scanning. The Enterprise Symantec Antivirus infrastructure is being upgraded to the next generation of malicious code protection, providing protection against malware and spyware, and adding host based firewall and network access control capabilities. A centralized reporting infrastructure for reporting patch compliance is being established, which results in the reduction of labor needed to manually track and report on system patching.

Telecommunications

(Estimates for 2008, \$8.4 million; 2009, \$7.9 million; 2010, \$8.0 million)

Through the Telecommunications component, the USGS manages and troubleshoots all voice and data services over its local area networks (LAN).

Enterprise Services Network (ESN) — The Department's ESN consolidates data telecommunications networks into one integrated system. In 2010, the USGS-wide area telecommunications networks will be fully controlled and operated by the Department's ESN. In 2008, the USGS worked with the Department to institutionalize Internet 2 as a Department service, not just a USGS-provided service. The USGS also completed "flattening" the USGS networks to the ESN in early 2008 and completed the connection process by using the ESN Security Architecture. In 2008, 89 sites (approximately half) were migrated to ESN, and the migration to VBNS (Very High Speed Broad Band Network System) connectivity, operated by Verizon Business connectivity enabled symmetric flow within the USGS network, which was necessary to move behind ESN security protections. Additionally, the USGS completed eRemote Access Services (eRAS) testing and transitioned at least 25 percent of USGS users to the eRAS while scaling back legacy remote access services. In 2009, the USGS is completing the transition of USGS eRAS users, while decommissioning legacy distributed remote access services. If needed, remote Access Services in Menlo Park, Hawaii, and Alaska will remain operational as a backup to the eRAS service. In 2010, the USGS wide area telecommunications networks will be fully controlled and operated by the Department's ESN.

Networx — The General Services Administration's "Networx" contract is the FTS 2001 follow-on comprehensive telecommunications service contract for the Federal Government. The USGS transition from FTS2001 to Networx will take 18 months with new services in 2009 and complete conversion in 2010. The USGS is completing deployment of voice services in 2009 with data services expected in 2010.

Radio — The USGS owns and operates more than 11 percent of all radio equipment within the Department. Multimillion dollars worth of equipment are critical to the mission of the USGS. Seismic detection, water gauging, wildlife telemetry, satellite data relay and communications are only a few of the USGS radio uses. The Federal Communications Commission Advanced Wireless Services Auction 66 action was to relocate federal operations in the 1710-1755 megahertz (MHz) band and provide the frequencies to the private sector. Sixteen of those radio frequency assignments were previously assigned to the USGS Earthquake Hazards Team from Menlo Park. Relocation meant replacement of most of the existing equipment. The USGS received \$6.2 million on March 1, 2007, with a requirement to have the frequencies cleared and relinquished to T-Mobile by March 1, 2010. The USGS completed the replacement of the microwave systems and relocated to new frequencies in less than 18 months. On August 20, 2008, the USGS officially relinquished the old 1710-1755 MHz spectrum to T-Mobile. Some infrastructure changes still remain and their anticipated completion is mid-2009, well ahead of the March 1, 2010, completion requirement. In 2009, the USGS is completing the 1710-1755 MHz project by completing work on radio towers. This effort aligns with the Department/OMB Big 9 Initiative.

Voice Over Internet Protocol (VoIP) — This is a group of transmission technologies for delivery of voice communications over IP networks such as the Internet or other packet-switched networks. VoIP systems usually interface with traditional public switched (PBX) telephone network. In 2008, the USGS completed eight PBX and LAN upgrades, allowing it to move toward an infrastructure that would ultimately support a common PBX architecture and simplified management. The USGS is currently nine percent VoIP capable. In 2009, the USGS began moving toward regionalizing its phone system under a common ePBX architecture and simplified management. The implementation of VoIP will continue in 2010 and will likely reduce costs for voice and data telecommunication services.

Computing Infrastructure

(Estimates for 2008, \$10.2 million; 2009, \$11.3 million; 2010, \$12.2 million)

The Computing Infrastructure component provides the USGS with a uniform office automation infrastructure using such foundational components as Active Directory and the Lotus Notes Name and Address Book. Together, these directory services provide authoritative IT credentials for a growing number of USGS IT services and applications. Computing Infrastructure also provides end-user IT services including electronic mail, collaboration services, and desktop applications for all bureau employees. Compliance with Federal mandates and Department directives are ensured through an ongoing and active Enterprise Architecture program and Information Management programs in Records Management, Privacy, Freedom of Information Act (FOIA), Section 508, and Information Collections.

Computing Infrastructure also manages several technical support teams that facilitate the integration and implementation of standards for Microsoft Windows, Macintosh, and Unix operating system environments. In addition, these teams provide leadership for the implementation of IT configurations, security controls, applications, databases and Web services with a purpose to promote excellence in development, implementation, and continuous improvement by establishing "best practice" procedures for deployment.

The USGS Service Desk System serves as a single point of contact for all IT support to an expanding customer base. The continuing consolidation of USGS help desk functions provides improvements and efficiencies in response time, problem resolution, and quality of technical support, while also relieving individual offices from having to perform these functions independently. Efficiencies and savings are gained through increasing incident resolution

during the initial call using tools, such as the new remote desktop support system, and by proactive support through on-line self-help tools and a searchable knowledge management system. The Service Desk System, built upon specialized hardware and software (i.e., for call tracking, automated call distribution, knowledge management, and configuration management), consists of IT support personnel from across the USGS who are formally linked together through organizational and matrix relationships to provide more consistent IT customer service. At the heart of this system is the USGS Service Desk located in Denver, which provides a multi-channel (voice, email, Web), single point of contact for all IT customer support. The Service Desk has primary responsibility for incident resolution, service request tracking, and customer satisfaction.

Additional EIS&T activities:

Department/OMB Big 9 IT initiatives — In 2009 and continuing in 2010, the USGS began implementation of selected Department Big 9 IT security initiatives, concentrating on Active Directory Optimization, Two-Factor Authentication, Threat Management, Encryption/Data At Rest, Network, and Radio.

Collaborative Communications Infrastructure (CCI) — The CCI consists of a suite of supported software tools that facilitate collaboration and sharing knowledge and data within the USGS and with USGS customers. The CCI will continue to provide a set of integrated, secure, and robust tools to help USGS science and administrative users accomplish the mission of the bureau. The following activities will be the highest priority in 2010:

- Provide secure and reliable infrastructure for the support of Enterprise Information projects, including EHP, myUSGS, The Science Catalog, Data Modeling, Data Integration, and Professional Pages.
- Continue to provide secure, reliable email services to all USGS employees, contractors, etc.
- Continue to provide secure, reliable Web conferencing, instant messaging, and online project management tools to all USGS employees, contractors, etc.
- Provide spam and virus protection for the USGS.
- Seek integration with other USGS enterprise IT projects/programs to improve overall efficiency and enhanced customer service satisfaction.
- Provide technical assistance and guidance to the USGS on new projects, initiatives, and platforms.
- Continue to ensure that the CCI environment meets all current and future Departmental initiatives and requirements from OMB and other required sources.

Capital Planning and Investment Control — In 2010, the USGS will continue to mature its IT investment management and related CPIC processes and procedures for planning and managing IT investments based on the General Accounting Office (GAO) IT Investment Management (ITIM) maturity model. These processes comply with the Clinger-Cohen Act of 1996 and OMB Circulars A-11 and A-130. The USGS Associate Director for Geospatial Information is responsible for developing bureauwide policies and procedures to continue to mature the CPIC process toward full compliance with Federal mandates and Department directives. The CPIC program ensures that the USGS IRB follows established processes for the selection, control and evaluation of the IT portfolio of investments. The control and evaluation activities include a regular cost, schedule and performance review of all major IT investments (defined as those investments with greater than \$5.0 million in planned annual spending or otherwise having far reaching program or policy significance) and annual reviews of all non-major projects and infrastructure investments.

In 2009, the USGS is continuing to mature its CPIC processes to support selection of IT investments that provide the best value to the USGS mission, to evaluate investment performance, and to ensure the application of best practices to the management of USGS IT resources. Work with the Enterprise Architecture program office to develop As-Is (current state) and To-Be (future state) infrastructure service cost models. These financial models are used to identify opportunities across the Geospatial Information Office (GIO) to leverage best practices and optimize USGS investments in IT resources.

Project Management Office (PMO) — In 2010, the USGS PMO will continue to expand its services by providing collaborative forums for bureau project managers to share best practices, to peer-mentor and coach, and to exchange project and program tools and technologies. The PMO supports the GIO by facilitating priority project review meetings.

Enterprise Architecture (EA) — In 2010, the USGS EA program will continue to provide analytical and planning support to the USGS mission delivery and technology programs to improve service delivery and enhance mission results. The USGS EA program supports the development and implementation of modernization blueprints using the Federal Segment Architecture Methodology and development of As-Is and To-Be architectures with reference models that conform to those of the Federal Enterprise Architecture. As part of the modernization effort, the USGS EA program seeks to help the USGS become more flexible, drive down cost, reduce cycle time and improve services to citizens in the delivery of its mission.

In 2009, the USGS is continuing to evaluate opportunities to achieve cost efficiencies across the organization and participate in Department activities to develop modernization blueprints for each of its defined business segments. The EA program office supports the deployment of the Financial and Business Management System, a major enterprise management initiative that will integrate financial management, procurement, property management and other subsidiary systems. As part of this effort, the EA program office is supporting the identification of opportunities for process optimization and standardization to eliminate unnecessary burden on the citizen. The USGS continues to integrate architecture, security, and capital planning processes that facilitate knowledge transfer and reuse between business, data, application, and technology components.

Electronic Records Management (ERM) —The USGS supports the Department's ERM initiative of moving the Department and its bureaus and offices to an enterprisewide centralized approach to ERM. In 2010, the USGS will continue its partnership with Department by participating on teams created to develop a strategy to analyze electronic records aligned to Department business lines. The USGS will continue (1) to address challenges to meet evolving requirements for e-mail and vital records management to prevent the loss of information critical to the continuing operation of the USGS in the most efficient and economic manner possible; and (2) to address the challenges of determining the extent and scope of responding to searches, document productions, electronic discoveries, litigation hold requests, and other legal matters related to USGS records, information, and data.

The E-Government Electronic Records Scheduling ERM Initiative, as required by Section 207(e)(2)(b) of the E-Government Act of 2002, for which the National Archives and Records Administration (NARA) is the managing partner, will provide a significant benefit to citizens by increasing data accessibility and reducing the cost of delivering those services. To achieve this goal, significant effort is required by agencies to develop agency records schedules by the end of 2009 to cover the official records contained in their electronic systems and databases identified as of December 17, 2005. The records schedules, after approval by NARA, will then

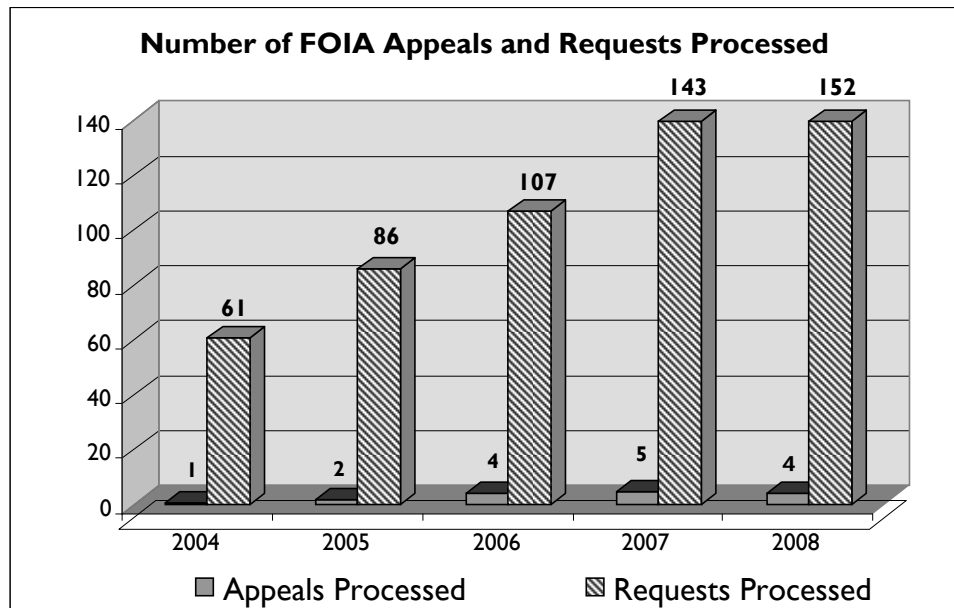
be made accessible on the agencies public Web Site. The USGS has already met and achieved this goal; however, the agency continues to search and identify additional electronic systems and databases created since the end of 2005.

Data Rescue — The USGS has significant challenges in keeping pace with assessing, preserving, and making accessible critical historical and legacy scientific information and data to be available for future studies affecting our Nation and the world. Since the end of 2006, work has been ongoing on establishing a viable Data Rescue or preservation initiative to address historical bureau science information and data at risk of loss. In 2009 and continuing in 2010, the USGS is increasing awareness of the Data Rescue initiative. Leading a more collaborative initiative enables a more integrated effort to ensure the long-term accessibility and use of the science of the USGS.

Privacy and FOIA — In 2010, the USGS privacy program will expand its capability to identify system privacy risks and ensure collections of personal information have been reduced, eliminated, or protected. The USGS FOIA program will continue to be administered per presidential and Department of Justice memorandums and guidelines thereby ensuring the improvement of information dissemination to the public.

In 2009, the OMB Directive to safeguard and reduce/eliminate collections of PII/SSN is being implemented per the requirements of the Department-OCIO Directive. With the advent of recent and increased attention regarding identity theft, personally identifiable information (PII) and system privacy risks, the USGS is strengthening its privacy program by creating a network of privacy liaisons to support the bureau's privacy responsibilities. The USGS is administering the FOIA program per the new guidelines governing the FOIA as directed by the President in his memorandum dated January 21, 2009, reaffirming the commitment to accountability and transparency as the USGS disseminates information to the public.

The USGS privacy program is fully integrated into the CPIC processes and the IT Security C&A activities. Privacy Impact Assessments for all USGS 2010 Capital Asset Plans (Exhibit 300's) were reviewed and completed. The privacy program responded to FISMA privacy questions in the 2008 FISMA annual report. FISMA reports responding to privacy questions are submitted quarterly. System of Records Notices have been reviewed and created when required for systems handling privacy act information. The USGS responded to 152 FOIA requests during 2008. The Department recognized the USGS as a FOIA best practice.



Number of FOIA appeals and requests processed for 2004 through 2008. The number of FOIA appeals and requests processed annually has increased 149% since 2004.

Document Production, Electronic Discovery, and Preservation Obligations — In 2010, the USGS will implement its litigation hold policy for USGS employees and contractors. The USGS continues to develop a data map or inventory of all bureau electronic systems and databases that contain Federal official records. The USGS also continues to monitor and remind employees of current litigation holds affecting bureau information and data as well as providing them with any new or changed requirements, as applicable.

Centralize Software Licensing — In 2010, the USGS will continue to consolidate and track software procurements to reduce redundant purchases and overhead within the GIO. Through gained efficiencies, the USGS will be able to decrease the amount of time various groups spend on software procurement activities. A documented process for consolidating software purchases within the GIO will be developed and put into operation.

IT Infrastructure Developments with the Department — USGS is working in partnership with the Department and its bureaus to plan, refine, and implement customer-focused enterprise IT systems, services, and processes that are mission-oriented and cost-effective. USGS is participating with the Department on three projects:

- IT Infrastructure Line of Business, a governmentwide initiative to improve delivery of standard IT services throughout the Federal Government. Knowledge gained through the 2009 data collection process will be used to improve the process for 2010;
- Department IT Roadmap, a portfolio of high-priority, tactical IT projects; and,
- Department IT Modernization Blueprint, a strategic plan for providing effective and efficient IT services on an enterprise scale.

Program Performance Overview

The following table highlights important performance measures for the Enterprise Information and Security Technology Subactivity.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
Percent of systems and lines of business/functional areas associated with an approved blueprint that are managed consistent with that blueprint (SP)	A	UNK	UNK	UNK	UNK	100%	100%	100%	0	100%
Percent of IT systems that have Certification and Accreditation (C&A) and are maintaining C&A status (SP) (EIS&T)	A	100%	100%	100%	100%	100%	100%	100%	0	100%
Comments	USGS has 12 major systems and all have undergone and are maintaining their C&A status.									
Intermediate Outcome Measures and Bureau and Outcome Measures										
E-Government and Information Technology Management										
Efficient IT Management: Score achieved on the OMB Enterprise Architecture Framework (SP) (EIS&T)	A	Level 4	Level 3	Level 4 – complete Level 3 – Use and Results	Level 4	Level 4 on “Completion,” “Use,” and “Results” categories	Level 4 in all areas	Level 4 in all areas	0	Level 4 in all areas
Comment	The Enterprise Architecture (EA) framework measures maturity on a scale of 1-5 in the following areas: completion, use, and results. 2008 scoring achieved: Bureau-level EA program actively contributes towards DOI achieving a score of 4 in the “Completion” section and 4 in both the “Use” and “Results” in support of OMB EA Maturity Framework 2.2, PMA Scorecard, and OMB's Proud to Be.									

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
<i>Efficient IT Management</i> . Stage achieved on the GAO IT Investment Management Framework (SP) (EIS&T)	A	100% stage 3	63% stage 3	70% stage 3	74% stage 3	100% stage 3	100% stage 3	100% stage 3	0	100% stage 3
Comment	The GAO's ITIM framework is a maturity model composed of 5 progressive stages of maturity that an agency can achieve in its IT investment management capabilities. For each maturity stage, the ITIM describes a set of critical processes/key practices that must be in place for the agency to achieve that stage. The ITIM is used to analyze a USGS investment management process and to determine its level of maturity. Evaluation of maturity is performed by capturing the status of implementation of the key practices across the 5 maturity stages. The status data includes (a) rating (executed, partially executed, not executed, N/A); (b) summary of evidence/comments; (c) point of contact. If the key practice has not been met, information required to evaluate progress toward execution of the key practice is captured, including (a) gap assessment, (b) planned actions; (c) responsibility; and (d) planned date.									
<i>Efficient IT Management</i> . Score achieved on the NIST Federal IT Security Assessment Framework (SP) (EIS&T)	A	4.5	3.37	3.5	4.5	3.99	5.0	5.0	0	5.0
Comment	The goal in 2009 is to make further progress in achieving a strong, secure NIST framework. The Annual Internal Control Review (ICR) assessments follow NIST Special Publication 800-53A security control procedures. 800-53A, "Guide for Assessing the Security Controls in Federal Information Systems," is a companion guideline to NIST SP 800-53, "Minimum Security Controls for Federal Information Systems." Each NIST publication provides guidance for implementing the steps in the NIST Risk Management Framework. Results from the ICR assessments define the level of security control maturity as identified in the NIST Federal IT Security Assessment Framework. NIST level 1 is whether a policy is in place; level 2 is whether procedures to implement the policy are in place; level 3 is whether the policy and procedures are implemented and actually used; level 4 is whether the security controls are tested or scanned or if a contingency plan is in place; level 5 is whether all systems are fully integrated. All 12 USGS systems were assessed using the ICR template provided by DOI which contained a roll-up process to determine the level of maturity by system. Results were aggregated to determine average percentage score.									
IT Investment Management Annual % of USGS IT investments reviewed, approved, and monitored through the CPIC process (EIS&T)	A	100%	100%	100%	100%	100%	100%	100%	0	100%

Enterprise Information

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	USGS has 7 IT investments and manages 2 DOI investments (Geospatial Line of Business and Geospatial One-Stop)..									
% of customers satisfied with service from USGS IT Service Desk (EIS&T)	A	95.9%	94%	95.9%	94% 4559/ 4850)	96.7%	94% 4559/ 4850)	94%	0	94%
Comment	USGS Service Desk users are randomly sampled whenever a service is requested. The numerator is the number of responses that indicate positive satisfaction; the denominator is the total number of surveys returned.									
% of identified USGS security incidents that receive corrective action within timeframes required by the DOI Incident Response Policy (EIS&T)	A	50%	75%	95%	100%	86%	100%	100%	0	100%

Activity: Enterprise Information

Subactivity: Enterprise Information Resources

	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Enterprise Information Resources (\$000)	16,775	17,478	+228	+2,000	19,706	+2,228
<i>Total FTE</i>	<i>115</i>	<i>114</i>	<i>0</i>	<i>+25</i>	<i>139</i>	<i>+25</i>

Summary of 2010 Program Changes for Enterprise Information Resources

Request Component	(\$000)	FTE
<ul style="list-style-type: none"> A 21st Century Youth Conservation Corps 	+2,000	+25
TOTAL Program Changes	+2,000	+25

Justification of 2010 Program Changes

The 2010 budget request for the Enterprise Information Resources (EIR) Subactivity is \$19,706,000 and 139 FTE, a program change of +\$2,000,000 and +25 FTE from the 2009 Enacted level.

A 21st Century Youth Conservation Corps (+2,000,000 / +25 FTE)

Through the 21st Century Youth Conservation Corps initiative, the USGS will expand education, training, and workshop opportunities to provide more in-depth training through coursework and internships for high school and college students. This initiative would increase by 120 the total number of internships and fellowships supported or facilitated by the USGS educational program. Additional details on the 21st Century Youth Conservation Corps initiative are described in section C, Key Increases.

Program Overview

The EIR Subactivity guides and manages bureau-level systems and activities in information policy, information integration and delivery, and science education. The Information Integration and Delivery component provides direction, coordination, and strategic planning of scientific data integration and management relating to Web-Internet services, science publishing, libraries, information centers, and enterprise-level coordination of educational activities and geographic information systems. The Information Resource Management component supports coordination of the Department's enterprise approach to Geographic Information Systems with respect to administrative and technical management of GIS applications and training.

The USGS is increasing efficiency and effectiveness of its scientific information integration and dissemination services through the Natural Science Network of integrated information, science, and knowledge to ensure that the latest USGS science data are easily and quickly available to citizens, agencies, academia, and the private sector in accessible formats. The bureau is optimizing customers' ability to "*find, get, and use*" USGS information and products tailored to their specific requirements.

2010 Program Performance

EIR includes the following components:

Information Integration and Delivery

(Estimates for 2008, \$15.5 million; 2009, \$16.2 million, 2010, \$18.4 million)

Information Integration and Delivery activities transform existing functions and services to reflect the changing nature of USGS science and science products; achieve efficiencies in the accessibility, delivery, and integration of USGS information through enterprise-level approaches; employ innovative and cost-effective technologies; and use future skills planning and partnerships for a flexible and balanced workforce.

Information Services, Library, and Product Distribution — The USGS Library system is the world's largest earth science library. The bureau's information offices and library system provide scientific and product information and technical assistance to a wide range of internal and external customers and to the natural science community as a whole. These offices use a variety of tools and capabilities to provide access to USGS science and identify sources of scientific information outside of the bureau. They are also a conduit for feedback between customers of USGS data and information and the USGS scientific and technical community. Significant emphasis is placed on increasing digital library capabilities, including electronic library subscriptions and new technologies that enhance flexibility and accessibility to research information. A major component of product distribution activities is access to USGS map and book products via the USGS on-line store and the Publications Warehouse. Efforts will continue for converting hard copy products to a digital format in support of electronic distribution and print-on-demand.

In 2010 and 2009, the USGS Library system will continue to expand its digital library services by working closely with the three regional and the national Library Advisory Boards and Science Programs to meet their needs. By example, instead of photo copying and printing, regional libraries will support patrons scanning or saving to electronic formats. Retrospective cataloging will proceed to make library holdings searchable and visible to others. Monthly Web-Ex training classes on using library databases and library tools will be implemented. The Library system will work to improve turnaround times on services provided and periodic Library Newsletters will keep science program staff informed about new services and resources. Support will continue for digitizing the USGS Photographic Collection as well as improving the "*find, get and use*" model for the Geologic Field Records Collection.

The USGS is making improvements to the USGS Frequently Asked Question (FAQ)'s text available via the Web and to the telephone and email inquiry support. Information Services will continue to improve their ability to measure and balance workload across regions and work with partners who also provide natural science information among State earth science information groups, academic libraries, and USGS Science Center Libraries.

The distribution activity efforts will continue to convert hard copy products to a digital format in support of electronic distribution. Additional partnerships will be opened to supplement reimbursable dollars and business strategies will continue to be developed that streamline operations and increase efficiencies while reducing overhead costs.

A strategy for science program support services will continue to support both regional and national research initiatives in 2010. Data Integration efforts will continue to move forward by expanding the myUSGS Web services portal to support bureau science initiatives. A new release of myUSGS is being prepared that will introduce notable changes to the document management component. The Science Information Services team will coordinate development activities to increase content, improve linking, and ensure the ability to find Web content using the Search USGS and internal Search tools. The team will continue to support USGS Store enhancements and myUSGS capability including new products presentation and improved Help documentation including videos; and establish user groups and WebEx sessions. The team will also help develop an automated process for the review and approval of new science project proposals and will set up wiki pages as needed to provide easy access to the commonly required Web metrics data.

The Science Information Team designed, developed, and launched a new Web site and established the ability for presenting other major Web sites within one uniform site and design. A new Web-based tool that enabled non-technical staff to maintain the content on their Web pages was used. A Web site for the USGS Field Records Collection was established to enable users to research and reserve Field Records items for in-person viewing and a public Web site was developed for a consortium group called Regional Interagency Mapping Coordination Working Group. The USGS Store was redesigned and re-launched with a more integrated Map Locator and Downloader. The myUSGS service was greatly expanded with a series of weekly WebEx sessions that introduced the toolset to users; expanded phone and email support; consulted with community managers; and developed metrics data for Web sites in development and in operation.

Enterprise Publishing — Accurate, efficient, effective, and timely reporting of reliable science information are key factors that assure the USGS role as a world leader in the natural sciences through scientific excellence and responsiveness to society's needs. In 2010, the Enterprise Publishing Network (EPN) will continue to develop transparent policies, business practices, and procedures to maintain the USGS reputation for publishing high-quality unbiased science. Many of the 8,700 USGS employees—scientists, managers, and others—use the professional publishing services of the EPN for editorial and visual information support. The EPN uses the latest publishing technology to support requests for information products and services that vary from USGS science publications and maps, to journal articles and external publications, to presentation and outreach materials, to Web site design, creation, and content maintenance. Printing of all USGS publications is handled through the Government Printing Office. The EPN also assists many partners, suppliers, and consumers of USGS data and information products and services. In 2010, the USGS will continue coordinating and maintaining an internal billing data tracking system, providing publishing services guidance to authors and managers, and, when requested, providing support for cooperative publishing activities with other agencies. The EPN Manager provides bureau publishing leadership and management oversight. Three Regional Publishing Managers coordinate production support through Publishing Service Centers across the USGS.

Enterprise Web (EWeb) — In 2010, the EWeb program will continue to provide support to over 700 USGS Web sites for delivering, managing, and integrating online USGS science information and applications. For 200 of those Web sites, it will continue to provide a secure

Enterprise Information

hosting infrastructure with an overall USGS Web manager satisfaction rate of 99 percent. The security and support of the EWeb program will continue to assure the delivery of uninterrupted content during disasters and other critical peak periods. The USGS Web presence will continue to serve millions of U.S. visitors per month. The plan to transition GIO web services to the Enterprise Hosting Platform will be implemented to improve quality and efficiency of web services to the bureau to support the Science Strategy.

In 2009, EWeb is continuing to maintain the USGS Web Inventory and provide regular monitoring of Web sites in the Web Inventory for compliance with Federal and USGS requirements such as Section 508 and continue to support the customer satisfaction survey. EWeb meets OMB requirements for completion of a 3-Year Recertification and Accreditation ensuring that all EWeb assets are recertified, and will oversee the development of the USGS Web Handbook based on the Department's and USGS' policies, and Fundamental Science Practices. EWeb will implement the USGS Professional Pages and continue to provide bureauwide web development contract support. A plan will be developed to integrate Web services provided across the GIO consistent with Enterprise Hosting Platform solution architecture.

Information Resource Management

(Estimates for 2008, \$1.3 million; 2009, \$1.3 million; 2010, \$1.3 million)

Information Resource Management focuses on establishing, monitoring, and guiding the efficient use of GIS applications.

Enterprise Geographic Information Systems and Enterprise Applications — The USGS will continue to lead the Department in administrative and technical management of geospatial technologies in 2010. Bureauwide training and technical support will continue to be provided. When appropriate and possible, web-based training will be emphasized to reduce travel requirements and to provide efficient training. Guidance and administrative policy will be developed for working with external web services and internet based geospatial technologies.

In 2009, the USGS awarded, administered and provided implementation outreach to the Department's bureaus on the third Departmentwide Enterprise License Agreement with Environmental Systems Research Institute. Bureauwide training and technical support will continue to be provided in 2010. Web-based training will be emphasized to reduce travel requirements and to provide efficient training.

Science Quality — The Science Quality activities of the USGS ensure compliance with existing Department and OMB requirements for peer review and information quality; monitor the internal policies practices and procedures for review and approval (i.e., USGS Fundamental Science Practices) related to these efforts; and through the USGS Information Product Data System track the metadata and workflow processes of USGS science information products intended for release. The USGS scientific reputation for excellence, reliability, integrity, and objectivity is one of USGS' most important assets. This reputation brings authority to data and findings, creates and protects long-term credibility, and ensures that the public trust is met.

In 2010, the Science Quality activities will continue to maintain the USGS' scientific reputation, by the coordination, development and revision of USGS policies and procedures related to science quality. In 2009, a permanent Fundamental Science Practices (FSP) intranet Web site is being developed and managed. The USGS continues to manage the public Web site for USGS Peer Review Agenda and Information Quality and the internal Peer Review guidance

intranet site. The USGS is conducting ongoing consultation with the bureau approving officials. The USGS is convening new permanent 14-member FSP Advisory Committee to provide policy and administrative support and is collaborating with discipline Chief Scientists and other bureau management regarding OMB Peer Review Agenda requirements.

Education — The USGS is engaged in a variety of educational activities over a range of instructional levels, in both formal and informal settings. This is accomplished by coordinating student internships, conducting workshops and presentations at national science and science education meetings, coordinating national earth science events, maintaining and expanding the USGS' principal educational web site, and responding to the science education requests of USGS partners in professional science societies. During 2010, in response to a number of legislative initiatives, including American Competitive Initiative and the National Competitiveness Investment Act, the USGS will continue working closely with other Federal science agencies to maintain national science preeminence and workforce requirements in science and technology.

In 2010, the USGS proposes an additional \$2.0 million in the EIR component for the 21st Century Youth Conservation Corps initiative. The requested funds would allow the USGS to expand efforts to reach new groups, build additional relationships with key partners, connect with the next generation of scientists, and expand efforts to assist with scientific and technical training for Tribes. This initiative would increase awareness of USGS as an employer of choice improving the ability to recruit mission critical competencies; increasing creativity and innovation with new talent; preparing for succession, and improving Tribal management of Native American resources. The initiative would improve performance including increasing the number of internships and fellowships supported and/or facilitated by the USGS educational program by 120.

In 2009, the USGS is enhancing and improving its Education Website by providing complete text search functionality to the entire holdings of the bureau's Fact Sheets and General Information Publications. The USGS will fully manage the USGS/National Association of Geoscience Teachers Cooperative Internship Program with placements increasing by 20 percent. The USGS is providing final reports to the Interagency National Science Literacy Initiative, the Incorporated Research Institutes for Seismology External Program Review, and College Board Commission for Redesign of Advanced Placement science courses. Management of and contract development for the USGS' Earth Science Week 2009 efforts will be completed. Continuing enacted practice of recent years, the USGS is organizing and managing an exhibit and workshop presence at the 2009 National Science Teacher's Association Conference.

Performance Overview

The following table highlights important performance measures for the Enterprise Information Resources Subactivity.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
E-Government and Information Technology Management										
<i>Implement Records Management Strategy:</i> % of all bureaus and offices developing consistent records management policy (SP) (EIR)	A	100%	100%	100%	100%	100%	100%	100%	0	100%
% of earth science instructors in the U.S., K-16, using USGS educational materials (EIR)	A	NA	NA	NA	NA	Baseline	K-12 = 32%; Levels 13-16 = 78%	K-12 = 32%; Levels 13-16 = 78%	0	K-12 = 32%; Levels 13-16 = 78%
Comment	In 2008, this measure was baselined to determine the number of earth science instructors in the U.S.									
Total USGS public web content managed by the enterprise web infrastructure (EIR)	A	NA	NA	NA	NA	NA	Baseline	TBD	0	TBD
Comment	In 2009, the USGS is working on a methodology for a baseline for this measure.									
Total # of internships and fellowships supported and/or facilitated by the USGS educational program (EIR)	A	55	55	70	55	55	55	175	+120	175
Comment	Change in 2010 results from the proposed A 21st Century Youth Conservation Corps initiative.									
Efficiency and Other Output Measures										
# of new and legacy information products added to the USGS publications database (EIR)	C	67,500	70,351	71,717	67,500	44,502	67,500	67,500	0	67,500

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Comment	All of the products counted are official USGS publications. The USGS estimates that 67,500 will be added each year through 2010. Per the USGS Survey Manual chapter SM 1100.1, a USGS information product is "the compilation of scientific communication or knowledge such as facts, data, or interpretations in any medium (e.g., print, digital, Web) or form, including textual, numerical, graphical, cartographic, or audiovisual, to be disseminated to a defined audience or customer, scientific or nonscientific, internal or external." Legacy products are those created in the past, and not currently in electronic format. To add these to the database, they must be scanned, converted to a machine-manipulative form, and then entered.									
# of online bibliographic records (EIR)	A	3,872	6,381	4,992	6,381	2,444	6,381	6,381	0	6,381
Comment	The USGS estimates that 6,381 records will be added each year through 2010.									

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Global Change

Activity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Global Change (\$000)	7,383	40,628	+549	+17,000	58,177	+17,549
<i>Total FTE</i>	<i>11</i>	<i>181</i>	<i>0</i>	<i>+38</i>	<i>219</i>	<i>+38</i>

Summary of 2010 Program Changes for the Climate Impacts Initiative

Request Component	(\$000)	FTE
• Climate Change Science	+5,000	+8
• USGS National Climate Change Wildlife Science Center	+5,000	+20
• Carbon Sequestration	+7,000	+10
TOTAL Program Changes	+17,000	+38

Justification of 2010 Program Changes

The 2010 budget request for Global Change is \$58,177,000 and 219 FTE, a net program change of +\$17,000,000 and +38 FTE from the 2009 Enacted level. Program changes associated with the Climate Impacts initiative are described in section C, Key Increases.

The USGS contribution to the U.S. Climate Change Science Program (CCSP) in 2009 is \$45.5 million and \$63.0 million in 2010.

Climate Change Science (+\$5,000,000 / +8 FTE)

Following recommendations provided by Federal, State, academic, and non-governmental (NGO) scientists, managers, and policymakers, USGS will continue to develop a Department of the Interior Climate Impacts Monitoring effort that will provide the science for Department and other Federal, State, and local resource managers and decisionmakers to proactively and effectively adapt to and mitigate the impacts of climate change on managed resources. Through this monitoring effort, USGS will establish a multi-scale national strategy for understanding and monitoring both the changes to ecosystems and natural resources that result from climate change and the efficacy of our responses to these changes. USGS researchers and non-USGS collaborating scientists, programs, and resource managers will have the ability to track environmental indicators linked to climate change causes and impacts. USGS will also make available science applications and related data that will support the development of scenario and forecast-based decision-support tools for Department resource and land managers and State and Federal policymakers (see Applications).

Funding in 2010 will support the enhancements of data integration and information delivery and the continued development of a Collaborative Observation and Research (CORE) area in the Yukon River Basin of Alaska, where dramatic changes in the hydrology of the landscape are

underway because of permafrost thaw. 2010 funding will also support strategic research and development across the full range of USGS capabilities and in partnership with other Federal agencies, with emphasis on coastal vulnerability forecasting, climate variability and abrupt climate change, completion of a multi-year effort to document and analyze land cover trends for the Nation, and efforts to develop decision-support tools to enable resource managers and policymakers to cope with and adapt to a changing climate. Accomplishments in 2010 for the Climate Impacts Monitoring effort also will include the initiation of two climate gradient transects in the mid-continent and eastern regions, as well as the establishment of two national collaborative surveys of forest and soil carbon. Additionally, USGS will further develop and test ecosystem forecasting models that utilize climate monitoring data collected from the Climate Impacts Monitoring effort to predict ecosystem change at scales useful to resource managers for more effective decisionmaking.

USGS National Climate Change and Wildlife Science Center (+\$5,000,000/ +10 FTE)

Building on standardized approaches developed at the national level by the National Climate Change and Wildlife Science Center (NCCWSC) regional Climate Science Hubs will be developed. National coordination of research and modeling at the regional hubs will ensure uniformity of downscaling and forecasting models and standardized information to support management for fish and wildlife managers for regional partnership collaborations including the FWS Landscape Conservation Cooperatives. The NCCWSC will facilitate synthesis of downscaled global climate models from the regional hubs with relevant USGS physical and biological information contributed by the Ecosystem Science Strategy and the Global Change Program and other national science programs for applications to the ecoregional and local needs of Federal, State, Tribal and local partners. The NCCWSC will gather, incorporate and disseminate updated information from the new models, applications and forecasts developed by the regional hubs. Assessment and synthesis of this body of work is essential for regional scenario building in support of coordinated conservation planning among Interior bureaus and other national and regional efforts. The NCCWSC regional Climate Science Hubs will provide direct contact between scientists and fish and wildlife managers to develop and evaluate models and tools for implementation in iterative adaptive management approaches based on sound science. Partner efforts integral to activities and outcomes at the NCCWSC regional hubs include the Fish and Wildlife Service (FWS) Landscape Conservation Cooperatives, Bureau of Land Management (BLM) National Landscape Conservation System, U.S. Forest Service (USFS) Climate Change Resource Center, National Park Service (NPS) Ecosystem Restoration and Endangered Species Programs, Climate Change Impacts on Tribal Trust Species and Resources, National Aeronautic Space Agency (NASA), National Oceanic and Atmospheric Administration (NOAA), and Environmental Protection Agency (EPA) among others.

Carbon Sequestration (+\$7,000,000/ +10 FTE)

An increase of \$7.0 million from the Climate Impacts initiative is provided to USGS to focus on geological and biological carbon sequestration research including starting a national assessment of the geological storage capacity for carbon sequestration and developing a methodology for national assessment of biological carbon sequestration. These activities were authorized in the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140), which calls for comprehensive assessment of geologic and biologic carbon sequestration to enable decisionmakers to evaluate the full range of sequestration options. This \$7.0 million supplements the \$3.0 million received in 2009 for ongoing and increased activities in both geological and biological carbon sequestration.

The 2010 budget request is \$7,000,000, of which \$3,500,000 will go to support the assessment of geological carbon sequestration using the methodology developed with 2008 funding, and an equal amount will go to develop the methodology to assess current and potential biological carbon sequestration.

Funds for the geologic carbon sequestration will be used to (1) begin year-one of a three-year national assessment of the Nation’s resources for geologic sequestration of carbon dioxide (CO₂) in saline formations and oil and gas reservoirs (physical traps); (2) coordinate and manage groups of geologists and computer scientists from USGS, and other Federal and State agencies working with USGS on the national assessment, and (3) conduct research on technical issues and data gaps that impact uncertainties in the ability to assess CO₂ storage resources.

Funds for biologic carbon sequestration will be used to (1) develop a methodology for assessment of the Nation’s resources for biological carbon sequestration; (2) establish mechanisms for consultation concerning biological carbon sequestration resource assessment with Interior resource managers and stakeholders from other Federal and State agencies and from the private sector; and (3) identify technical issues and data gaps that impact uncertainties in the ability to assess biological carbon sequestration.

Program Performance Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4 Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
# of systematic analyses and investigations completed			5	91	106	121	+15	+26
Total actual/ projected cost (\$000)			\$1,250	\$22,750	\$26,500	\$30,250	+\$3,750	+\$6,500
Actual/projected cost per scientific report or other product (whole dollars)			\$250,000	\$250,000	\$250,000	\$250,000	\$250,000	\$250,000
Comments	<p>This measure includes decision support tools delivered to stakeholders. Costs of decision support tool development include baseline research, field testing and customer workshops to determine user needs and delivery requirements. Out-year costs per tool may decrease as knowledge base on customer requirements increases. Cost per unit is an average from the program contributing to the Global Change Activity.</p> <p>This measure combines outputs from several USGS programs into a new budget activity.</p>							
# of workshops or training provided to customers (annual)			1	15	25	30	+5	+8
Total Projected Cost (\$000)			\$25	\$375	\$675	\$750	+\$125	\$200

Global Change

	2006 Actual	2007 Actual	2008 Actual	2009 Plan	2010 Base Budget (2009 Plan + Fixed Costs)	2010 President's Budget	Program Change Accruing in 2010	Program Change Accruing in Out-years
					A	B=A+C	C	D
1.4 Improve the understanding of National Ecosystems and Resources through interdisciplinary assessments								
Projected Cost per Workshop (whole dollars)			\$25,000	\$25,000	\$25,000	\$25,000	+\$25,000	+\$25,000
# of gigabytes collected annually					2.8	2.8	0	+8.4
# of gigabytes managed and distributed cumulatively					22.2	22.2	0	30.6
% of surface area with temporal and spatial research and modeling and assessment/data coverage			60% 3/5	60% 6/10	75% 15/20	83% 25/30	+8	+10
% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements (Global Change) (Number of completed eco-region assessments out of a total of 84 eco-regions).			78% (66/84)	87% (73/84)	100% (84/84)	100% (84/84)	+13%	100% Plan completion 2010
<p>Note: Projected costs may not equal program change as these are full costs, which may include funds from other sources and (or) use averages.</p> <p>Column A: The level of performance and costs expected in 2009 at the 2008 level plus funded fixed costs. Reflects the impact of prior year funding changes, management efficiencies, absorption of prior year fixed costs, and trend impacts, but does not reflect the proposed program change.</p> <p>Column D: Out-year performance beyond 2009 addresses lagging performance — those changes occurring as a result of the program change (not total budget) requested in 2009. It does <u>not</u> include the impact of receiving the program change again in a subsequent out-year.</p>								

Workforce Planning

In 2009, global change activities that were previously funded and managed under several different management units within the bureau were restructured into a single budget activity, both to consolidate the funding and to facilitate the development of a single set of strategic science and management goals and their implementation, a cogent set of global change-specific performance measures that can be reliably measured and related budgetary and communication strategies focused on the goals and objectives of USGS' work within global change. Although 158 FTE were identified in four different science disciplines with this budget restructure, the staff remain in their respective disciplines and no staff were formally transferred.

USGS management spent 2009 in identifying and evaluating the personnel associated with global change activities and their skill mix, and reviewing and revising work plans where necessary and developing an integrative bureau planning model to manage integrative and cross-disciplinary efforts like Global Change. USGS will implement the bureau planning model in 2010.

Performance Improvement

The Global Change activity is comprised of existing USGS programs that underwent an OMB review between 2002 and 2005. The USGS programs that are being reprogrammed to the Global Change activity that were assessed are: Biological Research and Monitoring; Geographic Research, Investigations, and Remote Sensing; and Water Resources Research. Performance Improvement Plans that were proposed and for which implementation occurred prior to 2010 include:

- Focus geographic research in the following high priority areas: Landscape status and trends, causes and consequences of landscape change, vulnerability and risk analysis, and vulnerability and risk reduction,
- Work with the National Academy of Sciences (NAS) to facilitate drafting of the first independent, holistic review of the Water Resources programs, and
- Develop a plan to maximize access to research and data and provide timely reports on the status and trends of the Nation's biological resources.

It is envisioned that the Global Change program will be subjected to a program review in the outyears in its entirety and that permanent performance metrics will be in place by the end of 2009.

Program Overview

Climate change is one of the biggest challenges the world faces and is a top priority for the USGS. Climate change and its impacts on natural resources are a key concern for resource managers in the Department of the Interior and for many of our external partners at State, Federal, and local levels. Work within the USGS Global Change activity will continue on developing the framework for a comprehensive, Climate Impacts Monitoring effort and to adapt scientific findings of the effort into real life applications. In 2010 and beyond, key components of the program include the continued development of a Climate Impacts Monitoring effort; the continuation of NCCWSC; activities in applications, partnerships and decision support; data management; and continuation of the rigorous scientific research that provides the data, new knowledge, inputs to modeling and other outcomes that are required to understand, assess, adapt and mitigate climate change. USGS has aligned the majority of its existing global change work under a single budget activity. The fusion of existing USGS global change research with the integrative elements of the Climate Impacts Monitoring effort and other components funded in 2009 provide a key opportunity to reinforce and build upon existing capabilities and to leverage new ones to help the Nation manage one of its biggest challenges.



Global Change

Global Change supports the Department's goal to improve the understanding of national ecosystems and resources through integrated interdisciplinary assessment. The goal of Global Change is to be the primary provider of scientific information on climate change impacts on Earth and human systems. Understanding of climate change impacts is used to provide perspectives for policymakers and to support land and resource managers.

Global Change projects support the goals of CCSP to (1) improve knowledge of the Earth's past and present climate and environment, including its natural variability; (2) improve quantification of the forces bringing about changes in the Earth's climate and related systems; (3) reduce uncertainty in projections of how the Earth's climate and related systems may change in the future; (4) understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes; and (5) explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change.

Results of scientific activities are communicated to customers in academia, resource management agencies, and the general public through project reports and peer-reviewed scientific papers, Websites, databases, and meetings with stakeholders. Metrics of program success in past years have included the number of reports and publications, number of people accessing Websites, and the frequency of meetings with stakeholders. In past years, outputs for which targets are set relate to the number of gigabytes, number of systematic analyses and investigations, and number of formal workshops or training. These outputs support the intermediate outcome goal of ensuring availability of long-term environmental and natural resource information, data, and systematic analyses needed by land and resource managers for informed decisionmaking.

Global Change Program Areas (\$000)			
	2008 Estimate	2009 Estimate	2010 Request
Climate Impacts Monitoring	2,300	4,000	9,000
NCCWSC	1,500	10,000	15,000
Science Application	583	1,500	1,500
Research & Development	2,000	22,128	22,128
Carbon Sequestration	1,000	3,000	10,000
<i>Biological</i>	-	[1,500]	[5,000]
<i>Geological</i>	[1,000]	[1,500]	[5,000]
Total Global Change Activity	7,383	40,628	58,177

DOI Climate Impacts Monitoring

(Estimates for 2008, \$2.3 million; 2009, \$4.0 million; 2010, \$9.0 million)

In 2008, Congress requested that USGS carry out high priority research efforts. In 2008, Congress requested the establishment of "high priority research" efforts (Climate Impacts Monitoring) to provide the baseline science information and trend detection needed by Federal natural resource agencies to respond to a range of environmental responses to climate change.

The impacts of climate on ecosystems, natural resources, and society are complex, and our cost-effective and successful response to those changes therefore requires information not just about separate component parts of our environment, but of the interactions of those components with each other as well. USGS responded by initiating a multi-scale, interdisciplinary research and observation strategy in high priority areas where the impacts of climate change appear to be most significant. These Collaborative Observation and Research (CORE) areas, and spatially-extensive research and observation survey sites and remote sensing tools are being designed using the Framework for Environmental Monitoring and Research proposed in the mid-1990's by an Office of Science and Technology Policy (OSTP) committee charged with better integrating the Federal environmental research and data collection programs. Using existing programs as a foundation and new resources to fill gaps for a comprehensive climate effects observation and research strategy, this Climate Impacts Monitoring effort will deliver locally-, regionally-, and nationally consistent data and understanding in support of policy and management decisionmaking. The Climate Impacts Monitoring effort, as a sum of the parts that builds on a national system of data management, protocol development, synthesis, and decision support, and leveraging topical assessment program such as the National Climate Change and Wildlife Science Center and the Carbon Sequestration initiative, will allow USGS to answer questions that have eluded individual research and observation programs. Plans for Climate Impacts Monitoring effort will be refined in 2009 and 2010, and the high priority research and observation strategy in Alaska will be strengthened in 2010.

National Climate Change & Wildlife Science Center

(Estimates for 2008, \$1.5 million; 2009 \$10.0 million; 2010, \$15.0 million)

USGS continues its leadership role in the development of the National Climate Change and Wildlife Science Center. The Center supports research, assessment and synthesis of global climate change data for use at regional levels. It is working to adapt and evaluate global climate change models to scales that are appropriate for resource managers of species and habitats; and it will facilitate data integration and outreach to collaborators and stakeholders.

USGS scientists are working to inform Federal management as it adapts to climate change. USGS science helps to design alternative landscapes to reduce vulnerability to climate change. A long history of wetland science is harnessed in evaluating carbon storage options, and trade-offs with ecosystem services and other habitat requirements. Likewise, expertise in ecosystem needs for water, sea ice and other fundamental habitat components is employed in understanding habitat changes related to climate change. USGS research on the impacts of drought conditions on mercury availability to water birds has shown that contaminant exposure is affected by climate.

In 2008, Congress requested establishment of a national center to increase the capacity of Federal natural resource agencies to respond to global warming. In particular, natural resource managers need forecasts of the adaptation of fish and wildlife, and other vital flora and fauna, to climate change. USGS responded by developing NCCWSC. The intent is to support research, assessment and synthesis of global climate change data for use at regional levels; to downscale and evaluate global climate change models to spatial and temporal scales appropriate for adaptive management of species and their habitats; and to facilitate data integration and outreach to collaborators and stakeholders. USGS' ability to provide such forecasts and to develop effective adaptive management strategies is dependent on a thorough understanding of the ecological and population responses of vulnerable species and habitats to climate change.

Inherent in this effort is the ability to link physical climate models and ecological and biological responses at appropriate spatial and temporal scales for better management of species and habitats.

To further the goals of the NCCWSC, the focus in 2008 was on targeted research to assist fish and wildlife managers with species management issues, and to gather partner and stakeholder input into the future priorities and organization of the Center. Regional stakeholder workshops in 2009 focus on development of regional climate science partnerships within existing regional infrastructures to address priorities that are to be determined by scientific and decisionmaking oversight boards. Downscaled models of climate effects on flora and fauna are being developed and tested, and coordinated with applications and validation in local adaptive management plans. In 2010, the focus of the Center will include enhancements and expansion of: national down-scaled climate forecasts for regional evaluations and forecasting; establishment of co-located regional climate science hubs to carry out priority ecological and populations modeling; workshops to further develop regional climate science hubs (with input from the broad community of stakeholders); and development of partnerships to implement adaptive management plans. The latter will inform further prioritization of research, and validation of models, for specific use by fish and wildlife managers.

Science Applications and Decision Support

(Estimates for 2008, \$0.6 million; 2009, \$1.5 million; 2010, \$1.5 million)

USGS is in a unique position in the climate change research and applications community because of its ability to leverage and integrate research results across the Earth-system science disciplines with in-situ data, space-based and airborne observational data, high-end computing capabilities, data and information management systems, and decision-support tool development. In 2010, the Science Applications and Decision Support element of the USGS Global Change program will continue its efforts to develop decision-support tools that enable resource managers and policymakers to cope with and adapt to a changing climate. Decision-support will be developed through new partnerships, enhancement of existing collaborations, and in training the next generation of applications scientists. An example of interagency cooperation and decision support tool development for adapting to climate change was realized through research and applications carried out by NOAA, Bureau of Reclamation (BOR), and USGS researchers and Interior managers (FWS and NPS) within the Columbia River Basin (fisheries and water supply) and in Yellowstone National Park (Grizzly Bear habitat) in 2009.

Global Change Research & Development: Strong Science in Support of Land and Resource Management

(Estimates for 2008, \$2.0 million; 2009, \$22.1 million; 2010, \$22.1 million)

USGS' long and distinguished history in the field of global change science provides the secure foundation that is needed to improve and expand understanding of current climate variability, climate change and its influence on other Earth processes, and their collective impacts on the Nation's resources and economy. The impacts of climate change and variability on natural resources are a growing concern for resource managers in the Department and for many of its external partners at State, Federal, and local levels. In order to continue to meet the science needs of the Department and the larger community in 2010, the Global Change program will continue, strengthen, and integrate the existing USGS portfolio of rigorous research, emphasizing existing, new or expanded work that 1) fosters a multidisciplinary approach to global change science and impacts, 2) aligns with USGS strategic goals, and 3) supports the management and policy decisionmaking needs of the Department and external partners and

customers. For 2009 and beyond, Global Change Research and Development includes the existing projects and FTE from the four science disciplines that have been reprogrammed into the single Global Change budget activity. The key focus for 2009 was the delivery of information and the integration of USGS research with the development of the Climate Impacts Monitoring effort and other components of the Global Change program.

Carbon Sequestration

(Estimates for 2008, \$1.0 million; 2009, \$3.0 million; 2010, \$10.0 million)

Geologic Carbon Sequestration

Geological storage of carbon dioxide in porous and permeable rocks involves injection of CO₂ into a subsurface rock unit and displacement of the fluid that initially occupied the pore space. This principle operates in all types of potential geological storage formations such as oil and gas fields and deep saline aquifers. Because the density of CO₂ is less than formation water, it will be buoyant in pore space filled with water and rise vertically until it is retained beneath a permeability barrier (seal). If the structure of the seal forms a trap with vertical and horizontal closure, CO₂ will accumulate in the same manner that buoyant fluids like crude oil and natural gas accumulate in nature. In addition to identification of adequate pore volume for CO₂ storage, a critical issue for evaluation of storage resources is the integrity and effectiveness of the seal that will retain the CO₂.

In 2009, USGS completed a 12-month project to develop a methodology to assess the geologic resources for CO₂ storage in physical (oil and gas) traps and saline formations. The draft report (Burruss, Brennan, and others, 2009, Development of probabilistic methods for assessment of CO₂ storage resources, USGS Open-file report, 2009, 125 p.) is done and awaiting release. This report was authorized in the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140). It is based on extensive USGS experience with national and international assessments of energy, water, and mineral resources. In 2010, USGS will conduct a number of activities to begin the development of a National Assessment of Geological Storage Capacity for Carbon Dioxide.

Biological Carbon Sequestration

Biological carbon sequestration refers to both natural and deliberate processes by which CO₂ is removed from the atmosphere and stored in vegetation, soils, and sediments. Biological carbon storage is susceptible to disturbances such as fire, disease, and changes in climate and land use. Deliberate biological sequestration can be accomplished through forest and soil conservation practices that enhance the storage of carbon (such as restoring and establishing new forests, wetlands, and grasslands) or reduce CO₂ emissions (such as reducing agricultural tillage and suppressing wildfires). The capacity of ecosystems to sequester additional carbon is uncertain, and the potential future vulnerability of biological carbon storage is difficult to predict. Decisions about biological carbon sequestration require careful consideration of priorities and tradeoffs among multiple resources. Assessment of biological carbon sequestration resources will require quantifying the factors that control potential sequestration, and providing information that can be used in complex resource management decisions and policies.

USGS scientific expertise is broadly interdisciplinary and uniquely qualified to assess the wide range of biological carbon sequestration resources. USGS scientists work at the multiple spatial scales that are necessary to link national assessments to regional and local needs. USGS

historical datasets provide information needed to test and update time-dependent models that are used to estimate potential future carbon sequestration and greenhouse gas fluxes. The extensive land and resource management experience of the Interior provides an essential practical context for applying information about potential rates and capacities of carbon storage in ecosystems.

USGS is leading a Department process to develop a methodology for a National Assessment of Biological Carbon Sequestration Resources. This activity, authorized by the Energy Independence and Security Act of 2007 (EISA), is being initiated in 2009. The assessment methodology is scheduled for completion in 2010.

2010 Program Performance

Climate Impacts Monitoring - Responding to global climate change and its impacts requires an unprecedented integration of information from multiple science disciplines and the full range of temporal and spatial scales. USGS is leading a multi-agency effort to build a Climate Impacts Monitoring effort that will provide more effective and timely science information on climate change and related impacts for resource management and policy decisionmaking. In 2010, the proposed funds will allow for implementation of the Climate Impacts Monitoring effort through four primary components of the system design:

- Strengthen USGS monitoring and research assets within the pilot study in the Yukon River Basin of Alaska that addresses the impacts of accelerated global warming on native communities, energy resources, Federal trust resources, and permafrost thaw leading to increases in global warming itself. This is a key partnership with the State of Alaska, the Canadian government, and other U.S. Federal agencies that will provide enhanced decision support for eight FWS Refuges and three National Parks, and will leverage multiple foundation programs established by Interior, NOAA, NSF, and USDA-FS.
- Initiate two climate transects in order to understand and anticipate potential climate-induced environmental changes occurring over time and across different landscapes. This effort will leverage USGS, NPS Vital Signs, and the NSF National Ecosystem Observing Network data collection and analysis programs.
- Initiate regional Climate Impacts Monitoring effort for tracking critical environmental indicators, including carbon. Currently, the nation has inadequate and incomplete tracking capability of key environmental elements, yet the changes in carbon occurring in the forests and soils from global warming could have a significant effect on ecosystem health and the national economy. This regional monitoring capability will allow us to map ecosystem and resource sensitivity to climate change. This effort leverages both USGS programs and the USDA-NRCS capabilities.
- Develop ecosystem forecasting models that will utilize the data and understanding collected from the Climate Impacts Monitoring effort to predict earth system changes at scales useful to resource managers and policymakers for more effective decisionmaking on a range of climate response issues.
- USGS will also work with the Department and other agencies to provide a detailed plan for a nationwide monitoring effort.

Responses of Wildlife and Vegetation to Climate Change — In 2008, five research projects were implemented to investigate the responses of fish, wildlife, birds and vegetation to climate change: 1) impacts of climate change on bird conservation in arid and semi-arid regions of North America; 2) fate of endangered species in San Francisco Bay tidal marshes in response to sea level rise; 3) impacts of past and future stream temperature and flow changes on

survival of endangered Atlantic salmon populations (<http://pubs.usgs.gov/fs/2008/3044/>); 4) potential influence of climate change on the survival of at-risk native salmonids; and 5) influence of climate change on migration and feedground use by Rocky Mountain ungulate populations and impacts on vegetation. Accomplishments in 2009 include release of the National Climate Change and Wildlife Science Center Summary Workshop Report, with recommendations of over 100 partner and stakeholder groups; three regional stakeholder workshops; establishment of the Southeast Regional Assessment science partnership; and planning of three other regional climate science hubs (in conjunction with Federal, State and university collaborators); coordination of regional research planning in adaptive management with fish, wildlife, conservation, and land management agencies; and a national workshop to finalize recommendations for full implementation of Center activities.

In 2010, the focus of the Center will include:

- Enhancements and expansion of national down-scaled climate forecasts for regional evaluations and forecasting,
- Establishment of co-located regional climate science partnership hubs to carry out priority ecological and populations modeling,
- Workshops to further develop regional climate science research hubs (with input from the broad community of stakeholders), and
- Development of partnerships to implement adaptive management plans.

The latter will inform further prioritization of research and validation of models for specific use by fish and wildlife managers.

Global Change Research & Development — In 2010, research and development will continue across the full range of USGS capabilities and in partnership with other Federal agencies. Particular areas of focus will include:

Coastal Vulnerability Forecasting – In order to help coastal communities and coastal resource managers anticipate and respond to changes in the vulnerability of the coastal zone from persistent processes, extreme events and climate change; USGS will invest in geospatial data, in the development of assessment and forecast modeling tools, and will further cement a partnership with NOAA to develop decision-support tools for changing coastal conditions and vulnerability. This project activity complements the priorities and directions of the USGS Coastal and Marine Geology Program and will be implemented collaboratively with that program. It is anticipated that this project will, with contributions from other USGS programs and in partnership with other Federal agencies, be enhanced over future years leading to improved and more widely available products to assist coastal managers in anticipating and responding to coastal change due to storms, erosion, and sea-level rise.

- The goal of this partnership is to provide decisionmakers in the coastal region with high quality science-based information that enables them to understand, anticipate, and adapt to a changing climate, including sea level rise. USGS and NOAA are ideally suited to lead a U.S. coastal climate activity with their complementary missions to conduct research, monitor, and perform assessments of hazards and resources, and to conserve and manage coastal and marine resources. Through research, observations, and sharing of ongoing agency programs, the two science agencies will address the needs of national, regional, and local coastal decisionmakers for tools and information to

anticipate and adapt to climate change. This new partnership will be based on the following principles:

- Decisionmakers in the coastal region will be active partners as we address their needs for data, tools, and information products;
- The highest quality environmental and social science available will be applied at the spatial and temporal scales required for decisions;
- Standards and protocols will be developed and used to maximize the accessibility and utility of the research, monitoring, assessment and mapping data collected by multiple partners; and
- Tools and information developed for addressing climate change and variability will be provided to decisionmakers with guidance and training that communicates the benefits, costs, and limitations.

Climate Variability and Abrupt Change – In 2009, USGS completed three Synthesis and Assessment Products (SAP) under the auspices of the CCSP. These three assessments led by USGS addressed the topics of Arctic paleoclimate as a way to understand Arctic amplification; abrupt climate change; and thresholds of change in ecosystems. Building upon these assessments and on long-term work conducted in USGS Global Change Research & Development (R&D), activities in 2010 will focus on areas including the following:

- improved understanding of past Earth climates to inform modeling and forecasting of current and future climates in the Arctic, Pacific Coast, Gulf Coast and Atlantic Coastal Margin, including studies of sea-ice history and Earth's history of abrupt climate change,
- improved understanding of landscape and vegetation responses to climate change including responses to aridification, sea level rise, changes in land cover and land use patterns, and temperature and precipitation changes, and
- implications of climate change and variability for future habitats and biological diversity as well as impacts on human communities and resources.

Complete Documentation of Land Cover Trends for the Lower 48 – In 1999, USGS began a comprehensive analysis of trends in land cover across the United States using the entire available satellite record. Satellite images from multiple time slices from 1973 through 2000 are being used together with statistical sampling and field verification to characterize the spatial and temporal characteristics of land cover change across the conterminous United States, and to document the regional driving forces and consequences of change. In 2010 this analysis will be complete for the lower 48 states, providing the foundational data for the first ever national assessment of trends in land cover and the impacts of those trends on land management practices, economic health and sustainability, and social processes. These data and the assessment, when complete, will also provide the basis for improved prediction of future changes in support of local and regional decisionmaking.

Global Change Applications & Decision Support – In 2010, the Science Applications and Decision Support element of the USGS Global Change program will continue its efforts to develop decision-support tools that enable resource managers and policymakers to cope with and adapt to a changing climate. Decision-support will be developed through new partnerships, enhancement of existing collaborations, and in training the next generation of applications scientists.

In the 2009-2010 academic year, USGS is supporting graduate students at MIT through the MIT/USGS Science Impact Collaborative. These students are working on climate change impacts and adaptation studies in Florida's Everglades National Park, along the coast of Maine, and in the southwestern U.S. training the next generation of applications scientists for the nation. Additionally, USGS is transitioning Earth-science research results to the operational missions of partnering agencies through the Science Applications and Decision Support element of the Climate Impacts Monitoring effort.

Carbon Sequestration – In 2010, activities will focus on both the geological and biological sequestration of carbon dioxide.

Geologic Sequestration: A number of activities will be conducted in 2010 in support of the development of a *National Assessment of Geological Storage Capacity for Carbon Dioxide*:

- Convene a National assessment committee of geoscientists from Interior (USGS, BLM, MMS), State geological surveys, DOE, EPA, and private industry to prioritize geological provinces within the U.S. for assessment. The committee will review initial definitions of storage assessment units (SAUs) and provide recommendations on potential revisions of SAU definitions.
- USGS will create assessment teams assigned to the highest priority provinces. Assessment teams will be led by USGS scientists who will have final responsibility for quantitative resource assessments. Teams will consist of USGS, State, and other Federal scientists as needed to complete assessments of individual basins.
- During the first year of the assessment (2010), a key goal will be evaluation of the effectiveness of the assessment methodology described in the USGS Open-file Report. Based on experience with practical application of the methodology, USGS will revise the methods, input parameters and forms, and output formats as needed to improve the effectiveness and efficiency of the numerical methods for estimating storage resources.
- Concurrent with the assessment activities, there will be a research task that will address key technical issues and data gaps that were identified during the development of the assessment methodology. For example, at present there is no quantitative definition of "injectivity," a term used to define the "ease" of injecting CO₂ into a storage formation. We need to develop quantitative estimates of this concept so that it can be incorporated into the numerical methodology. Also, the current methodology could not define the statistical dependencies of the volumes of storage resources in multiple SAUs within individual assessment provinces. These dependencies must be evaluated numerically so that resource estimates for individual SAUs can be aggregated into regional and national estimates of storage resource potential.

The national assessment will be conducted in coordination with a number of organizations, in order to maximize the usefulness of the assessment to a variety of partners and stakeholders. This effort will be coordinated with DOE, especially National Energy Technology Laboratory (NETL) and DOE's regional sequestration partnerships program. Particular emphasis will be placed on collaborative activities with NETL and their partnerships to build on their progress to date in storage assessment and to eliminate duplication of effort. Assessment activities will also be coordinated with EPA, as EPA has jurisdiction over a number of issues related to carbon sequestration including the potential impact on ground water availability and contamination; regulatory issues related to their Underground Injection Control (UIC) program; and input to criteria for evaluation of Environmental Impact Statements for CO₂ sequestration projects. The USGS will also work closely with the other Interior bureaus, such as BLM to evaluate the

potential for geologic sequestration on lands under their responsibility. Interactions with the States will also be an integral part of this effort.

Biological Carbon Sequestration: USGS is leading an Interior process to develop a methodology for a *National Assessment of Biological Carbon Sequestration Resources*. This activity, authorized by the EISA, is being initiated in 2009. In order to complete the assessment methodology in 2010, the following activities will be conducted:

- USGS scientists will meet with natural resource managers and other stakeholders from Interior (BLM, NPS, FWS, BIA, MMS), USDA, DOE, EPA, State agencies, and private industry to identify key questions and concerns about a national assessment of biological carbon sequestration resources. Stakeholder consultations will be an integral part of the process of developing the assessment methodology.
- USGS geospatial data experts will compile and integrate existing spatial datasets and inventories related to current and recent historical ecosystem carbon storage and greenhouse gas fluxes. This activity will utilize existing USGS and Interior land cover and remote sensing applications, such as Land Cover Trends and LANDFIRE, and will build on existing cooperation with USDA, EPA, and others. The resulting integrated geospatial database will be used to estimate current and recent historical ecosystem carbon storage and greenhouse gas fluxes.
- USGS scientists will compile spatially explicit scenarios for potential future climate change, land-use change, and economic trends that might affect management decisions and policies relevant to carbon sequestration and greenhouse gas fluxes. The timescale of these scenarios will be limited by the timescale of available projections, typically on the order of a few decades. Uncertainties will be estimated to the extent possible based on quantitative analysis and expert judgment.
- Teams of USGS and Interior experts, working in cooperation with stakeholders and other experts, will develop methods for assessment of carbon sequestration and greenhouse gas fluxes in specific ecosystems and regions. These methods will be consistent with current and recent historical trends, and will quantify uncertainties including the risk of rapid carbon loss via processes such as wildfire, permafrost melt, and loss of estuarine sediments that may be exacerbated by climate change. Specific methods will be reviewed by a national team of experts and stakeholders to assure that they will support a consistent and comprehensive national assessment methodology.
- USGS scientists, using expertise in working with geospatial data, remote sensing applications, and ecosystem modeling, have developed a data/model system to describe storage and fluxes of carbon in relationship to climate change and land use for broad-scale landscapes. This system will be deployed in prototype applications using the scenarios and assessment methods described above. The system is potentially capable of providing a framework for national assessment of biological carbon storage and greenhouse gas fluxes. Initial work will include the validation of prototype local to regional simulations for scientific quality and for usefulness in carbon management.
- Concurrent with the development of the assessment methodology, there will be a research task to identify key technical issues and data gaps. This activity will draw on lessons learned from all of the above activities. Ongoing research is an essential component of USGS resource assessments.

The USGS will work with partners to identify areas and ecosystems most promising for managed sequestration or most at risk for rapid loss of carbon. These areas and ecosystems will have highest priority for initial implementation of the national assessment. During the first

stages of the assessment, particular emphasis will be placed on evaluating the effectiveness of the biological sequestration assessment methodology.

Program Performance Overview

The Global Change activity supports the Department’s goal of improving the understanding of national ecosystems and resources through integrated interdisciplinary assessment. To measure progress in achieving the intermediate outcome goal of ensuring the quality and relevance of science information and data to support decisionmaking, USGS tracks the following Performance Improvement measures: number of gigabytes collected annually, number of gigabytes managed and distributed cumulatively, number of systematic analyses and investigations completed, and number of formal workshops or training provided to customers.

End Outcome Goal 1.4: Improve the understanding of National Ecosystems and Resources through Integrated Interdisciplinary assessment.

End Outcome Measure / Intermediate Measure /	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Ensure availability of long-term environment and natural resource information, data and systematic analyses needed by land and resource managers for informed decisionmaking										
% of surface area with temporal and spatial research and modeling and assessment/data coverage	C	UNK	UNK	UNK	UNK	60% 3/5	60% 6/10	83% 25/30	+23%	+10
% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements (Number of completed eco-region assessments out of a total of 84 eco-regions).	C	37%	48%	61% (51/84)	69% (58/84)	71% (60/84)	86% (72/84)	100% (84/84)	+14%	n/a
Efficiency and Other Output Measures										
# of gigabytes collected annually (Global Change)	C	2.8	2.8	2.8	2.8	2.8	2.8	2.8	0	2.8
# of gigabytes managed and distributed cumulatively (Global Change)	C	11	13.8	16.6	19.4	19.4	22.2	25	+2.8	30.6
# of systematic analyses & investigations completed (Global Change)	A	UNK	UNK	UNK	UNK	7	91	121	+30	102
# of formal workshops or training provided to customers (Global Change)	A	UNK	UNK	UNK	UNK	3	15	30	+15	19

Science Support

Activity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Science Support (\$000)	67,167	67,430	+1,795	0	69,225	+1,795
Total FTE	382	382	0	0	382	0

The 2010 budget request for the Science Support Activity is \$69,225,000 and 382 FTE. There are no program changes requested for Science Support in 2010.

Program Overview

Science Support funds the executive and managerial direction of the USGS, as well as bureau sustaining support services. Science Support has four components: leadership activities, the Office of Administrative Policy and Services, the Office of Human Capital, and bureauwide costs.

Key indications of USGS performance are reflected in its goals for increasing accountability, and advancing modernization and integration.

For details on changes to performance measures, see the table at the end of this section.

Leadership Activities

The Director serves as Chief Executive of the USGS with ultimate authority for all strategy, policy, and program decisions. This includes direct involvement in program, budget, finance, and communications development. The Deputy Director serves as Chief Operating Officer supporting the Director in implementing policy decisions, with a focus on operational issues.

The Executive Leadership Team is composed of fifteen senior policy-level leaders of the USGS including the Director and Deputy Director. It identifies issues of interest and concern to the USGS enterprise and functions as a senior advisory body to the Director and as the principal mechanism for building an interdisciplinary culture.

Associate Directors have oversight of national programs, establish program direction and goals, and serve as science advisors to the Director in their respective program areas. Regional Directors are responsible for implementing USGS goals while meeting regional science and operational needs. The USGS uses regional science programs and integrated science centers as tools to effectively coordinate program activities in addressing regional and multi-disciplinary science issues.

The Office of Budget and Performance (OBP) reports to the Director and provides bureau-level advice and staff assistance to the Director and executive leadership. This advice includes bureauwide policy, guidance, and direction for:

Science Support

- Budget formulation, execution, presentation, and advocacy with the Department of the Interior, Office of Management and Budget, and Congressional Appropriations Committees; and,
- Strategic planning and performance management.

Split into two teams, the Budget Formulation and Execution (BF&E) Team and the Planning Performance Management (PPM) Team, the OBP integrates budget and performance to help the USGS perform at a high standard. The BF&E Team provides guidance to senior managers in formulating annual budget requests, integrates budget and performance metrics, and communicates proposals to the Department, OMB, and the Congress. The PPM Team develops awareness and understanding and recommends strategy to ensure USGS compliance with Executive and Legislative Branch mandates for budget and performance integration and program performance accountability to preserve the public trust.

The Office of Communications (OC) reports to the Director and communicates information about USGS research, programs, activities and products, and liaison and close coordination between USGS and the Congress, the Department, and other bureaus for congressional and public affairs matters.

The OC provides the bureau with proactive, targeted communication guidance and support to keep all audiences, from USGS employees to the White House, informed about USGS activities, programs, and research.

Office of Administrative Policy and Services (APS)

APS provides bureau-level policy, program direction, and leadership for science support. These support services include accounting and fiscal management; general services and office support; security; safety, environmental protection, and occupational health; contract negotiation and administration; grant administration; technology transfer, facilities and property management; and business information systems management. The Associate Director for APS also serves as the USGS Chief Financial Officer.

Office of Accounting and Financial Management (OAFM) — OAFM consists of the branches of Accounting Operations, Systems Coordination and Fiscal Services. The Accounting Operations Branch provides bureauwide financial management and administrative support for payments, collections, and travel. The Systems Coordination Branch provides technical support, training and management control for the users of the Federal Financial System. The Branch of Fiscal Services provides bureau oversight and monitoring of fiscal programs, financial operating procedures, and allocation management in coordination with the Regional Fiscal Services staffs. Together they provide advice, formulation, and direction of bureauwide accounting and financial management designed to meet the needs of management in achieving overall program objectives and to ensure full compliance with applicable laws and regulations.

Office of Management Services (OMS) — OMS is responsible for providing staff advice, direction, and guidance in the areas of space and facilities management, security, property management, safety and industrial health, environmental and emergency management, supply management, and other administrative services programs. This office formulates policies and procedures within these areas to be implemented on a bureauwide basis, and provides general staff advice and assistance

to the Associate Director, APS. The Chief, OMS serves as the program coordinator for the Facilities budget activity.

Office of Policy and Analysis (OPA) — The Office of Policy and Analysis is responsible for management of the USGS's directives system including the Survey Manual, Handbooks, and Instructional Memoranda. The Office manages the USGS's Technology Transfer Program, including the preparation, review, and approval of Cooperative Research and Development Agreements and Technology Assistance Agreements; evaluation of USGS inventions for patentability and commerciality and preparation of patent applications and non-disclosure agreements; and execution of non-exclusive, exclusive, and partially exclusive licenses to companies interested in marketing, manufacturing, or using USGS developed technology. OPA also reviews non-standard cooperative and reimbursable agreements for compliance with statutory and regulatory requirements.

Office Acquisition and Grants (OAG) — OAG has primary responsibility for the effectiveness and integrity of the USGS acquisition and financial assistance functions as well as management of the operational acquisition and financial assistance support to Headquarters and national programs. Included among its responsibilities are the following: promulgation of acquisition and financial assistance related directives, including relevant Survey Manual Chapters and internal policy development; appointment of Contracting Officers and Contracting Officers Representatives; performance measurement and evaluation of the bureau acquisition and financial assistance functions; advancement, management and reporting on the Business Economic Develop Program, including socio-economic goals; management of the bureau Charge Card Program, including administration of the purchase business line; and management and operational support of the acquisition and financial assistance automated systems, including the Interior Department Electronic Acquisition System.

Office of Internal Controls and Reporting (OICR) — The OICR is responsible for evaluating the adequacy of the internal control environment within the USGS, including the effectiveness of existing policies and procedures and operational activities, in addition to performing internal and external financial reporting for the bureau. OICR develops procedures to ensure USGS compliance with OMB Circular A-123, and provides assistance in evaluating internal practices and policy changes on topics relevant to all USGS operations. OICR is also responsible for maintaining the integrity of the general ledger of the USGS, developing reports using cost accounting models, reporting to Treasury and OMB, and in producing the USGS contribution to the Department's Performance and Accountability Report (PAR). OICR works closely with OBP-PPM in implementing A-123 and producing the PAR.

Office of Business Information Systems (OBIS) — OBIS administers a comprehensive program in support of the Department and the USGS corporate information technology, information management and information resource management activities and requirements for administrative policy and services. Support is provided in the areas of centralized and distributed computing, FISMA related application security testing and evaluations, value added applications, as well as leadership, technical direction, coordination and policy support to the Office of the Director, APS, and other USGS programs as needed.

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Office of Human Capital (OHC)

OHC provides bureau-level leadership, program direction, and staff support for human capital programs, including equal employment opportunity, diversity and affirmative employment programs, personnel management policy and operations; employee development, competency management and technical, managerial and leadership training and development.

Bureauwide Costs

Bureau sustaining costs are budgeted centrally. The budget for these costs is formulated annually based on past actual expenses and an estimate of future need. Certain essential program support costs are relatively uncontrollable by the USGS and, because of the nature of organization and billing arrangements, are more effectively and efficiently managed centrally (e.g., payments to the Department for services provided through the Departmental Working Capital Fund for department-wide centralized services, payments to the Department's National Business Center (NBC) for administrative systems and automated data processing services provided through the NBC Working Capital Fund). Other bureau-level costs include payments to the Department of Labor for unemployment compensation and on-going injury compensation. The Science Support Activity also manages a partnership with other Interior bureaus and offices to provide shuttle service to and from the Main Interior Building and the Reston, Virginia area.

Workforce Planning

In 2009, the USGS continued to conduct workforce analyses and submitted a number of requests for Voluntary Early Retirement Authority/Voluntary Separation Incentive Payments (VSIP/VERA). In 2010, the USGS will continue its workforce planning efforts to assess the impacts of VERA/VSIP and other workforce strategies that will shift the numbers and balance of USGS employees and skills. These efforts will include the pursuit of additional authorities for VERA/VSIP from OPM and OMB.

Performance Improvement

Performance improvement incorporates tasks such as internal program reviews, performance improvement plans, GPRA, and ABC/M. The OBP is the main office within Science Support that focuses on USGS performance improvement. Part of the Director's Office, the OBP aligns USGS issues, strategies, and funding with the strategic planning, priorities, and policy of the Administration, Interior, and Congress. The OBP leads the USGS to secure the fiscal resources needed to provide scientific information for informed decision making and oversees accountability for these resources and program performance.

The OBP integrates budget and performance to help the USGS perform at a high standard. The BF&E Team integrates budget and performance metrics. The PPM Team develops awareness and understanding and recommends strategy to ensure USGS compliance with Executive and Legislative Branch mandates for budget and performance integration and program performance accountability to preserve the public trust. PPM works closely with the office of Internal Controls in the APS providing oversight for A-123 and the USGS contribution to the Departmental PAR.

2010 Program Performance

USGS activities in executive leadership and management and bureauwide support services are tracked through efforts such as Performance and Accountability Reporting (PAR). Highlights of USGS efforts in 2008, 2009 and 2010 on these initiatives and other bureau-level policy, program direction, and leadership activities of USGS follow:

Financial Management — The USGS created exception reports that identify the problem areas that management needs to focus on. These financial management tools give front line, cost center, regional, and headquarters managers the ability to quickly and accurately track and forecast the financial status of individual projects, cost centers, and the programs. This information has proven to be essential in conducting quarterly project and annual cost center management reviews. The USGS received an unqualified opinion on the USGS's Fiscal Year 2008 Annual Financial Report. The independent auditors identified four significant deficiencies; one deemed a material weakness related to budgetary controls associated with unfilled customer orders (reimbursable agreements). This material weakness has been completely remediated in 2009. Effective with the audit cycle for 2009, the USGS was included in the Department's consolidated audit process and thus did not receive a bureau-level independent auditor's report and did not produce a bureau PAR. In 2010, the USGS will continue to focus on improving financial management activities.

Real Property — Improving policy and guidance and updating planning is significant for providing the management processes, tools, concepts, and context for improving asset management and setting the foundation to realize results. To achieve this outcome, in 2009, the USGS updated the USGS's Asset Management Plan to align it with the regional and science center Site Specific Asset Business Plans that were updated in 2008. To assist managers in making informed investment decisions, the USGS has established targets for improving our asset management performance and will incorporate these into the USGS's Asset Management Plan in 2010. A key performance measure will be reducing unneeded assets.

Transportation Management — In 2010, the USGS will continue to work towards meeting its transportation management goals. Information obtained from the 2008 Fleet Inventory and Utilization Data Validation effort will be analyzed to form recommendations to Cost Center Managers optimizing the placement of vehicles to increase vehicle sharing and the use of alternative fuels. The USGS will work to implement the long term goals of the Fleet Management Strategic Plan. A Fleet Acquisition and Replacement Plan will be implemented in 2009 as a strategy for acquiring higher fuel economy vehicles and eliminating growth in the USGS Fleet. A Fleet Acquisition and Replacement Plan was implemented in 2009 and will be expanded in 2010 as a strategy for acquiring higher fuel economy vehicles and eliminating growth in the USGS Fleet.

Woods Hole Science Center Receives Energy Award - In 2008, the USGS Woods Hole Science Center won a Department of Energy Federal Energy and Water Management Award in the Sustainable Design/High Performance Buildings Category. The 4,400 square foot laboratory addition was designed and constructed using sustainable design principles and technologies. The design aspects include using: a vegetated roof system; native landscaping; installing a rain garden; using low emitting and non-toxic materials; natural ventilation; and natural lighting.

Energy Efficiency — In 2010, the USGS will continue to work to achieve the goals of the Energy Independence and Security Act of 2007. The USGS will sustain the current reduction of 27 percent in energy intensity at all facilities compared with the 2003 baseline. This reduction exceeds the target established in 2003. To the extent practical and technically feasible, the USGS will seek to obtain a minimum of 3

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percent of our electricity from renewable sources, with 1.5 percent from new renewable sources. The USGS continues an annual review of the metering implementation plan. To ensure that metering is installed at all facilities where it is feasible, the USGS will continue to update the plan in 2010.

Environmental Management — In 2010, the USGS will continue work related to goals established in 2003 using the Environmental Management System. The USGS will implement mission-focused environmental management systems at appropriate organizational levels by the end of 2009 and use these tools to become fully implemented by the end of 2011. The USGS will systematically manage environmental risks while minimizing cost, improve performance and enhance cooperation with our many stakeholders, partners and the public. Best business practices will be shared across the Department.

Safety and Health — The Occupational Safety and Health Act of 1970 requires establishment of a safety and health program to reduce work related personnel injuries, illnesses and associated lost production, wages, medical expenses and disability compensation payments. Within the USGS national program administration for this function is housed in the OMS with staff providing regional and facility based policy development, program assessment, compliance inspections, industrial hygiene guidance, training and educational services.

USGS Safety and Health Achievements

Safety and health efforts contribute to the USGS sustaining below average accident rates compared to other Federal and Interior rates while achieving above average ratings from our internal customers. Expectations are these positive trends will continue in 2010 and beyond.

In 2009, the USGS adopted an integrated Department/USGS Safety and Health Strategic Plan. In 2010, the USGS will continue to implement and measure performance in achieving this strategic plan's objectives and goals. These efforts will include on-line enhancements to the USGS Inspection and Abatement System enabling management to identify organizational safety and health performance linked to Department metrics and the Five-Year Deferred Maintenance and Capital Improvement Plan. Additional initiatives include conducting regional internal control reviews in accordance with the OMB Circular A-123, continued improvement of on-line training through DOI Learn training module updates, and initial implementation of standardized exposure monitoring and medical surveillance procedures within the USGS.

Technology Transfer — The Federal Technology Transfer Act, 15 USC 3710 as amended, requires each Federal laboratory having 200 or more full-time scientific, engineering and related technical positions to establish a research and technology application function. Within USGS this function is housed in the OPA where two FTEs service USGS Science Centers and offices throughout the country.

In 2010, the USGS will continue their duties negotiating and drafting Cooperative Research and Development Agreements (CRADAs), Technical Assistance Agreements (TAAs), Facility Use Agreements, Material Transfer Agreements, and Patent Licenses. This office also manages the USGS intellectual property and inventions program; markets USGS technology opportunities and assistance to industry, non-profits, academic institutions, and State agencies; and provides training to USGS personnel on technology transfer and intellectual property protection. At the end of 2008, the USGS had a total of 51 current patents. During 2008, the U.S. Patent and Trademark Office accepted filings for 5 new USGS patent applications and issued 1 patent to USGS. The table below summarizes the number of projects in 2008. The 94 technology

agreements concluded in 2008 represents an 11 percent increase over the number of agreements concluded in 2007, and an increase of over 84 percent in partner contributions.

Technology Transfer 2008	Total Number	Private/ Small Businesses	Non-Profits/ Academic Institutions	Gov't/ International Entities	Partner Contributions (\$000)	USGS In-Kind Contribution (\$000)
CRADAS	12	9/1	0/1	0/1	\$3,157	\$ 75
Other Technology Agreements	82	24/11	16/15	8/8	\$4,840	\$ 321
Patent Licenses	17	0 / 14	0/3	0/0	\$ 65	\$ 0

USGS science and research contributes to a broad range of valuable collaborative projects in the private and academic sector. With the expansion of its facility use program, the USGS has increased to 12 the number of specialty analytical laboratory services providing unique capabilities to U.S., foreign partners and academia.

Financial and Business Management System (FBMS) — Having begun implementation activities in the spring of 2009, the USGS will deploy the FBMS effective with 2011 business. As the cornerstone to the Department’s future financial and business management, the FBMS functionality spans budgeting, project management, acquisitions, financial assistance, core finance, real and personal property and reporting including activity based-costing. Deployment of the FBMS will support and foster Department-wide common business practices. In 2009, the USGS is blueprinting functions and will continue implementation in 2010.

Human Capital — In 2010, the OHC will continue to focus on Workforce Planning and Succession Planning.

The USGS uses a systematic workforce planning approach as the foundation for the development of more detailed workforce plans at the science center and office level. We will continue to work with managers in offices, science centers, and regions to conduct workforce analysis and planning. Additionally, the USGS will implement a succession planning strategy to complement the workforce planning model to take a more holistic, strategic approach to human capital management and planning.

In 2009, the USGS finished developing standardized queries, published them on the USGS Intranet, along with summary workforce data and Department data, each spanning 10 years. These data allow managers to use standard queries to pull data at their organizational level and conduct workforce planning analyses. Additionally, a set of standardized definitions and formulas were developed to create a glossary of terms, metrics and measures.

In 2009, the OHC began working with managers to identify procedures that incorporate workforce planning into an integrated program review process, which will continue in 2010. A strategy will be developed that incorporates structured decision-making into the business practices at the science center and regional levels and allows for adaptive management to occur. This is not a single occurring event; it is a continuous process.

In 2009, the OHC completed an analysis of the annual Federal Human Capital Survey and developed strategies to address the findings and take actions that benefit our science and our employees and that advance the mission of both the USGS and the Department.

Leadership Development — The USGS will continue to develop leadership skills and behaviors at all levels of the organization in 2009 and 2010. A survey was conducted in early 2009 to determine areas for improvement in the leadership development nomination process, to focus attention on increasing diversity, and to improve the USGS's internal leadership development training program. During 2009 and 2010, the USGS will continue its longitudinal evaluation of the program. In 2010, the program will expand to include a fresh new cadre of leadership instructors, comprised of USGS leadership 101 and 201 graduates. Participation by graduates becomes their USGS 301 learning experience. In addition to internal training focused on leadership skills, the USGS is expanding its internal supervisory development program. This program is shepherded by a Human Capital Joint Planning Team in partnership with a Supervisory Development Review Team (SDRT). The SDRT is comprised of exemplary managers and supervisors from across the USGS who truth-test ideas and provide field input. In 2009, the supervisory development program implemented the use of online SkillSoft courses, pre-work for the basic supervisory training class, an updated/revised standardized curriculum (to include critical transitions), and ongoing monthly webinars to augment and support supervisory performance. In 2010, a supervisory mentoring component will be implemented.

Competency Management — In 2009, the USGS worked with the Department to develop methodology for conducting competency studies that build models and inform decision-making within human resource systems. The USGS will continue placing major emphasis on ensuring that the USGS is using competencies in the management of human capital operations in 2010.

- **Mission Critical Competency Management** — The USGS will continue to work with the Department toward developing and implementing competency models for mission critical occupations through 2010. In addition, the USGS will work with the Department to refine information reporting capabilities, link identified skill needs to course listings, and other developmental opportunities, and help managers use this information to strategically plan for the use of training and development dollars for high priority skill development needs through the use of a learning management system.
- **Core Competencies for Managers** — The USGS will use the Core Competencies for Managers Model to develop structured interview questions and input to the online USA JOBS for hiring into supervisory and managerial positions, use assessment of supervisory and managerial competencies to set priorities for supervisory and managerial training and development to increase supervisory and managerial performance at all levels. In 2010, the USGS will continue to implement core competencies for managers and supervisors, placing additional emphasis on the performance management and partnership and collaboration skills.
- **Partnership and Collaboration Competencies** — The USGS supported performance in partnership and collaboration competencies by providing a workshop on collaboration and partnering for business and science leaders and by developing and supporting a community of practice on partnering and collaboration to provide on-going support for development of these critical competencies. In 2010, the USGS will continue to build on these competencies by incorporating the topic into future training courses. In addition, the USGS will be focusing on partnership and collaboration competencies for the Department's Mission Critical Occupations of hydrologists and geologists. The Human Capital Office will be identifying the

competencies, conducting a gap analysis, developing and implementing a plan to close the gaps, and measuring the results.

- **Tools for Managers** — During 2010, the USGS will continue to support managers in the use of on-line tools provided through the Department's learning management system to assess skills and workforce competencies; to develop succession strategies, to prioritize and deliver training, and development; and to develop technology enabled learning to meet high priority dispersed training needs.

Workforce Diversity — Improving workforce diversity is a priority for the USGS and a significant workforce planning issue. The USGS continues to implement strategies to comply with the requirements of the Equal Employment Opportunity Commission's (EEOC) Management Directive (MD)-715, particularly with regard to the identification of barriers that prevent the accomplishment of diversity and affirmative employment goals. In 2008, the USGS MD-715 self-assessment identified that three of the five deficiencies from the previous year were corrected, resulting in a 60 percent improvement. The USGS now has two identified deficiencies, which is a marked improvement from the 22 deficiencies identified in 2004, the first year of the MD-715 report. During 2009 and 2010, the USGS will continue to implement strategies to comply with the requirements of MD-715. The USGS Office of Equal Opportunity will continue posting workforce demographic information that assists Human Resource (HR) and line managers with identifying trends and recruitment opportunities. The USGS will use the USGS Diversity Council to help identify barriers to diversity and recommend solutions to management. The USGS will direct its recruitment efforts to provide additional fiscal resources to establish relationships with local colleges and universities with majors in the USGS programs and with high enrollments of minority students. The USGS will continue implementing the Department's Workforce Diversity Plan and focus on goals measured by outcomes in recruitment, retention, zero tolerance and accountability.

Science Support

Program Performance Overview

The Science Support Activity promotes the orderly and efficient conduct of USGS programs through organizational leadership, shared administrative support services, and promotion of common business practices. Key indications of USGS performance are reflected in the end outcome goals for increasing accountability, and advancing modernization/integration. To measure progress in achieving the intermediate outcome goals of improving financial management, human capital management, organizational reviews and acquisition, the USGS tracks intermediate measures such as obtain unqualified audit, percent of material weaknesses and material non-compliance issues that are corrected on schedule, number of MD-715 identified deficiencies that have been corrected, and the number of employees trained in collaboration and partnering competencies.

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Measures										
Obtain unqualified audit (SP)	A	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	--	Unqualified Opinion
Establish and maintain an effective, risk-based internal control environment as defined by the Federal Manager's Financial Integrity Act (FMFIA) and revised OMB Circular A-123 (SP)	A	100%	100%	100%	100%	100%	100%	100%	0	100%
Intermediate Outcome Measures and Bureau and Outcome Measures										
Improved Financial Management										
Corrective actions: Percent of material weaknesses, and material non-compliance issues that are corrected on schedule (SP)	A	UNK	UNK	UNK	UNK	UNK	100%	100%	0	100%
Corrective Actions: Percent of established targets in Financial Performance Metrics met as defined in FAM No. 2003-015. (SP)	A	100%	100%	100%	100%	100%	100%	100%	0	100%

Activity Summary

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Human Capital Management										
<i>Worker Competency:</i> % of employees who have resolved competency gaps in specified occupational groups identified as critical occupations in the Department (SP)	C	65%	77%	77%	79%	75%	75%	76%	+1%	79%
Comment	The results of the 2008 Federal Human Capital Survey indicated that USGS employees have the right skills and abilities to accomplish the mission of the organization.									
<i>Diversity:</i> The % of managers who have completed the 4-hour required minimum annual diversity/EEO training USGS EEO Office	A	UNK	UNK	39.2%	30%	78%	30%	85%	+5%	95%
Comment	In 2008, 78 percent of USGS managers completed EEO/Diversity training. The 78 percent actual far exceeded the goal of 30 percent set for 2008. Given the marked improvement and the fact that this year the USGS is making more EEO/Diversity training available to managers, the USGS has raised its 2009 target to 80 percent (the 2009 Plan, prepared in September 2008, was 30 percent). Based on this, the USGS expects to continue improving in this area through 2013.									
<i>Diversity:</i> The # of MD-715 identified deficiencies that have been corrected	A	UNK	UNK	3	3	3	1	1	0	1
<i>Collaboration Capacity:</i> # of volunteer hours per year supporting DOI mission activities (SP)	A	UNK	UNK	138,761	200,000	143,792	144,000	Rebaseline	--	Rebaseline
Comment	The USGS is currently rebaselining this measure based on new reporting capabilities being put in place.									
<i>Cooperative Conservation Internal Capacity:</i> # of employees trained in collaboration and partnering competencies	C	UNK	UNK	150 FTE	4,339 FTE	4,106 FTE	* 4,500 FTE	4,000 FTE	-500	4,500
Comment	* The USGS target assumed employees viewing the Department's "Together We Can" video and recording their training in DOI LEARN. For USGS, DOILEARN recorded only 5 employees viewing the video due to a number of hosting and DOILEARN interface issues. The number that actually viewed the video in various venues could be greater, but we have no proof in the required system (DOI LEARN).									

Science Support

End Outcome Measure / Intermediate or PART Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
<i>Cooperative Conservation Internal Capacity: % of organizations that have trained and developed employees in collaboration and partnering competencies (SP)</i>	C	UNK	UNK	41%	50%	46%	* 60%	60%	0%	53%
<i>Cooperative Conservation External Capacity: # of conservation projects that actively involve the use of knowledge and skills of people in the area, and local resources in priority setting, planning, and implementation processes (SP)</i>	A	UNK	UNK	90	92	91	92	96	+4	100
Intermediate Outcome Measures and Bureau and Outcome Measures Organizational Reviews and Acquisitions										
<i>Increase Competition: Percentage of eligible service contract actions over \$25,000 awarded as performance-based acquisitions (SP)</i>	A	48%	25%	50%	50%	57.1%	50%	50%	0	50%
Intermediate Outcome Measures and Bureau and Outcome Measures Performance-Budget Information										
% of programs with demonstrated use of performance measures in budget justifications and decisions (SP)	A	UNK	UNK	100%	100%	100%	100%	100%	0	100%
% of programs that can estimate marginal cost of changing of performance (SP)	A	UNK	UNK	100%	100%	100%	100%	100%	0	100%

Facilities

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Rental Payments and Operations and Maintenance (\$000)	0	94,802	+4,274	0	99,076	+4,274
<i>FTE</i>	0	51	0	0	51	0
Rental Payments (\$000)	72,479	0	0	0	0	0
<i>FTE</i>	0	0	0	0	0	0
Operations and Maintenance (\$000)	19,592	0	0	0	0	0
<i>FTE</i>	51	-51	0	0	0	0
Deferred Maintenance Capital Improvements (\$000)	7,898	7,321	0	0	7,321	0
<i>FTE</i>	0	0	0	0	0	0
Maintaining America's Heritage ^{al} (\$000)	[37,455]	[30,989]	0	0	[31,097]	[+108]
<i>FTE</i>	0	0	0	0	0	0
Total Requirements (\$000)	99,969	102,123	+4,274	0	106,397	+4,274
Total FTE	51	51	0	0	51	0

^{al} Maintaining America's Heritage – The 2010 numbers included in Maintaining America's Heritage are: \$7,321 for Deferred Maintenance and Capital Improvements, including Facilities, Equipment, Maintenance Management System, Condition Assessment, and Project Planning; \$4,000 is the estimated amount spent from program dollars for facilities equipment maintenance needed for Hazards Networks, Cableways, Wells and Streamgages; and \$19,776 for Operations and Maintenance.

Activity Summary

The 2010 budget request for the Facilities Activity is \$106,397,000 and 51 FTE. There are no program changes requested from the 2009 Enacted level.

The Department of the Interior defines a facility as a separate and individual building, structure or other constructed real property improvement. The USGS further defines facilities to include all locations where USGS resources are housed in the performance of mission related work, including office space, laboratory space, warehouse space, and related parking and common space, and large research vessels. The USGS has classified large (greater than 45 feet in length) research vessels as facilities and an installation is an operational unit comprised of one or more facilities and the associated land.

Funds for this activity provide safe, functional workspace and facilities for accomplishing the Bureau's scientific mission. The appropriated funds included in this activity cover approximately 73 percent of recurring USGS facilities costs. Customers, through reimbursable funding provide approximately 25 percent, and USGS science programs provide the remaining 2 percent.

This activity supports the Department's goal of facilities improvement tracking outcomes such as; overall condition of building and structures; percent change in the operating costs per square foot of buildings that are "not-mission dependent" as reported in Federal Real Property Profile (FRPP) in the current fiscal year compared to the previous fiscal year; percent change in the total number of buildings reported as "under utilized" or "not utilized" in the Federal Real Property Profile, and the percent of assets targeted for disposal that were disposed. This activity also tracks outputs including "number of bureau condition assessments completed" (within a 5-year cycle), and "number of deferred maintenance and capital improvements."

Use of Cost and Performance Information

In 2009, USGS completed its fourth update to the Bureau Asset Management Plan (AMP) based on feedback from the Department's AMP Review and in accordance with the Department's AMP. The AMP articulates the Bureau's strategy and plan for improving the management and condition of the Bureau's asset inventory. The AMP also describes the Bureau's strategy and process for managing the total cost of asset ownership and serves as a framework to guide asset investment decisions, including operations, preventive maintenance, component renewal, repair and construction. The document reflects the information gathered through the Site Specific Asset Business Plans (ABPs) completed at the science centers and the regional levels. Through analysis of the ABPs the AMP reflects the current condition of the real property portfolio and the direction USGS is taking to improve performance metrics associated with those assets.

The bureau updated the Site Specific ABPs in 2008. The ABPs are a 5 to 10 year strategic plan addressing facility needs at a science center, campus, or region. The ABPs were completed by the cost center managers who have a greater understanding of the current and future needs of their science center. This new version of the ABPs includes greater detail on such topics as operations and maintenance, project planning, asset prioritization, and deferred maintenance. The new format provides a more in-depth 5 and 10 year strategic focus on projected changes in staffing, funding and mission that will impact the facilities.

The goal for the facilities program is to meet Bureau science needs while optimizing facilities location, distribution, and use to control or reduce costs. Objectives for meeting this goal include:

- Coordinate facility planning with science planning to provide safe, high-quality workspace aligned with science needs,
- Development of Asset Business Plans to meet assessment management goals, continue annual surveys and cyclic condition assessments,
- Meet performance targets by improving space utilization, controlling rent and operating costs, and releasing unneeded space,
- Reduce deferred maintenance by renovating and constructing buildings and other facilities to replace assets that are otherwise no longer cost-effective to operate,
- Establish an effective maintenance program at each owned facility to meet industry best practices, and
- Increase co-location consistent with science program objectives.

Facility Planning — The Bureau updated its Site-Specific Asset Business Plans (ABP) to further support the bureau's Asset Management Plan (AMP). The ABPs are 5-to-10 year plans addressing specific needs of a field unit, campus, or region covering all assets reported in the FRPP. The USGS ABPs effectively address and articulate the life cycle issues and characteristics of a site's real property assets. These plans, prepared by local

managers, provide facility and regional managers throughout the organization a micro-level view of these assets. The performance metrics and substantial inventory data included in ABPs are used by local managers to aid daily decisionmaking. They are also used as annual action plans to direct bureau and regional resources where they are most needed in support of the USGS mission.

Bureau Systems — Web-based facilities information systems continue to streamline the budget data collection process for facilities and increase the availability of much-needed management information on bureau real property holdings. Comprehensive facility condition assessments continue to identify deficiencies that need priority attention, creating an information base that promotes effective stewardship and a more informed asset investment process. The implementation of Interior's standard facilities maintenance management system provides the capability for the USGS to report our operations and maintenance consistently across the Bureau.

Maintaining America's Heritage — The DOI is committed to preserving and maintaining operational facilities and major equipment investments, as well as responsible stewardship of Interior's managed natural and cultural treasures. The 2010 USGS budget request includes an estimated \$31 million for facilities and equipment maintenance and deferred maintenance under the Maintaining America's Heritage. The Operations and Maintenance and the Deferred Maintenance and Capital Improvements subactivity descriptions provide details on the immediate and long-term maintenance projects underway. The Deferred Maintenance and Capital Improvement five year plan ensures that facilities and equipment are functional, safe, and useful to the fullest extent of their lifecycle per departmental guidance.

The USGS continues to work collaboratively with FWS to address the real property asset issues at the Patuxent Wildlife Research Center. The joint FWS-USGS plan for improving Interior's assets at the Patuxent Research Refuge and Patuxent Wildlife Research Center proposed a multi-phase effort to upgrade and modernize the utility infrastructure and facilities at Patuxent. Details regarding ARRA funds are included in Section T.

Subactivity Overview

The Facilities Activity comprises two subactivities:

The **Rental Payments and Operations and Maintenance** subactivity provides for rental payments to the General Services Administration (GSA), to other Federal agencies, to private lessors, and to cooperators for space holdings nationwide and includes the recurring costs of providing for the basic operations and maintenance, security costs, and upkeep of facilities to ensure that they are maintained in compliance with applicable safety and other standards. The USGS occupies a total of 4.1 million square feet of rentable space in about 166 GSA buildings nationwide, making USGS one of the largest users of GSA space within the Department. The USGS acquires space directly at 98 other sites. The USGS has 34 owned installations with 279 owned buildings on approximately 2,340 acres.

The **Deferred Maintenance and Capital Improvement** subactivity funds are used to address the highest priority USGS facility and equipment needs per departmental guidance. The current funding level provides for approximately 14.6 percent of the facilities deferred maintenance of \$41 to \$60 million; as reported in the 2008 Performance

Facilities

and Accountability Report. The condition assessment program includes annual surveys and a cyclic process for comprehensive onsite inspections to document deferred maintenance. Details regarding ARRA funds are included in Section T.

Activity: Facilities

Subactivity: Rental Payments and Operations and Maintenance

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Rental Payments and Operations and Maintenance (\$000)	0	94,802	4,274	0	99,076	+4,274
FTE	0	51	0	0	51	0
Rental Payments (\$000)	72,479	0	0	0	0	0
FTE	0	0	0	0	0	0
Operations and Maintenance (\$000)	19,592	0	0	0	0	0
FTE	51	0	0	0	0	0
Total Requirements (\$000)	92,071	94,802	4,274	0	99,076	+4,274
Total FTE	51	51	0	0	51	0

Summary of 2010 Program Changes for Rental Payments and Operations and Maintenance

The 2010 budget request for Rental Payments and Operations and Maintenance subactivity is \$99,076,000 and 51 FTE. There are no program changes requested from the 2009 Enacted level.

Program Overview

The Rental Payments and Operations and Maintenance subactivity provides the USGS with the funding needed to meet asset management goals and carry out Executive Order (EO) 13327: Federal Real Property Asset Management, dated February 6, 2004. The Operations and Maintenance (O&M) cost component provides for the reoccurring and basic facility operations, upkeep of facilities ensuring they are maintained in compliance with Federal, State, and local standards, and to ensure that facilities remain safe for USGS employees working at the facilities, as well as visiting partners and customers.

The Rental Payments cost component funds payments to GSA, other Federal sources, private lessors, and cooperators for space occupied by the USGS nationwide. The USGS has unique facility requirement for supporting science functions and relies heavily on GSA to meet needs such as providing modern laboratory space. The USGS occupies a total of 4.1 million square feet of rentable space in about 166 GSA buildings nationwide, making the USGS one of the largest users of GSA space within the Department. The USGS has 34 owned installations with 279 owned buildings on approximately 2,340 acres. This includes 11 biological science centers, five biological field and research stations, [the National Center for Earth Resources Observation Science] (EROS), 10 geomagnetic, seismic and volcano observatories, and seven miscellaneous owned properties, such as gauging stations, warehouses and a storage annex.

Rental Payments and Operations Maintenance

The USGS also owns eight large research vessels having characteristics, costs, and operations and maintenance features that comport with the definition of a USGS facility. These vessels meet the criteria for the Comprehensive Condition Assessment, exceed 45 feet in length and perform overnight research and support biology research, water resources investigations, and marine geology research vessels work; five on the Great Lakes, two in California, and one in Alaska.

The goal for the subactivity is to meet Bureau science needs while optimizing facilities location, distribution, and use to control or reduce costs. Objectives for meeting this goal include:

- Coordinate facility planning with science planning to provide safe, high-quality workspace aligned with science needs,
- Develop Asset Business Plans to meet assessment management goals,
- Meet performance targets by improving space utilization, controlling rent and operating costs, and releasing unneeded space, and
- Increase co-location consistent with science program objectives.

Approximately 80 percent of USGS rental costs for space holdings are provided through GSA, nine percent through cooperative space arrangements, and the remaining rental costs are provided through other Federal agencies and private lessors.

Funds for this activity provide safe, functional workspace and facilities for accomplishing the Bureau's scientific mission. In 2008, the USGS spent \$126.0 million on Rent and O&M. Of these costs, 73 percent (\$92.1 million in 2008) are funded through the subactivity. The remaining cost are funded by reimbursable partners (25 percent) and science programs (two percent). In 2008, the total facilities rent alone was \$98.6 million. The 2010 Budget Request includes a fixed cost increase of \$4.2 million.

Although only 20 percent of Rent and O&M funds are spent on owned properties, these assets are the most unique and mission critical in the USGS portfolio. As part of the Strategic Facilities Master Plan, USGS facilities were ranked in terms of their mission dependency using a tool called the Asset Priority Index. Despite the fact that the largest concentrations of employees are in GSA-leased space in Reston, VA; Denver, CO; and Menlo Park, CA; 15 of the top 20 mission critical assets are owned assets in other locations. These owned assets have unique capabilities or are uniquely positioned on the landscape to address specific science issues.

The USGS key asset management goal is to improve the condition of owned facilities. Operations and maintenance functions include ongoing facility support that sustains day-to-day USGS scientific activities at owned installations ranging from major science centers with complex facilities such as laboratories and chemical storage to offices, garages, residences, research vessels, and other buildings.

Maintenance of facilities involves the upkeep of constructed USGS-owned facilities and structures and capitalized equipment necessary to maintain the useful life of the asset. This includes preventive maintenance; cyclic maintenance; repairs; rehabilitation; replacement of parts, components, or items of equipment associated with the facility; adjustment, lubrication, and cleaning (non-janitorial) of equipment associated with the facility; periodic inspection; painting; re-roofing; resurfacing. Also included are special safety inspections and other actions to ensure continuing service and to prevent breakdown; scheduled servicing of equipment (such

as heating, ventilation, and air conditioning equipment); and maintenance for owned facility-related vehicles such as snowplows, and landscaping equipment vehicles.

Operational costs at the USGS owned and some leased facilities include:

- Electricity, water, and sewage;
- Gasoline, propane, natural gas, diesel, and oil;
- Janitorial services;
- Groundskeeping;
- Waste management and disposal;
- Vehicles solely operated in direct support of operating the facility;
- Annual certification for facility systems, such as fire systems, fire extinguishers, back flow preventers, and fume hoods; and
- Vessels - operations and maintenance, upkeep standards necessary to realize the anticipated useful life of the fixed asset, salaries and benefits of marine professionals operating the vessel, fuel, docking fees, inspections, minor repairs, cyclic maintenance, and at least one vessel haulout a year.

In addition to maintenance cost, salary costs associated with staff performing operations and maintenance activities are also included in the subactivity. Staff at the facilities are responsible for the day-to-day operations of the facility and for maintaining it in operating order, including such operations as janitorial services, landscaping, snow removal, operation of the heating and air conditioning system, plumbing, electrical, elevator operations, fire alarm systems, fume hood operations, storage, and removal of hazardous materials, etc. These functions are carried out by government employees and service contracts.

Staff associated with operations and maintenance program management at the regions and headquarters are funded by the Science Support Activity not the Facilities Activity. Bureau policy for facilities operation and maintenance is established at headquarters in consultation with region staff. Headquarters staff establish standards for operations and maintenance, develop and implement plans for the bureau-wide systems (e.g., MAXIMO), develop deferred maintenance plans, develop contracts for Operation and Maintenance services and cost modeling, formulate regional and bureau-wide operation and maintenance budgets, and respond to departmental and OMB reporting requirements.

The Rental Payments and Operations and Maintenance includes the following components:

Use of the USGS Investment Review Board (IRB) — The USGS IRB makes recommendations to the USGS Director on new and ongoing information technology and major facilities capital investments in order to create and maintain a Bureau investment portfolio that best supports USGS and Interior mission and strategic goals. IRB membership includes the Deputy Director (who chairs the body), Chief Financial Officer, Chief Information Officer, Director of the Office of Budget and Performance, the Associate Director for Human Capital, and executives representing the science disciplines, the regions, the field, and key USGS business activities. For facility investments, the IRB reviews proposed construction projects with a life cycle cost of \$2.0 million or more, and all space transactions (occupancy agreements, leases, etc.) with a life cycle cost of \$5.0 million or more. Regional boards review proposed investments below this threshold.

Space Savings — Space savings is integral to Rent and Operations management. The USGS realizes its space savings when locations are able to consolidate space or relocate to reduced space at a reduced rate.

Space Management — The USGS 5-Year Space Management Plan supports the bureau's Asset Management Plan and Site Specific Asset Business Plans and provides a framework, strategic vision, and plan of action for effective bureau space management of GSA-provided space, USGS direct leases, and owned property. It is used by USGS management to implement Bureau space goals, including consolidation, collocation, and disposal. Information contained in the Asset Management Plan is focused on mission dependency and program requirements for space.

Facility Maintenance Management System (FMMS) — FMMS assists the USGS facility managers in efficiently operating and maintaining various facilities by providing them with accurate facility information at the local, regional, and national level. It supports the development of facility budgets, creation of the Deferred Maintenance Capital Improvement 5-year plan, and the implementation of the USGS Asset Management Plan (AMP). FMMS standardizes the various business processes, creates an inventory of the building equipment, helps in tracking and reporting on the facility related maintenance information and data, and helps in the development of the necessary AMP components that assist in the budgeting and the five-year planning process. In 2010, the handheld devices used to enter information into FMMS will be upgraded to include entering operation tour readings of the equipment within the assets. Tour readings will allow the mechanics in the field to document and trend how well equipment is operating and improve the facility manager's ability to identify problems or potential failures before they impact mission operations. Trending at this level gives facility managers the tools to ensure energy efficient operation of the equipment.

Operations and Maintenance Cost Modeling — Operations and maintenance cost modeling is the use of a representative amount of data to predict the outcome for a large amount of data. O&M models in conjunction with Asset Priority Index (API), Facility Condition Index (FCI), and utilization provide a basis for managers to reallocate existing O&M funds. Facility managers now have the opportunity to use O&M models based on industry standards to predict the cost of operating and maintaining an asset. Properly funding O&M is the first line of defense in preventing increases in deferred maintenance. In 2010, the allocation of operation and maintenance funding will be based on the cost modeling assigned to the assets.

Energy Management — The USGS is dedicated to achieving the energy and water reduction and renewable energy consumption goals set forth in the Energy Independence and Security Act of 2007 and EO 13423, "Strengthening Federal Environmental, Energy, and Transportation Management", and has implemented an energy management plan to guide programs toward meeting the mandated goals

2010 Program Performance

In 2008, the USGS awarded a new contract for a Web-based system to assist in capturing, storing, and analyzing utility cost and consumption data. The contractor collects required energy data for USGS facilities that pay utility providers directly. Currently, 250 invoices are processed monthly through this system. This contract benefits USGS by providing electronic bill consolidation and processing into an Internet-accessible database; utility bill auditing; collection of current and historical energy data; utility bill discrepancy flagging; payment tracking; and

generation of charts and reports. The ability to analyze energy cost and consumption patterns and identify opportunities is now available.

In 2008, the Facilities Budget Allocations Team (FBAT) was formed to review and recommend improvements to the processes used for allocating and managing facilities funds, to include both rent and operations and maintenance (O&M) allocations. In addition, the FBAT was charged with designing a facility cost savings strategy to promote and maximize Bureau-wide cost savings. The FBAT was composed of interdisciplinary experts from both the programmatic and science support communities. In April and June of 2008, the FBAT presented their recommendations to the USGS IRB. After deliberating in executive session the Board agreed to changes in the processes for allocating and managing facilities funds that included the basis for the budget allocation, determining a process for distribution of the shortfalls, establishing a holdback safety net for unforeseen funding issues, a process to stabilize the budgeting by accepting a no year-end adjustment to the facilities allocation, and a strategy to reward facility cost savings.

The USGS will continue to work toward a targeted reduction (set by the Energy Independence and Security Act of 2007, the reduction is required by 2015) of 30 percent in energy intensity at all facilities from the 2003 baseline. By the end of 2009, USGS will exceed the target reduction of 12 percent. To the extent practical and technically feasible, the USGS will work to obtain a minimum of 3 percent of our energy from renewable sources in 2008 and 2009, and 5 percent in 2010. USGS will work to reduce water consumption by 2 percent annually as compared to the 2007 baseline established in EO 13423.

Energy Conservation Measures (ECMs) installed in 2008 at the National Center located in Reston, VA., include installation of a high efficiency air compressor system, reflective white roof installation, and energy efficient equipment for the cafeteria renovation. The energy program coordinator worked with the National Center's Infrastructure Technology Team to arrange for the automatic shutdown of computers during non-working hours. Water conservation measures include replacement of all National Center bathroom faucets with photovoltaic low-flow faucets and changing the cooling water for several pieces of scientific equipment from domestic water to a closed loop chilled water system. All ECMs will ultimately further reduce energy consumption at the National Center and help maintain green on the scorecard.

In 2009 and 2010, The USGS will continue energy conservation efforts begun in 2008. In 2010, energy funding will be used for energy audits and to initiate work on new ECMs. Planned ECMs include energy efficient lighting retrofits, heating, ventilation, and air conditioning improvements and replacements, and building envelope enhancements. This funding will support additional improvements in the overall energy management program and will help further reduce the bureau's energy consumption and help maintain green on the scorecard.

This subactivity supports the Department goal of facilities improvement tracking outcomes such as; percent change in the operating cost per square foot of buildings that are "not-mission dependent" as reported in the Federal Real Property Profile (FRPP) in the current fiscal year compared to the previous fiscal year; percent change in the total number of buildings reported as "under utilized" or "not utilized" in the Federal Real Property Profile; and the percent of assets targeted for disposal that were disposed.

MAXIMO is the Department's maintenance management system software used for tracking the day-to-day operations and maintenance of facilities assets and their components. MAXIMO is implemented at USGS, National Park Service (NPS), Bureau of Land Management (BLM),

Rental Payments and Operations Maintenance

Bureau of Indian Affairs (BIA), Fish and Wildlife Service (FWS) and Bureau of Reclamation (BOR). In 2009, a condition assessment module will be developed and installed in MAXIMO to include the utilization of the facility condition index (FCI) and the asset priority index (API). In 2010, the 24 additional smaller sites within the USGS shall be added to the database. In addition, a reporting tool will be developed to extract projects from Maximo for preparation of the 5-year DMCI plan.

In 2010, the USGS will continue developing planning requirements outlined in the Department's Asset Management rolling 3-year timeline. These include establishing targets for meeting performance metrics identified by the Federal Real Property Council; reporting accomplishments in asset performance; and implementing a standardized practice for calculating the current replacement value of facilities and repair projects.

Program Performance Overview

Advance Modernization/Integration

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Budget	Change from 2009 Plan to 2010	Long-term Target 2013
End Outcome Goal: Facilities Improvement										
Percent change in the Operating Costs (operations and maintenance costs) per square foot of buildings that are "Not-Mission Dependent" (NMD) as reported in the Federal Real Property Profile (FRPP) in the current fiscal year compared to the previous fiscal year. (SP)	A	UNK	\$3.15sf 0% UNK	\$3.03sf -1.6%	\$2.94sf -3%	\$ 2.38 sf -1%	\$2.33sf -3%	\$2.26sf -3%	-\$.07 sf -3%	\$2.07sf -3%
Total Operations and Maintenance cost of Not-Mission Dependent Building (000)		UNK	159	149	144	\$24	\$23	\$22	-1	\$20
Total Square Footage of buildings that are "Not-Mission Dependent" as reported in the FRPP (000)		UNK	51	49	49	8.7	8.4	8.2	-2	7.8
Comment	In 09 multiple assets were reclassified as Mission Dependand-Not Critical. This reduced the square footage of the Not-Mission Dependand assets.									
Percent change in the total number of buildings (office, warehouse, laboratory, and housing) reported as "Under Utilized" or "Not Utilized" in the Federal Real Property Profile (FRPP) in the current fiscal year compared to the previous fiscal year.	A	UNK	UNK	83%	-5%	-7.9	-5%	-5%	-5%	-5%
Number of buildings (office, warehouse, laboratory, and housing) reported as "Under /Not Utilized" USGS owned and direct lease.		UNK	13	21	20	15	14	13	-1	11

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Activity: Facilities

Subactivity: Deferred Maintenance and Capital Improvement

Subactivity	2008 Actual	2009 Enacted	2010			Change From 2009 (+/-)
			Fixed Costs & Related Changes (+/-)	Program Changes (+/-)	Budget Request	
Deferred Maintenance and Capital Improvement (\$000)	7,898	7,321	0	0	7,321	0
<i>FTE</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>
Total Requirements (\$000)	7,898	7,321	0	0	7,321	0
Total FTE	0	0	0	0	0	0

Summary of 2010 Program Changes for Deferred Maintenance and Capital Improvement

The 2010 budget request for the Deferred Maintenance and Capital Improvement subactivity is \$7,321,000 and 0 FTE. There are no program changes requested from the 2009 Enacted level.

Program Overview

The Deferred Maintenance and Capital Improvements (DMCI) subactivity funds are used to address the highest priority USGS facility and equipment needs to conform to safety and environmental standards. At the requested funding level of \$7.3 million, 14.6 percent of the facilities deferred maintenance will be completed. Deferred Maintenance at USGS facilities is \$40-61 million per the 2008 Performance and Accountability Report. The condition assessment program for facilities includes annual surveys and a cyclic process for comprehensive onsite inspections to document deferred maintenance.

Through the asset management planning processing, USGS is able to identify real property assets that are candidates for disposition. Any asset that is no longer critical to the mission, or that is in such poor condition that is no longer cost effective to maintain, will be identified for possible disposal.

The USGS is committed to the continual improvement of the stewardship of its assets. The primary goal is to provide a safe, comfortable, environment for the employee, visitors and contractors at USGS facilities. Improving the maintenance of existing facilities and equipment ensures the health and safety of the public and employees, protects the asset, and ensures compliance with building codes and standards. This program tracks the Facilities Condition, as measured by the Facilities Condition Index (FCI).

Facilities projects reflect the results of comprehensive evaluations conducted by independent architect and engineer firms. These installation-wide assessments are key to establishing core data on the condition of the USGS constructed assets.

The USGS has stewardship responsibility for unique mission equipment assets such as hazard-warning networks, river cableways, and stream gaging stations, requiring effective maintenance

Deferred Maintenance and Capital Improvement

and capital investments to preserve functionality. Projects addressing these assets are included under the Equipment Section of the 5-Year DMCI Plan and are evaluated using the same safety criteria as constructed real property assets.

For 2010, remediation of the most critical health, safety, and resource-protection deficiencies continues to be the focus of the priority facility projects. In 2010, 36 facility deferred maintenance projects are proposed to be funded. The activity's goal is to reduce the deferred maintenance and capital improvement at facilities and establish an effective maintenance program at each owned facility to meet industry's best practices.

The USGS addresses the most critical maintenance and capital improvement needs prioritized according to Department's guidelines. Yearly, a five-year plan is established listing the USGS priority deferred maintenance and capital improvement facilities needed to accomplish management objectives. This plan is subject to adjustments in out-years due to funding changes and revised priorities based on comprehensive facility condition assessments, annual condition surveys, and emergency needs.

As of 2008, the overall FCI for USGS owned assets was 0.183, which is "*unacceptable*", (not meeting most maintenance standards and requires frequent repairs to prevent accelerated deterioration and provide a minimal level of operating function). In some cases this includes condemned or failed facilities. A FCI of 0 to 0.15 is classified as "acceptable", a FCI of 0.15 to 1 is classified as "unacceptable".

The condition assessment process identifies deferred maintenance needs and determines the current replacement value of constructed assets. Knowing the estimated cost of deferred maintenance and the replacement value of constructed assets allow the USGS to use the industry standard Facilities condition Index (FCI) as a method of measuring the condition and change of condition of facilities. The FCI is a ratio of accumulated deferred maintenance to the current replacement value (Facilities Condition Index = Deferred Maintenance/Current Replacement Value). It is an indicator of the depleted value of capital assets. The general rule is that FCI should be below 0.15 for a facility to be considered in good condition.

Deferred maintenance needs identified in condition assessments and other inspections are developed into specific projects and proposed in the Five-Year Deferred Maintenance and Capital Improvement Plan. Projects are ranked using the Department's weighting process based on the percentage of the work (total project amount) that falls in each of the categories and the corresponding rank listed below:

- Critical Health and Safety Deferred Maintenance (CHSdm) 10
- Critical Health and Safety Capital Improvement (CHSci) 9
- Critical Resource Protection Deferred Maintenance (CRPdm) 7
- Critical Resource Protection Capital Improvement (CRPci) 6
- Energy Policy, High Performance, Sustainable Buildings CI (EPHPSBci) 5
- Code Compliance Capital Improvement (CCci) 4
- Critical Mission Deferred Maintenance (CMdm) 4
- Other Deferred Maintenance (Odm) 3
- Other Capital Improvements (Oci) 1

Based on these weight factors, projects are ranked using the following calculation:

$$(\%CHSdm \times 10) + (\%CHSci \times 9) + (\%CRPdm \times 7) + (\%CRPci \times 6) + (\%EPHPSBci \times 5) + (\%CCci \times 4) + (\%CMdm \times 4) + (\%Odm \times 3) + (\%Oci \times 1) = \text{Total Project Score}$$

These percentages must add to 100%. It places the highest priority on facility-related Critical Health and Safety and Critical Resource Protection deferred maintenance needs.

When routine and cyclic maintenance is completed on schedule, the routine and cyclic maintenance projects do not become deferred maintenance. USGS has started modeling exercises to project the appropriate sustainment level of operations and maintenance funding that will allow identification of critical cyclical and preventive maintenance that is currently not being done.

This activity supports the Department's goal of facilities improvement tracking outcomes such as overall condition of buildings and structures. It also tracks outputs including number of bureau condition assessments completed (within a 5-year cycle) and number of deferred maintenance and capital improvements (cumulative).

2010 Deferred Maintenance and Capital Improvement Plan

The following table lists, in priority order, the proposed projects and equipment to be addressed by DMCI in 2010.

2010 Facility Projects (\$000)

<p>PATUXENT WILDLIFE RESEARCH CENTER (PWRC), MD \$309</p>	<p>Replace 10 Small Research Structures, Buildings or Sheds (B19980008E): Replace structures facility wide used to support biological research. Most of the structures are located within the Endangered Species area. Approximately ten small buildings and structures built as many as 30+ years ago (e.g. equipment storage sheds and feeding structures), have serious structural deficiencies, rotted floorboards, severe water damage, and exposed and rusted metal meshing and similar sharp materials that are pose significant health and safety concerns to employees who routinely work there in the conduct of their waterfowl and other studies. Replacement is required to eliminate these unsafe conditions. The removal of debris and disposal is included in this project in accordance with Federal regulations.</p>
<p>NATIONAL WETLANDS RESEARCH CENTER (NWRC), LA \$180</p>	<p>Design Hazardous and Flammable Materials Storage Building (NWRC NC 9301): Phase 1) Design \$180,000. Phase 2) Construction and disposal. The current hazardous and flammable materials storage building is 462 sq ft. It is too small to house the quantity of hazardous materials required to support the research and maintenance operations at the National Wetlands Research Center. The design will include the required installation of a fire alarm system with a connection to the fire dept., sprinkler system tied to the main fire alarm system, proper ventilation system and an emergency shower/eyewash station. Building will be designed as same, 3 separate sections, hazardous waste storage, cylinder storage, and chemical, gasoline, paint, pesticides, and small power equipment storage. Design will also include a backflow preventer to separate the fire sprinkler system from the domestic water system. The existing building consists of louvered doors and roof opening to vent fumes from the building and is currently not tied to the main fire alarm system. Limited space has prevented the installation of an emergency shower/eyewash station. Entrance doors into the rooms have open louvers to the outside allowing a wet, humid condition to exist, where the walls and floor sweat, all the metal surfaces have rust and drip with condensation. There is no positive air movement within any of the rooms to vent fumes or humidity. Phase I of the project will be the design of the new hazardous and flammable materials storage building. Phase II will be construction of the new building and demolition of the old building. 2010 funding of \$180,000 is for design work only.</p>

Deferred Maintenance and Capital Improvement

<p>GUAM SEISMOLOGICAL AND MAGNETIC OBSERVATORY \$375</p>	<p>Replace Office/Warehouse Building at Guam: Replace the existing structure with new energy-efficient structure compliant with building codes and designed to withstand typhoons and earthquakes. The general condition of the facilities in Guam has degraded considerably since the observatory was established in 1957. All of the buildings on site were constructed long before current building codes were adopted for Guam. Data from USGS magnetic and seismic equipment, as well as that of site partners, are transmitted through the office building via a wide variety of computer, communications, and data acquisition equipment. A building failure resulting from typhoon or earthquake damage would result in catastrophic loss of multiple, critical data streams. As a result, the USGS mission would be adversely impacted by any catastrophic failure of this building and its components. Replacement of this building will eliminate all deferred maintenance at the Guam location.</p>
<p>WESTERH FISHERIES RESEARCH CENTER (WFRC) SEATTLE, WA LABORATORY \$40</p>	<p>Install Drain Field for Maintenance Building: Recent changes to the City's storm drain system have caused flooding in the basement of the Maintenance building. The basement is used to store records and scientific equipment, all of which can be damaged by flooding. At times the floor is covered by two inches of water, a situation that creates electrical and water hazards and will likely create mold problems. To prevent further damage and eliminate these hazards, a French drain must be installed around the perimeter of the building to divert the storm water away from the structure.</p>
<p>NATIONAL WILDLIFE HEALTH CENTER (NWHC), WI \$150</p>	<p>Master Planning of NWHC Modernization (B2006NWHC01): This project proposes to fund the development of a Master Plan for the 26-acre, USGS-owned campus of the National Wildlife Health Center (NWHC). The aging NWHC facility is in need of significant renovation and expansion to meet current/future mission requirements. This study would evaluate three important areas to consider: current and projected program mission and regulatory requirements for the NWHC biomedical containment facility; current facility condition assessments, including deferred maintenance projects, energy costs and operating costs; and staff safety and comfort considerations. The study's objective is to develop a strategy to renovate and/or construct new office, laboratory and animal facilities. USGS has seven cost centers located in the Madison metropolitan area. A study is currently underway to prepare a cost estimate and business case analysis for consolidating all USGS cost centers on the USGS-owned campus in Madison, WI. The scope of the consolidation study is limited to estimating the cost of design, construction and operation of a new facility to accommodate the USGS Madison Footprint with minimal renovation of the existing NWHC facility.</p>
<p>WESTERH FISHERIES RESEARCH CENTER (WFRC) SEATTLE, WA LABORATORY \$93</p>	<p>Design and Replace Leaking Wet Lab Process Water Mixing and Filtering System: WFRC Seattle Laboratory operates a highly technical wet laboratory that draws over 500,000 gallons of fresh water daily from Lake Washington. The current process water mixing system is old and is increasingly unreliable. Leaking pipes have been reglued and aquatic bays have been abandoned where leaks could not be repaired. Reduced capacity is now impacting scheduling of scientific experiments. Plumbing, pneumatic valves, positioners, and Direct Digital Control systems and the inadequate filtering system will need to be replaced.</p>
<p>FRESNO GEOMAGNETIC OBSERVATORY, CA \$50</p>	<p>Design and Construct New Instrument Building: Three critical data acquisition/sensor buildings with unique operational and facilities requirements will be replaced by a new combination building of the same square footage. The design and construction of the three data acquisition/sensor buildings no longer support current USGS critical mission requirements at the site. Sensitive magnetic instruments housed in these facilities need a stable, temperature-controlled operational environment for optimum performance. Because conditions are not adequate, data quality is compromised, and the USGS mission is at risk. This project will restore critical USGS mission capability at the site to meet international geomagnetic data standards and customer requirements.</p>
<p>ELKO "H" FIELD STATION, NV \$480</p>	<p>Elko Field Station: The USGS Elko 'H' site is approximately one acre in size and currently undeveloped but has electrical, water, and natural gas supply lines nearby. This project would pave approx 1/2 acre, 1/4 would be asphalt the other 1/4 gravel for parking. Install new sewer lines to be connected to city service lines, and construct a new fence around the site. The Elko Field Station building would provide sustainable, environmentally friendly office and storage space supporting science projects in this area. Office space needs require approximately 1,440 square feet and the</p>

	garage/storage space needs are approx. 900 square feet. Site work: \$80,000; Building (new construction): \$400,000. The original USGS Elko Field Station was demolished due to conditions and USGS was relocated to leased space.
UPPER MIDWEST ENVIRONMENTAL SCIENCE CENTER (UMESC) OFFICE/LABORATORY BUILDING, WI \$138	Replace Main Boiler Burners and Connect to Secondary Source of Fuel in Lab/Office Building (B20010006B): Replace main boiler burners to provide capability to operate on dual fuel and connect to secondary fuel source. Remediate the installation of new burners on main boiler capable of utilizing both natural gas and fuel oil. Also requires piping and pump with day tank to connect to existing underground fuel storage tank or installation of propane tanks will duel fuel with propane rather than fuel oil be advantageous. Upon installation demonstrate boiler performance (capacity and efficiency) using each fuel source.
WESTERN FISHERIES RESEARCH CENTER (WFRC) COLUMBIA RIVER RESEARCH LABORATORY, WA \$42	Replace Emergency Diesel Generator: The current emergency diesel generator is undersized for the current need of reliable back up power. Power outages are common to this remote location and can be as long as one week without power. A power outage disrupts staff ability to work but more importantly it has the potential to destroy years of research samples and ongoing wet laboratory experiments valued at over \$1M. Some samples cannot be replicated and the loss would be substantial. This project would replace the undersized generator with a Cummins NW 100DSHAF Diesel Genset which would provide adequate power for all emergency power needs.
WESTERH FISHERIES RESEARCH CENTER (WFRC) SEATTLE, WA LABORATORY \$37	Eliminate Electrical, Exhaust System, and Boiler Deficiencies: Upgrade electrical system to eliminate periodic spikes, shorts, and outages, including rewiring for autoclave installation and water UV system. Troubleshoot and correct main switchgear problems during emergency-to-normal transitions. Replace ineffective chemical storage exhaust system. Replace failing boiler control system.
NATIONAL WILDLIFE HEALTH CENTER MAIN BUILDING, WI (NWHC) \$239	Replace Inefficient Chiller in Main Building with Energy Efficient Chiller (B20080007C): The new energy efficient chiller will replace the existing 30 year old 95 ton reciprocating chiller that has proven to be very unreliable and very inefficient compared to most recent technology. The existing chiller is very noisy due to the type of compressor it has on it. The new chiller will be energy efficient and much quieter in the mechanical equipment room. The existing chiller and other related equipment will be removed and disposed of in accordance with Federal regulations.
COLUMBIA ENVIRONMENTAL (CERC), MO \$79	Replace Elevator A3 (B20080005): The freight elevator in building A3 (Main Building) at the CERC is original equipment installed in 1965. The unit is obsolete and parts are no longer available to support it. Latches and hardware are worn and require replacement. The unit needs to be replaced with a new one compliant with current safety, fire, and building code.
RESEARCH VESSEL STURGEON, MI \$46	Modify Unsafe Trawl Gallows (B2008RVSTURG01: The gallows modifications needed for the R/V Sturgeon are typical of the trawling vessel industry and can swivel. Modifications required are the post size reduced to a six inch pipe that has a rotating collar on top to install a heavy reinforced top plate and stiffener to mount the trawl block assembly. This type of gallows allows safe storage of trawl doors alongside and would be able to effectively swivel the top post cap inboard. Current design could pose a risk of serious personnel injuries or damage to property. The big gallow posts are now positioned outside of the beam pointing outboard, and most always interfere with docking the vessel, especially if the dock is tall and seas present. The fixed position usually results in the assembly banging into the dock post and pier pilings. The biggest safety concern is that storing the big trawl doors on B-Deck involves picking the doors up with the crane and swinging them around 180 degrees carefully placing them on the back deck area. There is the potential for many things that could go wrong with this type of arrangement which could be mitigated with the design modification to store the trawl doors in pockets along side the gallow posts. Until modified, vessel Captain and crew have mitigated the safety risks down by constantly monitoring the sea conditions and ship position when having to work on the doors during trawling or moving to stored position.

Deferred Maintenance and Capital Improvement

<p>NATIONAL WILDLIFE HEALTH CENTER MAIN BUILDING (NWHC), WI \$195</p>	<p>Replace Controls of Main Building's Waste Treatment System for Energy Conservation (B20080006C): The 30 year old complex pneumatic controls are failing and parts are almost impossible to find. The system is incredibly inefficient due to the malfunctions that occur and the controls that are obsolete. Control glitches have also allowed hot sterilized waste to be released into the sanitary sewer before it was cooled, causing a geyser of steam and water to push out of the nearest man-hole. New controls and valves will replace the existing old ones and will allow the waste to be heated efficiently and quickly, while also providing fail safe release of waste water after it is cooled. The existing control units and other items will be dismantled and disposed of according to Federal regulations.</p>
<p>UPPER MIDWEST ENVIRONMENTAL SCIENCES CENTER (UMESC), WI \$95</p>	<p>Upgrade and Insulate Storage Building Roofing (B20060001B): The heated storage building was originally designed and constructed as a cold (unheated) steel frame building and heat was added after initial building construction. Consequently, there is no thermal break between the steel structure and the standing seam metal roof. As a result, during the winter there is repeated melting then refreezing causing significant ice formation on the minimally pitched roof until large sheets (up to one foot thick) of ice crash down on the North and South sides of the building where overhead doors for vehicle entry and personnel doors for personnel entry and egress are located. The melting action on the roof falls on the North side of the building where it once again freezes (no sun exposure) causing significant ice slip hazards. Adding insulation will solve the problem of no thermal break from the heated metal building frame and result in little or no ice formation on the roof. Adding a membrane roof system will prevent damage to a standing seam metal roof that the freeze/thaw action of built up ice and snow and gutters cause. Eliminating the ice build up on the roof allows the installation of gutters to prevent ice formation on the North side of the building and stop water from splashing at the building base and washing inside the building. Extending storm drains to receive the gutter discharge will prevent any ice hazards as there is little slope at the building base.</p>
<p>CENTER FOR EARTH RESOURCES OBSERVATION AND SCIENCE (EROS), SD \$250</p>	<p>Replace Indoor Cooling Towers in 1973 Original Wing of the Mundt Federal Building (M2007D3): The existing indoor cooling towers in the original section of the main building are 23 and 24 years old. The expected life of a cooling tower with good maintenance is 15 years. The towers have deteriorated through use to a point where failure is probable. The fan shaft and bearings have been replaced in both units, the water baffles have deteriorated causing a decrease in load capacity of both units, the tower basins have been recoated and resealed multiple times, and the basin material is showing signs of corrosion. The replacement of the current towers with wet and dry cooling towers will improve the efficiency of the heat recovery system, save energy, lower maintenance costs significantly and avoid system failure.</p>
<p>COLUMBIA ENVIRONMENTAL RESEARCH CENTER (CERC), MO CONFERENCE CENTER \$225</p>	<p>Brick Veneer Replacement and Building Perimeter and Exterior Renovations (B20070010): The Conference Center has 2,677 square feet of brick veneer that is failing. This thin brick veneer exterior wall system was installed on the building in the 1980's. The 1/2" brick was factory adhered to rigid styrofoam insulation board, supplied in 4' x 8' panels, and mechanically fastened to the building's metal wall system beneath. Joints were mortar filled. Over time the mechanical fasteners have failed and the brick panel has separated from the subsurface. Water has entered the void, frozen, and pushed the veneer out causing some mortar failure. Maintenance staff continues to reattach bricks that fall from the wall system with a mortar-like adhesive and bolts and caulking but larger portions could become loose over time and fall. This project will include removal of the brick veneer system and 1,455 square feet of interior and exterior conference room walls down to the original metal shell and installation of new interior studs and insulation covered with gypsum, fiberboard, and covered with a 4" single width brick wall system and existing metal fascia will be refinished.</p>

STEILACOOM WAREHOUSE AND STOAGE FACILITY, WA \$33	Environmental Study – Asbestos and Lead Paint (WA20070010): The Steilacoom Warehouse Facility is made up of three main buildings and some storage areas on 3.64 acres. As a result of a Condition Assessment in 2002 and a recent OSHA inspection in 2007, it is determined that a full analysis needs to be performed on the complete facility to document current levels of asbestos and lead paint conditions. This survey must also include recommendations to dispose of such hazards. It has been documented in the condition survey that pipes, roofing materials, and flooring may possibly contain asbestos as well as lead paint being present in the buildings.
RESEARCH VESSEL KIYI, WI \$40	Repair Engine (B2008GLSCRV0002): The main engine and ship's service generator mufflers aboard the R/V KIYI need to be improved to reduce noise levels. The noise levels on the back deck are in excess of NIOSH (National Institute of Occupational Safety and Health) Standards (85dB) action levels, requiring constant wearing of hearing protection making vocal communication difficult, which in turn increases risk of safety hazards. The excessive noise also makes radio and intercom communications between the bridge and the back deck very difficult. The engine noise is also audible from over a mile away from the ship, This is very disturbing to the public when the ship is moored or working near public marinas. R/V KIYI has already been asked to shut down the ship's service generator for the night while moored at a marina. Upon denying that request, the science center was informed that the vessel might not be allowed to moor or anchor at that location in the future due to the noise. Ports suitable for R/V KIYI are rare enough on Lake Superior, and to be barred from any of them would have an adverse impact on the science we would be able to conduct.
SO CONTE ANADROMOUS FISH LABORATORY, MA \$90	Miscellaneous Concrete and Sealant Repairs to Buildings (B2008CAF03C): The 2008 Condition Assessment identified a number of concrete, masonry and sealant problems in the three main buildings. Several concrete access pads need to be repaired and several more added for safety and ADA compliance. Windows need to be recaulked and some seals replaced for energy savings and to prevent water damage. Masonry expansion joints need to be repaired by removing sealant and backing rods and replaced with new materials.
NORTHERN APPALACHIAN RESEARCH LABORATORY (NARL), PA \$73	Upgrade Electrical System (B2008NARNA0002): This project is to repair, replace, and upgrade electrical deficiencies in the NARL main building as detailed in the Faith+Gould Inc. 2006 Condition Assessment report, projects G1-G8. These include, removing redundant electrical circuits, provide maintenance on switchgear, panel boards, and connections, install ground fault protection to chemistry benches, replace unsafe transformers, breakers, and panel boards, provide clearance for transformers, refurbish generator, and replace corroded wiring in Isolation Room.
SITKA MAGNETIC OBSERVATORY, AK \$40	Rehabilitate Observatory Site (G1998SIT001): Renovation of two quarters and one garage to include repainting interior and exterior, removing asbestos siding, repairing drainage problem, replacing windows, install rain gutters, repair steps, replace kitchen sink and faucet, upgrade electrical system, replace toilets, fixtures, and hot water heaters. Repair of science buildings to include removing and replacing asbestos siding, repainting, replacing heating units, refinish floors, and refit interior doors. Grounds need to be cleared back of trees which contribute to rotting problem on all buildings. Additional renovation required: Finish Electrical upgrade of the garage and in the main quarters. Electrical upgrade of the main quarters is partial. Re-pave access road. Seismic vault in need of repair due to dampness and water damage.
UPPER MIDWEST ENVIRONMENTAL SCIENCE CENTER LAND (UMESC), WI \$342	Install Storm Water Diversion Collection and Treatment System (B19990009B): Change grade of roads in the research pond area and add curbing and gutter to prevent rain water from exceeding the hydraulic capacity of the effluent treatment system. Redirect storm water runoff to new detention/settling basin. Relocation of underground utilities (gas and electric) is required for installation of detention/settling basin. Install water sampling station to provide automated 24 hour composite sampling per regulatory requirements. The project will also include the removal and disposal of all construction debris in accordance with Federal regulations.

Deferred Maintenance and Capital Improvement

<p>PATUXENT WILDLIFE RESEARCH CENTER (PWRC), MD \$69</p>	<p>Rehabilitate Veterinarian Hospital (B2001PWRC42): Rehabilitation and repair of the Vet Hospital includes re-stripping and installing a ramp in parking lot for ADA compliance, adding snow clips on roof to protect snow from accumulating and crashing down on walkways. Rehabilitate baths with GFI outlets and accomplish minor electrical work. Install smoke detectors and change fixtures to energy efficient tubes and ballasts. In addition, move propane tank away from building per code requirements.</p>
<p>NORTHERN APPALACHIAN RESEARCH LAB (NARL), PA \$383</p>	<p>Re-Roof Main Building (B2008NARNA0001): This project is to replace the roof of the main laboratory building of the Northern Appalachian Research Laboratory in Wellsboro, PA. The current roof was installed in 1994 as a recovery system over the original 1978 seam metal roof. Despite its relatively young age, the roof is in poor condition with widespread deficiencies and deviation from manufacturer and industry standards. This project will remove of the current roof system and install new R-25 rigid insulation, plywood sheathing, saturated felt underlayment, and fiberglass-reinforced granular surfaced asphalt shingle. Roof is approximately 39,000 sf in size.</p>
<p>CENTER FOR EARTH RESOURCES OBSERVATION AND SCIENCE (EROS), SD \$161</p>	<p>Replace 77 Exterior Windows and Frames in the Mundt Federal Building (M2005120B13): The windows and frames are 33 years old and were not adequately designed for the extreme temperature fluctuations of South Dakota. The outside aluminum to inside aluminum frame contact should have been separated to prevent heat or cold transfer to the inside of the building. In sub zero temperatures, large amounts of condensation are produced inside the building at the windows due to this temperature transfer issue. This additional moisture contributes to the deterioration of the building envelope. The pliable sealant around the windows has become brittle and unable to handle thermal expansion and contraction. The windows have no glazing (UV Protection/Energy Savings) and provide little or no thermal insulation. The windows will be replaced with glazed, double paned windows with operable internal blinds.</p>
<p>SOLID STATE LABORATORY RESEARCH AND DEVELOPMENT BUILDING, VA \$315</p>	<p>Repair Foundation and Flooring (A2002001SSL): Separation between the floor slab and the foundation at the Solid States Physics Lab indicates a structural problem that is leading to structural failure. The basement area is considered unusable for equipment. The floor is approx. 1-2 inches below the level of the foundation along the entire length of the northwest wall. Funding requested for this project will cover three phases: Phase I will commission a Structural Evaluation and a Load Analysis of the building as it is currently being used; Phase II will procure the design to repair the deficiencies identified in Phase I; and Phase III will repair the deficiencies defined in Phase II.</p>
<p>GREAT LAKES SCIENCE CENTER (GLSC), MI \$49</p>	<p>Install sidewalk (B20010021): The entire east side of the Center's parking lot has no sidewalk making it unsafe for people walking in the parking lot area where there is vehicular traffic. A sidewalk needs to be installed next to the building along the entire length of the building and parking lot. This will require a retaining wall be built at the northeast corner of the parking lot. This will provide a safer and better access to Center facility.</p>
<p>FLORIDA INTEGRATED SCIENCE CENTER (FISC), MAIN RESEARCH AND DEVELOPMENT BUILDING, FL \$273</p>	<p>Replace and Update Existing Equipment/HVAC/Lighting Controls, in Environmental Chambers (B19990032F): The current environmental chambers have obsolete Heating, Ventilating, and Air-Conditioning (HVAC) systems that do not provide for adequate temperature control. The lighting systems are also antiquated and inefficient, they will not provide for the flexibility of manipulating light levels, intensity, or photoperiods. Existing environmental chambers will have all existing equipment removed and replaced with state-of-the art HVAC and lighting controls.</p>
<p>GREAT LAKES SCIENCE CENTER (GLSC) RESEARCH AND DEVELOPMENT BUILDING, MI \$567</p>	<p>Replacement of Windows and Exterior Doors (B19900007G): The Center has approximately 235, old, single-pane, high-maintenance windows with no energy-conservation features standard today. In addition, 2 sets of exterior double doors require replacement. Outside air infiltration creates drafts and increases utility bills. A majority of all existing windows and exterior doors should be removed and replaced with thermal/insulated windows and doors that address weather conditions for the geographic area of Ann Arbor, MI.</p>

<p>LEETOWN SCIENCE CENTER (LSC), WV \$55</p>	<p>Repair Ceiling in Hatchery Building Wet Lab (B20010021): Existing ceiling tile in wet lab is not suitable for the high moisture content of the area and is deteriorating and accumulating mold. This project will provide for replacing the ceiling with suspended system and drywall. Project includes removing existing ceiling, light fixtures, etc.; installation of suspension system and drywall; painting drywall; and installation of a new vapor barrier above sheetrock. These repairs will address the mold/moisture that impacts safe/healthy air quality for persons in the lab.</p>
<p>UPPER MIDWEST ENVIRONMENTAL SCIENCE CENTER LAND (UMESC), WI \$180</p>	<p>Connection to Municipal Water Supply (B20033CW1B): Connect the UMESC to the local municipal water supply. The Center has three wells that currently serve both process and potable water requirements of the Center. Connection to the nearby municipal water system will provide potable water meeting all requirements and is more cost effective than the design, installation, and maintenance of a new potable water treatment system. Significant plumbing modifications are required within the facilities to separate the potable water from the process water system (currently they are all one system). Extension of the underground water line from the connection point under a paved area adjacent the Center property into the facility (approximately 1,000 feet) which will require excavation and restoration of lawn areas, paved areas, sidewalk, and landscaped areas. The removal and disposal of existing components will be included in this project in accordance with Federal regulations.</p>
<p>LEETOWN SCIENCE CENTER (LSC), WV \$94</p>	<p>Repair Boilers and Repair Interior of Maintenance Building (B20010017): This project provides for replacing three boilers which are in poor condition (one failed and was replaced in FY02). Boiler replacement includes repair or replacement of hose connections, piping insulation and valves, and installation of disconnects on all heater motors in building. Safety and reliability of existing boilers are questionable. Project also provides for replacement of suspended ceiling; cleaning and painting of all walls (2,800 sf) concrete floors (2,400 sf), door frames, etc., carpet replacement (150 sf); replacement of pre-fabricated kitchen unit and replace wall coverings (1,000 sf).</p>
<p>TUNISON LABORATORY OF AQUATIC SCIENCE ENTRANCE ROAD AND PARKING LOT (TLAS), NY \$184</p>	<p>Regrade and Resurface Deteriorating Roadway at the Tunison Laboratory of Aquatic Science (B20060018G): The winding roadway approximately 500 feet long into the Tunison Laboratory of Aquatic Science (TLAS) facility is on a very steep slope, and the road surface is extremely hazardous during inclement winter or weather conditions. The road receives heavy traffic, to include area school buses that bring school students to the nature center and to their environmental careers classes housed at TLAS. The surface of the road and the parking lot has degraded and is crumbling which makes maintenance and safe passage in winter a major problem. The road and the parking lot need re-graded and resurfaced with overlay asphalt surfaces. In addition, install new drain piping, curbing and excavation work to improve the roadway and parking lots.</p>

2010 Equipment Projects

<p>600 SITES NATIONWIDE \$240</p>	<p>Repair OR Replace Cablecars (W1998A10000): Revised load test reveal that the 600 cablecars in active use nationwide could fail under adverse field conditions such as snagged cables during flood conditions. Depending on their design and condition, cablecars will be repaired or replaced. Interim actions have begun where risk is the highest, but all 600 cars will require either retrofit or replacement.</p>
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Deferred Maintenance and Capital Improvement

NORTHERN CALIFORNIA SEISMIC NETWORK \$200	Replace Network Analog and Microwave Stations (G987160001): Replace earthquake network stations that provide seismic monitoring and (or) warning for large metropolitan areas. The requested funds would be used to replace existing equipment that has exceeded its expected life and that cannot be expected to operate continuously without increased failure rates. The current equipment, which supports the network, may fail during an emergency, which would limit or possibly prevent adequate response to other Federal agencies, local governments, the private sector, and public needs.
CONDITION ASSESSMENTS \$210	Condition Assessments/Engineering Support: Funding is proposed to complete condition assessments for the identification of maintenance and capital improvement needs and to provide engineering services support for funded facility projects.
MAINTENANCE MANAGEMENT SYSTEM \$500	Maintenance Management System: Funding is proposed to implement and maintain a maintenance management system that meets bureau reporting and oversight requirements.
PROJECT PLANNING \$200	Project Planning: Funding will be applied toward contract architectural, engineering and design services for complex projects particularly for developing project requirements and budget estimates.

Program Performance Overview

End Outcome Goal 5.2: Advance Modernization/Integration

End Outcome Measure / Intermediate Measure	Type	2005 Actual	2006 Actual	2007 Actual	2008 Plan	2008 Actual	2009 Plan	2010 President's Request	Change from 2009 Plan to 2010	Long-term Target 2013
Intermediate Outcome Measures and Bureau and Outcome Measures										
Facilities Improvement										
Overall condition of buildings and of structures (as measured by the FCI) that are mission critical and mission dependent (as measured by the API), with emphasis on improving the condition of assets with critical health and safety needs (SP)	A	UNK	0.150	0.124	0.133	0.134 68,4004/ 510,141	0.124 (63,500/ 509,616)	0.115 (58,612/ 510,141)	-0.009	0.086 43,923/ 510,141
Comment:	Performance will be impacted by ARRA funding. See the performance measures in the Program Plan behind the ARRA tab in the back of the budget.									
Percent of assets targeted for disposal that were disposed (SP) targeted/disposed	A	UNK	26%	100%	50% (8/19)	11.7% (17/2)	24% (25/6)	42% (19/8)	-24%	42% (12/5)
Efficiency and Other Output Measures										
# of bureau condition assessments in progress or completed (within a 5-year cycle) (Facilities)	C	9	+5 Cum 14	+9 Cum 23	+9 Cum 32	+10 Cum 33	+9 Cum 42	+6 Cum 6	-3	+25 Cum 31
Comment	A new 5-year cycle begins in 2010.									
# of deferred maintenance and capital improvements (cumulative) (Facilities)	C	53	67	70	80	76	87	123	+36	185

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Working Capital Fund Overview

The U.S. Geological Survey (USGS) Working Capital Fund (WCF) was established to allow for the efficient financial management of the components listed below. The WCF was made available for expenses necessary for furnishing materials, supplies, equipment, work, and services in support of USGS programs, and as authorized by law, to agencies of the Federal Government and others. The WCF consists of four components: Investment Component, Fee-for-Service Component, General Services Administration (GSA) Building Delegations Component and Enterprise Services Component, as follows:

Investment Component

- **Telecommunications Investments** — The Telecommunications Investments are used for telecommunication hardware, software, facilities, and services. Examples include replacement or expansion of automatic exchange systems and computerized network equipment such as switches, routers, and monitoring systems.
- **Equipment Investments** — The Equipment Investments are used for the acquisition, replacement, and expansion of equipment for USGS programs. Equipment may include, but is not limited to, hydrologic, geologic, and cartographic instruments; laboratory equipment; and computer hardware and software.
- **Facilities Investments** — The Facilities Investments support facility and space management investment expenses for USGS real property, including owned and leased space. Authorized investment expenses include nonrecurring and emergency repair, relocation of a facility, and facility modernization. The component does not include annual expenses such as rent, day-to-day operating expenses, recurring maintenance, or utilities. The investment component is not used to fund construction of buildings.
- **Publications Investments** — The Publications Investments are used for the preparation and production of technical publications reporting on the results of scientific data and research. Research projects typically are 3 to 5 years in duration, and planning the medium in which to report results occurs over the life of the project. The Publications Investment Component provides a mechanism for establishing an efficient, effective, and economical means of funding publications costs over the long term.

Fee-for-Service Component

- **National Water Quality Laboratory (NWQL)** — The NWQL conducts chemical analyses of water, sediments, and aquatic tissue for all USGS water district offices and other customers, including other USGS disciplines, other Interior bureaus, and government agencies. The NWQL also does biological classification for these customers. NWQL analysis services are provided on a reimbursable basis, with the price of services calculated to cover direct and indirect costs.
- **USGS Hydrologic Instrumentation Facility (HIF)** — The HIF provides hydrologic instrumentation on a fee-for-service basis. The facility provides its customers with hydrologic instruments that can be rented or purchased, maintains a technical expertise on instrumentation, and tests and evaluates instruments as they become available in the marketplace.

Working Capital Fund

- **Bureau Laboratories** — There are currently three laboratories in Eastern Region Water Research that perform gaseous dissolved chlorofluorocarbon measurements, environmental microbiology analyses and isotope-ratio measurements of water, sediments, rocks, and gases for all Water Resources Discipline (WRD) district offices, other USGS disciplines, and other Federal agencies.
- **National Training Center** — The National Training Center conducts USGS training programs. These programs include, but are not limited to, specialized training for USGS employees, cooperators, and international participants in many facets of hydrology, hydraulics, and water resources investigations, as well as computer applications, management and leadership seminars, and various workshops.
- **Drilling** — There are currently two drilling units, one is based in Lakewood, CO and one is based in Henderson, NV. The drilling units provide drilling services to conduct exploratory drilling for obtaining geologic samples and cores in difficult hydrogeologic environments and the emplacement of sampling devices and sub-surface sensors for hydrologic investigations.

GSA Building Delegations Component

- The GSA buildings delegation component is used to manage funds received under the delegated authority for the J.W. Powell Building and Advanced Systems Center in Reston, VA, as provided by 40 U.S.C. 121 (d) and (e) (formerly subsections 205 (d) and (e) of the Federal Property and Administrative Services Act of 1949, as amended, and 40 U.S.C. 486 (d) and (e), respectively). Delegated functions include building operations, maintenance, cleaning, overseeing fire and life safety, maintaining high voltage switchgear and fire alarms, recurring repairs, minor alterations, historic preservation, concessions, and energy management. Because of the size of the Reston buildings and the need to expend the facility funds in a manner corresponding to GSA's no-year funding (Federal Buildings Fund) mechanisms and the GSA National Capital Region long-range capital improvement plan, no-year funding is a prerequisite to administering the delegation. Public Law 104–208, Section 611, provides that, for the fiscal year ending September 30, 1997, and thereafter, any department or agency that has delegated authority shall retain that portion of the GSA rental payment available for operation, maintenance, and repair of the building and the funds shall remain available until expended. This WCF component was established to provide USGS with this no-year flexibility.

Enterprise Services Component

- The Enterprise Publishing Network (EPN) operates within the Enterprise Services Component. The EPN provides high quality publishing support for science information products while improving operational effectiveness and efficiencies. The EPN offers a complete range of publishing services to authors of USGS information products and others. Services include consultation, technical editing, illustrating, layout and design, Web services, printing management/distribution, electronic publishing as well as other publishing needs.

The WCF Investment Component provides a mechanism to assist USGS managers in planning for and acquiring goods and services that are too costly to acquire in a single fiscal year or that, due to the nature of services provided must operate in a multi- as opposed to a single-year

basis of funding. Investments are supported by documented investment plans that include estimated acquisition/replacement costs, a schedule of deposits, and approval of the plans, deposits and expenditures by designated USGS officials. The WCF Fee-for-Service Component provides a continuous cycle of client services for fees established in a rate-setting process and, in some cases, with funding provided by appropriated funds. Fees are predicated upon both direct and indirect costs associated with providing the services, including amortization of equipment required to provide the services. The GSA buildings delegation component is used to manage funds received under the delegated authority for the J.W. Powell Building and Advanced Systems Center in Reston, VA, as provided by 40 U.S.C. 121 (d) and (e) (formerly subsections 205 (d) and (e) of the Federal Property and Administrative Services Act of 1949, as amended, and 40 U.S.C. 486 (d) and (e), respectively). Delegated functions include building operations, maintenance, cleaning, overseeing fire and life safety, maintaining high voltage switchgear and fire alarms, recurring repairs, minor alterations, historic preservation, concessions, and energy management. The Enterprise Services component operates in a businesslike manner, recovering fees for various consolidated services provided to USGS disciplines and other Federal agencies. By leveraging these services through a unified effort, USGS achieves cost and business efficiencies that would otherwise be lost.

Appropriation Language and Citations

Permanent authority:

1. Provided further, That, in fiscal year 1986, and thereafter, all amortization fees resulting from the Geological Survey providing telecommunications services shall be deposited in a special fund to be established on the books of the Treasury and be immediately available for payment of replacement or expansion of telecommunications services, to remain available until expended.
 - **43 U.S.C.50a** This authority established the Telecommunications Amortization Fund, which was displayed as part of the Surveys, Investigations and Research appropriation from 1986 through 1990. Beginning in 1991, the Telecommunications Amortization Fund was merged into the WCF described in the next citation.
2. There is hereby established in the Treasury of the United States a working capital fund to assist in the management of certain support activities of the United States Geological Survey (hereafter referred to as the "Survey"), Department of the Interior. The fund shall be available on and after November 5, 1990, without fiscal year limitation for expenses necessary for furnishing materials, supplies, equipment, work, facilities, and services in support of Survey programs, and, as authorized by law, to agencies of the Federal Government and others. Such expenses may include laboratory modernization and equipment replacement, computer operations, maintenance, and telecommunications services; requirements definition, systems analysis, and design services; acquisition or development of software; systems support services such as implementation assistance, training, and maintenance; acquisition and replacement of computer, publications and scientific instrumentation, telecommunications, and related automatic data processing equipment; and, such other activities as may be approved by the Secretary of the Interior.

There are authorized to be transferred to the fund, at fair and reasonable values at the time of transfer, inventories, equipment, receivables, and other assets, less liabilities, related to the functions to be financed by the fund as determined by the Secretary of the Interior. Provided, That the fund shall be credited with appropriations and other funds of the Survey, and other agencies of the Department of the Interior, other Federal agencies, and other sources, for providing materials, supplies, equipment, work, and other services as authorized by law and such payments may be made in advance or upon performance: Provided further, That charges to users will be at rates approximately equal to the costs of furnishing the materials, supplies, equipment, facilities, and services, including such items as depreciation of equipment and facilities, and accrued annual leave: Provided further, That all existing balances as of November 5, 1990, from amortization fees resulting from the Survey providing telecommunications services and deposited in a special fund established on the books of the Treasury and available for payment of replacement or expansion of telecommunications services as authorized by Public Law 99-190, are hereby transferred to and merged with the working capital fund, to be used for the same purposes as originally authorized. Provided further, That funds that are not necessary to carry out the activities to be financed by the fund, as determined by the Secretary, shall be covered into miscellaneous receipts of the Treasury.

P.L. 101-512 Department of the Interior and Related Agencies Appropriations Act, 1991 This authority established a Working Capital Fund account in 1991. The Telecommunications Amortization Fund was included as part of the WCF and all balances of the Telecommunications Amortization Fund existing at the end of 1990 were transferred to the WCF. These balances were to be used for the same purposes as originally authorized.

P.L. 103-332 Department of the Interior and Related Agencies Appropriations Act, 1995 The amendments that were made in this appropriations act are shown in underline in the second citation shown above. This authority expanded the use of the Working Capital Fund to partially fund laboratory operations and facilities improvements and to acquire and replace publication and scientific instrumentation and laboratory equipment.

Working Capital Fund

United States Geological Survey

Federal Funds

General and special funds:

WORKING CAPITAL FUND

Program and Financing

(In millions of dollars)

Identification Code		2008	2009	2010
14-4556-0-4-306		Actual	Estimate	Estimate
Obligations by program activity:				
09.01	Working Capital Fund	69	93	89
10.00	Total new obligations	69	93	89
Budgetary resources available for obligation:				
21.40	Unobligated balance carried forward, start of year	85	89	86
22.00	New budget authority (gross)	72	90	78
22.10	Resources available from recoveries of prior year			
	Obligations	1	0	0
23.90	Total budgetary resources available for obligation	158	179	164
23.95	Total new obligations	-69	-93	-89
24.40	Unobligated balance carried forward, end of year	89	86	75
New budget authority (gross), detail				
Mandatory:				
69.00	Offsetting collections (cash)	72	90	78
Change in obligated balances:				
72.40	Obligated balance, start of year	14	17	35
73.10	Total new obligations	69	93	89
73.20	Total outlays (gross)	-65	-75	-67
73.45	Recoveries of prior year obligations	-1	0	0
74.40	Obligated balance, end of year	17	35	57
Outlays (gross), detail:				
86.97	Outlays from new mandatory authority	39	58	47
86.98	Outlays from mandatory balances	26	17	20
87.00	Total outlays (gross)	65	75	67
Offsets:				
Against gross budget authority and outlays:				
Offsetting collections (cash) from:				
88.00	Federal sources	72	90	78
Net budget authority and outlays:				
89.00	Budget authority	0	0	0
90.00	Outlays	-7	-15	-11

WORKING CAPITAL FUND

Balance Sheet

(In millions of dollars)

Identification Code		2007	2008
14-4556-0-4-306		Actual	Actual
ASSETS:			
	Federal assets:		
1101	Fund balances with Treasury	98	105
	Investments in U.S. securities:		
1106	Receivables, net		
1803	Other Federal assets: Property, plant and equipment, net	13	16
1999	Total assets	111	121
LIABILITIES:			
2101	Federal liabilities: Accounts payable		
2201	Non-Federal liabilities: Accounts payable	3	3
2999	Total liabilities	3	3
NET POSITION:			
3300	Cumulative results of operations	108	118
3999	Total net position	108	118
4999	Total liabilities and net position	111	121

Working Capital Fund

WORKING CAPITAL FUND

Object Classification

(In millions of dollars)

Identification Code		2008	2009	2010
14-4556-0-4-306		Actual	Estimate	Estimate
Reimbursable obligations:				
Personnel compensation:				
11.1	Full-time permanent	10	22	23
11.3	Other than full-time permanent	1	1	1
11.5	Other personnel compensation	1	1	1
11.9	Total personnel compensation	12	24	25
12.1	Civilian personnel benefits	3	6	6
13.0	Benefits for former personnel	0	1	1
21.0	Travel and transportation of persons	1	1	1
22.0	Transportation of things	1	1	1
23.1	Rental payments to GSA	2	2	2
23.2	Rental payments to others	1	1	1
23.3	Communications, utilities, and miscellaneous charges	1	1	1
24.0	Printing and reproduction	2	3	2
25.2	Other services	9	8	7
25.3	Other purchases of goods and services from Government			
	Accounts	2	3	3
25.4	Operation and maintenance of facilities	5	5	5
25.7	Operation and maintenance of equipment	2	2	2
26.0	Supplies and materials	4	4	5
31.0	Equipment	24	31	27
99.0	Reimbursable obligations	69	93	89
99.9	Total new obligations	69	93	89

WORKING CAPITAL FUND

Employment Summary

Identification Code		2008	2009	2010
14-4556-0-4-306		Actual	Estimate	Estimate
Reimbursable:				
2001	Civilian full-time equivalent employment	157	312	307

Summary of Requirements by Object Class

SURVEYS, INVESTIGATIONS, AND RESEARCH

Summary of Requirements by Object Class

(Millions of Dollars)

Appropriation: Surveys, Investigations, and Research		2009 Estimate		Fixed Costs & Related Changes		Program Changes		2010 Request	
Object Class		FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
	Personnel compensation								
11.1	Full-time permanent		418		10		7		435
11.3	Other than full-time permanent		38		1		-2		37
11.5	Other personnel compensation		13		0		0		13
	Total personnel compensation	5,354	469	-12	11	76	5	5,418	485
12.1	Civilian personnel benefits		125		5		1		131
13.0	Benefits for former personnel		1		0		1		2
21.0	Travel and transportation of persons		26		0		1		27
22.0	Transportation of things		5		0		1		6
23.1	Rental payment to GSA		56		4		0		60
23.2	Rental payments to others		5		0		0		5
23.3	Comm., utilities and misc. charges		12		0		1		13
24.0	Printing and reproduction		4		0		1		5
25.1	Advisory and assistance services		11		0		0		11
25.2	Other services		173		1		-27		147
25.3	Other purchases of goods and services from Government accounts		52		0		0		52
25.4	Operation and maintenance of Facilities		4		0		0		4
25.7	Operation and maintenance of Equipment		8		0		0		8
26.0	Supplies and materials		33		0		-8		25
31.0	Equipment		83		0		-45		38
32.0	Land and structures		26		0		-25		1
41.0	Grants, subsidies, and contributions		91		0		-13		78
	Total requirements		1,184*		21		-107		1,098

This information is displayed in budget authority (not obligations) by object class.

* The funding for the American Recovery and Reinvestment Act of 2009 (\$140 million) is included above.

Surveys, Investigations, and Research — Exhibits

SURVEYS, INVESTIGATIONS, AND RESEARCH

Summary of Requirements by Object Class cont'd

(Millions of Dollars)

Appropriation: Surveys, Investigations, and Research

Reimbursable Obligations		2009 Estimate		2010 Request		Increase or Decrease	
		FTE	Amount	FTE	Amount	FTE	Amount
Personnel compensation							
11.1	Full-time permanent		164		169		5
11.3	Other than full-time permanent		25		25		0
11.5	Other personnel compensation		5		5		0
	Total personnel compensation	2,672	194	2,672	199	0	5
12.1	Civilian personnel benefits		50		51		1
21.0	Travel and transportation of persons		12		12		0
22.0	Transportation of things		5		5		0
23.1	Rental payments to GSA		17		17		0
23.2	Rental payments to others		2		2		0
23.3	Communications, utilities and miscellaneous charges		4		4		0
24.0	Printing and reproduction		3		3		0
25.1	Advisory and assistance services		2		2		0
25.2	Other services		57		54		-3
25.3	Other purchases of goods and services from Government accounts		38		36		-2
25.4	Operation and maintenance of facilities		1		1		0
25.7	Operation and maintenance of equipment		3		3		0
26.0	Supplies and materials		13		13		0
31.0	Equipment		10		10		0
41.0	Grants, subsidies, and contributions		35		35		0
	Total requirements		446		447		1

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing

(Millions of Dollars)

Identification Code		2008	2009	2010
14-0804-0-1-306		Actual	Estimate	Estimate
Obligations by program activity:				
Direct program:				
00.01	Geographic research, investigations, and remote Sensing	76	72	139
00.02	Geologic hazards, resources, and processes	242	238	249
00.03	Water resources investigations	214	215	227
00.04	Biological research	182	182	198
00.05	Enterprise information	106	109	51
00.06	Global change	5	41	57
00.07	Science support	64	69	69
00.08	Facilities	98	103	106
00.09	Recovery Act activities	0	56	84
09.01	Reimbursable program	459	446	447
10.00	Total new obligations	1,446	1,531	1,627
Budgetary resources available for obligation:				
21.40	Unobligated balance carried forward, start of year	30	466	565
21.45	Adjustments to unobligated balance carried forward, start of year	246	0	0
22.00	New budget authority (gross)	1,733	1,630	1,545
22.22	Unobligated balance transferred from other accounts [72-1021]	5	0	0
23.90	Total budgetary resources available for obligation	2,014	2,096	2,110
23.95	Total new obligations	-1,446	-1,531	-1,627
23.98	Unobligated balance expiring or withdrawn	-102	0	0
24.40	Unobligated balance carried forward, end of year	466	565	483
New budget authority (gross), detail:				
Discretionary:				
40.00	Appropriation	1,022	1,044	1,098
40.01	Appropriation, Recovery Act	0	140	0
40.35	Appropriation permanently reduced (H.R. 2764)	-16	0	0
43.00	Appropriation (total discretionary)	1,006	1,184	1,098
Spending authority from offsetting collections:				
58.00	Offsetting collections (cash)	331	446	447
58.10	Change in uncollected customer payments from Federal sources (unexpired)	396	0	0
58.90	Spending authority from offsetting collections (total discretionary)	727	446	447
70.00	Total new budget authority (gross)	1,733	1,630	1,545

Surveys, Investigations, and Research — Exhibits

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing cont'd

(Millions of Dollars)

Identification Code		2008	2009	2010
14-0804-0-1-306		Actual	Estimate	Estimate
	Change in obligated balances:			
72.40	Obligated balance, start of year	137	-385	-358
72.45	Adjustment to obligated balance, start of year	-246	0	0
73.10	Total new obligations	1,446	1,531	1,627
73.20	Total outlays (gross)	-1,437	-1,504	-1,637
73.40	Adjustments in expired accounts (net)	-3	0	0
74.00	Change in uncollected customer payments from Federal sources (unexpired)	-396	0	0
74.10	Change in uncollected customer payments from Federal Sources (expired)	114	0	0
74.40	Obligated balance, end of year	-385	-358	-368
	Outlays (gross), detail:			
86.90	Outlays from new discretionary authority	1,176	1,346	1,359
86.93	Outlays from discretionary balances	259	155	277
86.98	Outlays from mandatory authority	2	3	1
87.00	Total outlays (gross)	1,437	1,504	1,637
	Offsets:			
	Against gross budget authority and outlays:			
	Offsetting collections (cash) from:			
88.00	Federal sources	-229	-232	-232
88.40	Non-Federal sources	-215	-214	-215
88.90	Total, offsetting collections (cash)	-444	-446	-447
	Against gross budget authority only:			
88.95	Change in uncollected customer payments from Federal sources (unexpired)	-396	0	0
88.96	Portion of offsetting collections (cash) credited to expired account	113	0	0
	Net budget authority and outlays:			
89.00	Budget authority	1,006	1,184	1,098
90.00	Outlays	993	1,058	1,190
95.02	Unpaid obligation, end of year	305		

SURVEYS, INVESTIGATIONS, AND RESEARCH

Object Classification

(Millions of Dollars)

Identification Code		2008	2009	2010
14-0804-0-1-306		Actual	Estimate	Estimate
Direct obligations:				
Personnel compensation:				
11.1	Full-time permanent	403	418	435
11.3	Other than full-time permanent	33	36	39
11.5	Other personnel compensation	12	13	13
11.9	Total personnel compensation	448	467	487
12.1	Civilian personnel benefits	118	124	132
13.0	Benefits for former personnel	2	1	2
21.0	Travel and transportation of persons	26	26	27
22.0	Transportation of things	5	5	6
23.1	Rental payments to GSA	53	56	60
23.2	Rental payment to others	5	5	5
23.3	Comm., utilities, and miscellaneous charges	12	12	13
24.0	Printing and reproduction	4	4	5
25.1	Advisory and assistance services	11	11	11
25.2	Other services	126	140	163
25.3	Other purchases of goods and services from Government Accounts	48	52	52
25.4	Operation and maintenance of facilities	4	4	4
25.7	Operation and maintenance of equipment	8	8	8
26.0	Supplies and materials	20	27	31
31.0	Equipment	30	53	68
32.0	Land and structures	1	11	16
41.0	Grants, subsidies, and contributions	66	79	90
99.0	Direct obligations	987	1,085	1,180

Surveys, Investigations, and Research — Exhibits

SURVEYS, INVESTIGATIONS, AND RESEARCH

Object Classification cont'd

(Millions of Dollars)

Identification Code		2008	2009	2010
14-0804-0-1-306		Actual	Estimate	Estimate
Reimbursable obligations:				
Personnel compensation:				
11.1	Full-time permanent	164	164	169
11.3	Other than full-time permanent	24	25	25
11.5	Other personnel compensation	5	5	5
11.9	Total personnel compensation	193	194	199
12.1	Civilian personnel benefits	49	50	51
21.0	Travel and transportation of persons	12	12	12
22.0	Transportation of things	5	5	5
23.1	Rental payments to GSA	17	17	17
23.2	Rental payments to others	2	2	2
23.3	Comm., utilities, and miscellaneous charges	4	4	4
24.0	Printing and reproduction	3	3	3
25.1	Advisory and assistance services	2	2	2
25.2	Other services	66	57	54
25.3	Other purchases of goods and services from Government accounts	44	38	36
25.4	Operation and maintenance of facilities	1	1	1
25.7	Operation and maintenance of equipment	3	3	3
26.0	Supplies and materials	13	13	13
31.0	Equipment	10	10	10
41.0	Grants, subsidies, and contributions	35	35	35
99.0	Reimbursable obligations	459	446	447
99.9	Total new obligations	1,446	1,531	1,627

SURVEYS, INVESTIGATIONS, AND RESEARCH

Employment Summary

Identification Code		2008	2009	2010
14-0804-0-1-306		Actual	Estimate	Estimate
	Direct:			
1001	Civilian full-time equivalent employment	5,416	5,354	5,418
	Reimbursable:			
2001	Civilian full-time equivalent employment	2,752	2,672	2,672
	Allocation account:			
3001	Civilian full-time equivalent employment	11	11	11

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Funding of U.S. Geological Survey Programs (Obligations)

**Funding of U.S. Geological Survey Programs
(Obligations)**
(Thousands of Dollars)

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Geographic Research, Investigations, and Remote Sensing			
Multi-Year appropriation	36,395	31,719	98,777
No-Year appropriation	39,602	40,211	40,150
Subtotal (appropriation)	75,997	71,930	138,927
<i>Non-Federal (Domestic) sources</i>			
Sale of photos, reproductions, and digital products	5,537	1,650	0
Optical calibration	417	593	593
Technology transfer	0	50	50
Miscellaneous	352	289	746
Subtotal (non-Federal domestic sources)	6,306	2,582	1,389
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	1,640	1,640	1,640
Subtotal (non-Federal foreign sources)	1,640	1,640	1,640
<i>State and local sources</i>			
Unmatched	167	230	5,856
Subtotal (State and local sources)	167	230	5,856
<i>Federal sources</i>			
Agency for International Development	2,213	2,038	2,081
Central Intelligence Agency	996	996	996
Department of Agriculture	440	240	804
Department of Commerce			
National Oceanic and Atmospheric Administration	14	46	213
Other	20	20	187
Department of Defense			
Corps of Engineers	109	109	418
National Geospatial-Intelligence Agency	646	646	7,041
Other	72	72	181
Department of Education	0	0	15
Department of Energy	27	49	92
Department of Homeland Security			
Federal Emergency Management Agency	86	86	834
Other	906	907	1,071
Department of the Interior			
Bureau of Land Management	449	518	535
Bureau of Reclamation	497	396	299
Fish and Wildlife Service	622	740	590
National Park Service	965	971	974
Office of Secretary	2,780	2,793	4,254
Department of Justice	0	0	64
Department of Labor	0	0	17

Exhibits

	2008 Actual	2009 Estimate	2010 Estimate
Department of State	0	0	36
Department of Transportation	0	0	64
Department of Treasury	0	0	15
Department of Veterans Affairs	0	0	15
Environmental Protection Agency	606	657	866
General Services Administration	0	0	41
Health and Human Services	86	86	150
Housing and Urban Development	0	0	36
National Aeronautics and Space Administration	9,138	9,039	9,039
National Science Foundation	162	162	162
Sale of maps, photos, reproductions, and digital products	2,842	1,650	0
Optical calibration	7	7	7
Remote sensing data purchases	88	2	0
Miscellaneous	23	23	445
Subtotal (Federal sources)	23,794	22,253	31,542
Total: Geographic Research, Investigations, and Remote Sensing	107,904	98,635	179,354

Funding of U.S. Geological Survey Programs (Obligations)

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Geologic Hazards, Resources, and Processes:			
Multi-Year appropriation	234,349	234,319	246,642
No-Year appropriation	503	863	1,000
Subtotal (appropriation) *	234,852	235,182	247,642
<i>Non-Federal (Domestic) sources</i>			
Permittees & licensees of the Fed Energy Regulatory Commission	397	409	424
Technology transfer	1,946	2,064	2,129
Miscellaneous	943	983	983
Subtotal (non-Federal domestic sources)	3,286	3,456	3,536
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	979	967	969
Subtotal (non-Federal foreign sources)	979	967	969
<i>State and local sources</i>			
Matched	2,718	2,718	2,718
Unmatched	7,879	8,449	8,779
Subtotal (State and local sources)	10,597	11,167	11,497
<i>Federal sources</i>			
Agency for International Development	45	0	0
Department of Agriculture	110	103	97
Department of Commerce			
National Oceanic and Atmospheric Administration	1,113	197	159
Other	372	200	110
Department of Defense			
Corps of Engineers	705	855	878
National Geospatial-Intelligence Agency	309	285	195
Other	3,888	4,314	4,241
Department of Energy	819	866	837
Department of Homeland Security	0	50	0
Department of the Interior			
Bureau of Indian Affairs	87	87	87
Bureau of Land Management	319	336	322
Bureau of Reclamation	170	187	194
Fish and Wildlife Service	178	210	210
Minerals Management Service	169	207	212
National Park Service	1,022	1,201	1,218
Department of State	930	1,192	1,234
Department of Veterans Affairs	57	63	69
Environmental Protection Agency	753	674	1,062
Federal Aviation Administration	2,236	0	0
General Services Administration	68	34	31
Housing and Urban Development	38	0	0
National Aeronautics and Space Administration	4,882	6,001	6,362
National Science Foundation	905	1,071	1,099

Exhibits

	2008 Actual	2009 Estimate	2010 Estimate
Nuclear Regulatory Commission	1,279	1,189	1,049
Miscellaneous agencies	1	0	0
Subtotal (Federal sources)	20,455	19,322	19,666
Total: Geologic Hazards, Resources, and Processes	270,169	270,094	283,310

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2008 \$2,291; FY 2009 \$2,539; and FY 2010 \$1,000.

Funding of U.S. Geological Survey Programs (Obligations)

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources Investigations:			
Multi-Year appropriation	212,170	214,219	227,424
No-Year appropriation	1,606	283	0
Subtotal (appropriation)	213,776	214,502	227,424
<i>Non-Federal (Domestic) sources</i>			
Permittees & licensees of the Federal Energy Regulatory Commission	3,824	4,133	4,488
Technology Transfer	302	307	309
Miscellaneous	2,762	2,761	2,761
Subtotal (non-Federal domestic sources)	6,888	7,201	7,558
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	1,001	1,001	1,001
Subtotal (non-Federal foreign sources)	1,001	1,001	1,001
<i>State and local sources</i>			
Matched	62,849	64,078	65,561
Matched (In-Kind Services – NON ADD)	433	433	433
Unmatched	111,202	112,635	115,237
Subtotal (State and local sources)	174,051	176,713	180,798
<i>Federal sources</i>			
Agency for International Development	381	383	383
Central Intelligence Agency	608	562	562
Department of Agriculture	2,093	1,977	1,937
Department of Commerce			
National Oceanic and Atmospheric Administration	948	902	902
Department of Defense			
Corps of Engineers	25,801	25,175	25,887
National Geospatial-Intelligence Agency	800	754	754
Other	10,929	10,483	10,713
Department of Energy			
Bonneville Power Administration	61	61	61
Other	14,280	14,063	14,601
Department of Homeland Security			
Federal Emergency Management Agency	1,533	1,456	1,436
Department of the Interior			
Bureau of Indian Affairs	634	545	382
Bureau of Land Management	3,572	3,931	4,541
Bureau of Reclamation	12,389	11,819	11,844
Fish and Wildlife Service	1,275	1,239	1,249
Minerals Management Service	0	0	1,142
National Park Service	3,549	3,125	1,881
Office of Secretary	69	70	72
Office of Surface Mining	17	17	17
Department of Justice	22	22	22
Department of State	1,272	1,226	1,226

Exhibits

	2008 Actual	2009 Estimate	2010 Estimate
Environmental Protection Agency	12,637	11,925	11,808
General Services Administration	3	3	3
Health and Human Services	146	146	146
National Aeronautics and Space Administration	502	456	456
National Science Foundation	6	6	6
Tennessee Valley Authority	85	85	85
Miscellaneous agencies	968	884	884
Subtotal (Federal sources)	94,580	91,315	93,000
Total: Water Resources Investigations	490,296	490,732	509,781

Funding of U.S. Geological Survey Programs (Obligations)

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Biological Research:			
Multi-Year appropriation	181,779	182,045	198,298
No-Year appropriation	270	168	0
Subtotal (appropriation)	182,049	182,213	198,298
<i>Non-Federal (Domestic) sources</i>			
Permittees & licensees of the Federal Energy Regulatory Commission	562	562	562
Technology Transfer	443	461	480
Miscellaneous	20	20	20
Subtotal (non-Federal domestic sources)	1,025	1,043	1,062
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	14	16	18
Subtotal (non-Federal foreign sources)	14	16	18
<i>State and local sources</i>			
Matched	135	135	135
Unmatched	7,968	8,100	8,237
Subtotal (State and local sources)	8,103	8,235	8,372
<i>Federal sources</i>			
Department of Agriculture	1,731	1,640	1,647
Department of Commerce			
National Oceanic and Atmospheric Administration	448	419	422
Other	299	299	299
Department of Defense			
Corps of Engineers	15,789	15,251	15,413
Other	13,178	12,625	12,735
Department of Energy			
Bonneville Power Administration	1,470	1,448	1,491
Other	253	252	260
Department of the Interior			
Bureau of Indian Affairs	74	74	74
Bureau of Land Management	5,214	5,087	5,222
Bureau of Reclamation	13,948	13,608	13,953
Fish & Wildlife Service	8,769	8,430	8,511
Minerals Management Service	548	526	537
National Park Service	3,886	3,739	3,785
Office of the Secretary	509	478	479
Department of Justice	4	4	4
Department of Transportation	162	167	171
Environmental Protection Agency	1,413	1,351	1,353
Health and Human Services	82	82	82
National Aeronautics and Space Administration	11	11	11
Nuclear Regulatory Commission	50	50	50
Miscellaneous	21	21	21
Subtotal (Federal sources)	67,859	65,562	66,520
Total: Biological Research	259,050	257,069	274,270

Exhibits

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Enterprise Information:			
Multi-Year appropriation	106,331	108,637	50,624
Subtotal (appropriation)	106,331	108,637	50,624
<i>Non-Federal (Domestic) sources</i>			
Map receipts	3,228	2,597	2,289
Miscellaneous	457	457	0
Subtotal (non-Federal domestic sources)	3,685	3,054	2,289
<i>State and local sources</i>			
Unmatched	5,621	5,621	0
Subtotal (State and local sources)	5,621	5,621	0
<i>Federal sources</i>			
Agency for International Development	43	43	0
Department of Agriculture	553	564	0
Department of Commerce			
National Oceanic and Atmospheric Administration	158	167	0
Other	158	167	0
Department of Defense			
Corps of Engineers	360	309	0
National Geospatial-Intelligence Agency	6,585	6,547	0
Other	109	109	0
Department of Education	15	15	0
Department of Energy	85	43	0
Department of Homeland Security			
Federal Emergency Management Agency	731	748	0
Other	64	164	0
Department of the Interior			
Bureau of Indian Affairs	748	1,269	1,269
Bureau of Land Management	1,735	1,684	1,684
Bureau of Reclamation	161	247	247
Fish and Wildlife Service	599	899	899
Minerals Management Service	80	117	117
National Park Service	594	901	901
Office of Secretary	1,643	1,585	0
Office of Surface Mining	80	154	154
U.S. Geological Survey			
Enterprise Publishing Network	7,700	0	0
Department of Justice	126	64	0
Department of Labor	2	17	0
Department of State	36	36	0
Department of Transportation	64	64	0
Department of Treasury	15	15	0
Department of Veterans Affairs	15	15	0
Environmental Protection Agency	239	203	0
General Services Administration	40	41	0

Funding of U.S. Geological Survey Programs (Obligations)

	2008 Actual	2009 Estimate	2010 Estimate
Health and Human Services	64	64	0
Housing and Urban Development	0	36	0
National Aeronautics and Space Administration	345	336	336
National Science Foundation	30	0	0
Sale of maps, photos, reproductions, and digital products	1,327	927	463
Miscellaneous agencies	433	422	0
Subtotal (Federal sources)	24,937	17,972	6,070
Total: Enterprise Information	140,574	135,284	58,983

Exhibits

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Global Change:			
Multi-Year appropriation	4,485	40,682	56,949
Subtotal (appropriation)	4,485	40,682	56,949
Total: Global Change	4,485	40,682	56,949
Science Support:			
Multi-Year appropriation	63,871	69,377	69,189
Subtotal (appropriation)	63,871	69,377	69,189
<i>Non-Federal (Domestic) sources</i>			
Technology Transfer	78	78	78
Miscellaneous	70	0	0
Subtotal (non-Federal domestic sources)	148	78	78
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	37	37	37
Subtotal (non-Federal foreign sources)	37	37	37
<i>Federal sources</i>			
Department of Defense			
Corps of Engineers	232	232	232
Department of Homeland Security	381	165	170
Department of Interior			
Bureau of Indian Affairs	131	156	164
Bureau of Land Management	94	94	94
Bureau of Reclamation	392	392	392
Minerals Management Service	71	80	82
National Park Service	69	69	69
Office of Secretary			
National Business Center	74	85	88
Other	1,145	3,236	1,239
Environmental Protection Agency	67	67	67
National Science Foundation	83	83	83
Miscellaneous	320	335	335
Subtotal (Federal sources)	3,059	4,994	3,015
Total: Science Support	67,115	74,486	72,319

Funding of U.S. Geological Survey Programs (Obligations)

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Facilities:			
Multi-Year appropriation	93,659	94,342	98,990
No-Year appropriation	4,634	8,655	7,321
Subtotal (appropriation)	98,293	102,997	106,311
<i>Federal sources</i>			
Central Intelligence Agency	302	316	320
Department of Interior			
Office of Secretary	634	861	869
Miscellaneous	88	0	0
Subtotal (Federal sources)	1,024	1,177	1,189
Total: Facilities	99,317	104,174	107,500
Surveys, Investigations, and Research (SIR), Recovery Act			
Recovery Act Activities:			
Multi-Year appropriation	0	56,000	84,000
Subtotal (appropriation)	0	56,000	84,000
Total: Recovery Act Activities	0	56,000	84,000
SIR Summary:			
Multi-Year appropriation	933,039	1,031,340	1,130,893
No-Year appropriation	46,615	50,180	48,471
Non-Federal sources			
Map receipts	3,228	2,597	2,289
Domestic	18,110	14,817	13,623
Foreign	3,671	3,661	3,665
State and local sources	198,539	201,966	206,523
Federal sources	235,708	222,595	221,002
Total: SIR *	1,438,910**	1,527,156	1,626,466

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2008 \$2,291; FY 2009 \$2,539; and FY 2010 \$1,000.

** FY 2008 does not include \$5,057 in obligations for the USAID unobligated balance transfer, which is included in the MAX obligations.

Exhibits

	2008 Actual	2009 Estimate	2010 Estimate
Surveys, Investigations, and Research (SIR)			
Contributed Funds:			
Permanent, indefinite appropriation:			
Geographic Research, Investigations, and Remote Sensing	33	0	5
Geologic Hazards, Resources, and Processes	326	167	51
Water Resources Investigations	318	419	317
Biological Research	1,843	1,581	1,095
Science Support	0	12	0
Total: Contributed Funds	2,520	2,179	1,468
Operation and Maintenance of Quarters:			
Permanent, indefinite appropriation:			
Geologic Hazards, Resources, and Processes	68	34	35
Biological Research	42	0	15
Total: Operation and Maintenance of Quarters	110	34	50
Working Capital Fund:			
National Water Quality Lab	16,217	14,364	15,793
Hydrologic Instrumentation Facility	20,502	17,550	19,092
Other	32,091	60,605	53,742
Total: Working Capital Fund	68,810	92,519	88,627
Allocations from other Federal Agencies: *			
Department of the Interior: Departmental Offices			
Natural Resource Damage Assessment	2,483	2,400	2,400
Total: Allocations	2,483	2,400	2,400

* Allocations are shown in the year they are received, not when they are obligated.

United States Geological Survey

Trust Funds

CONTRIBUTED FUNDS

Special and Trust Fund Receipts

(Millions of Dollars)

Identification Code		2008	2009	2010
14-8562-0-7-306		Actual	Estimate	Estimate
01.00	Balance, start of year	0	0	0
01.99	Balance, start of year	0	0	0
Receipts:				
02.20	Contributed funds, Geological Survey	3	2	2
04.00	Total: Balances and collections	3	2	2
Appropriations:				
05.00	Contributed funds	-3	-2	-2
07.99	Balance, end of year	0	0	0

Program and Financing

(Millions of Dollars)

Identification Code		2008	2009	2010
14-8562-0-7-306		Actual	Estimate	Estimate
Obligations by program activity:				
09.01	Donations and contributed funds	3	2	1
10.00	Total new obligations	3	2	1
Budgetary resources available for obligation:				
21.40	Unobligated balance carried forward, start of year	1	1	1
22.00	New budget authority (gross)	3	2	2
23.90	Total budgetary resources available for obligation	4	3	3
23.95	Total new obligations	-3	-2	-1
24.40	Unobligated balance carried forward, end of year	1	1	2
New budget authority (gross), detail:				
Mandatory:				
60.26	Appropriation (trust fund)	3	2	2

Exhibits

CONTRIBUTED FUNDS

Program and Financing cont'd
(Millions of Dollars)

Identification Code		2008	2009	2010
14-8562-0-7-306		Actual	Estimate	Estimate
	Change in obligated balances:			
72.40	Obligated balance, start of year	1	2	1
73.10	Total new obligations	3	2	1
73.20	Total outlays (gross)	-2	-3	-2
74.40	Obligated balance, end of year	2	1	0
	Outlays (gross), detail:			
86.97	Outlays from new mandatory authority	2	2	2
86.98	Outlays from mandatory balances	0	1	0
87.00	Total outlays (gross)	2	3	2
	Net budget authority and outlays:			
89.00	Budget authority	3	2	2
90.00	Outlays	2	3	2
95.02	Unpaid obligation, end of year	1	0	0

Object Classification
(Millions of Dollars)

Identification Code		2008	2009	2010
14-8562-0-7-306		Actual	Estimate	Estimate
	Direct obligations:			
	Personnel compensation:			
11.3	Other than full-time permanent	1	1	0
99.5	Below reporting threshold	2	1	1
99.9	Total new obligations	3	2	1

CONTRIBUTED FUNDS
Employment Summary

Identification Code		2008	2009	2010
14-8562-0-7-306		Actual	Estimate	Estimate
	Direct:			
1001	Civilian full-time equivalent employment	19	21	11

Employee Count by Grade (Total Employment)

	2008 Actual	2009 Estimate	2010 Estimate
Executive Level V.....	1	1	1
SES.....	26	26	27
Subtotal.....	27	27	28
SL - 00.....	10	11	12
ST - 00.....	37	37	40
Subtotal.....	47	48	52
GS/GM -15.....	546	535	538
GS/GM -14.....	777	762	766
GS/GM -13.....	1,287	1,261	1,268
GS -12.....	1,586	1,555	1,564
GS -11.....	1,310	1,284	1,292
GS -10.....	16	15	16
GS - 9.....	974	955	960
GS - 8.....	254	249	251
GS -7.....	645	632	636
GS - 6.....	236	231	232
GS - 5.....	360	353	355
GS - 4.....	259	254	256
GS - 3.....	131	129	129
GS - 2.....	49	48	49
GS -1.....	27	26	26
Subtotal.....	8,458	8,290	8,336
Other Pay Schedule Systems.....	256	256	256
Total employment (actual/estimate).....	8,788	8,621	8,672

Mandatory Budget and Offsetting Collection Proposals

The USGS does not have any legislative proposals in the 2010 President's budget that impact receipts or mandatory spending levels.

Program/Project Support of Bureau, Department, and Governmentwide Costs

External Administrative Costs

The Department's Working Capital Fund was established pursuant to 43 U.S.C. 1467, to provide common administrative and support services efficiently and economically at cost. The Fund is a revolving fund, whereby capital is expended to provide services for customers who pay for the services. Customers consist of the Department's bureaus and offices, as well as other Federal agencies. Through the use of centrally provided services, the Department standardized key administrative areas, such as commonly used administrative systems, support services for those located in and around the Main and South Interior building complex, and centrally managed departmental operations that are beneficial to the bureaus and offices.

Centralized billing is used whenever the product or service being provided is not severable or it is inefficient to bill for the exact amount of product or service being procured. Customers are billed each year using a pre-established basis that is adjusted annually to reflect change over time. The following table provides the actual centralized billing to the USGS for 2008 and estimates for 2009 and 2010. The change between 2009 and 2010 is fully funded through a mixture of uncontrollable and program changes.

Program/Project Support of Bureau, Department, and Governmentwide Costs

**Working Capital Fund Revenue
Centralized Billing
Geological Survey
(\$ in thousands)**

Activity/Office	2008 Actual	2009 Estimate	2010 Estimate
Other OS Activities			
Invasive Species Council	206.6	218.9	226.7
<u>Invasive Species Coordinator</u>	<u>34.6</u>	<u>35.6</u>	<u>38.5</u>
Secretary's Immediate Office	241.2	254.6	265.2
<u>Document Management Unit</u>	<u>0.1</u>	<u>8.1</u>	<u>6.5</u>
Office of the Exeditive Secretariat	0.1	8.1	6.5
Alaska Field Office	11.8	13.3	12.4
<u>Alaska Resources Library and Information Services</u>	<u>166.4</u>	<u>166.4</u>	<u>166.4</u>
Secretary's Immediate Office	178.2	179.7	178.8
<u>Departmental Communications Office</u>	<u>89.3</u>	<u>92.1</u>	<u>97.9</u>
Office of Communications	89.3	92.1	97.9
Southern Nevada Water Coordinator	39.0	39.9	41.8
<u>Conservation Partnerships and Management Policy</u>	<u>30.0</u>	<u>30.3</u>	<u>31.5</u>
Policy, Management and Budget	69.0	70.2	73.2
Environmental and Disposal Liabilities	0.0	0.0	0.4
<u>FedCenter</u>	<u>0.0</u>	<u>2.7</u>	<u>2.7</u>
Office of Environmental Policy and Compliance	0.0	2.7	3.1
<u>CPIC</u>	<u>16.1</u>	<u>19.5</u>	<u>22.4</u>
Office of Budget	16.1	19.5	22.4
Activity Based Costing/Management	127.3	123.0	122.1
Travel Management Center	48.7	51.0	25.7
<u>e-Gov Travel</u>	<u>182.2</u>	<u>364.3</u>	<u>110.3</u>
Office of Financial Management	358.1	538.3	258.1
Quarters Program	2.4	0.0	0.0
Interior Collections Management System	2.5	2.5	2.5
Space Management Initiative	32.9	37.3	40.2
Renewable Energy Certificates	23.7	22.9	11.4
<u>Facility Maintenance Management System</u>	<u>0.0</u>	<u>2.4</u>	<u>0.6</u>
Office of Property and Acquisition Management	61.6	65.2	54.7
<u>SBA Certifications</u>	<u>0.9</u>	<u>0.9</u>	<u>0.9</u>
Small and Disadvantage Business Utilization	0.9	0.9	0.9
<u>Planning and Performance Management</u>	<u>145.5</u>	<u>137.4</u>	<u>150.9</u>
Office of Planning and Performance Management	145.5	137.4	150.9
<u>Alternative Dispute Resolution Training</u>	<u>0.0</u>	<u>12.0</u>	<u>6.0</u>
Office of Collaborative Action and Dispute Resolution	0.0	12.0	6.0
<u>Center for Competition, Efficiency, and Analysis</u>	<u>78.6</u>	<u>79.7</u>	<u>68.4</u>
Center for Competition, Efficiency, and Analysis	78.6	79.7	68.4
HSPD-12	125.8	107.4	87.7
Department-wide OWCP Coordination	9.3	28.4	29.7
Accountability Team	0.0	52.0	59.7
DOI LEARN	22.5	97.0	46.8
CLC - Human Resources	4.2	0.0	0.0
<u>OPM Federal Employment Services</u>	<u>51.9</u>	<u>68.4</u>	<u>61.6</u>

**Working Capital Fund Revenue
Centralized Billing
Geological Survey
(\$ in thousands)**

Activity/Office	2008 Actual	2009 Estimate	2010 Estimate
Other OS Activities – con't			
Office of Human Resources	213.8	353.2	285.5
EEO Complaints Tracking System	3.0	3.5	0.0
Special Emphasis Program	4.9	5.9	5.9
<u>Accessible Technology Center</u>	<u>36.9</u>	<u>36.4</u>	<u>38.0</u>
Office of Civil Rights	44.8	45.8	43.8
Occupational Health and Safety	105.9	107.5	177.3
Health and Safety Training Initiatives	24.1	23.8	23.8
<u>Safety Management Information System</u>	<u>73.6</u>	<u>75.2</u>	<u>0.0</u>
Office of Occupational Health and Safety	203.6	206.5	201.1
Security (Classified Information Facility)	39.5	40.0	54.0
Law Enforcement Coordination and Training	68.1	68.1	103.9
Interior Operations Center (Watch Office)	146.7	186.3	232.1
Emergency Preparedness	162.1	69.0	82.8
<u>Emergency Response</u>	<u>0.0</u>	<u>90.4</u>	<u>104.0</u>
Law Enforcement and Security	416.4	453.9	576.7
Enterprise Services Network	4,656.2	3,251.3	3,166.3
Web & Internal/External Comm	72.5	70.5	54.0
Enterprise Architecture	503.1	569.2	522.6
FOIA Tracking & Reporting System	9.3	15.6	24.4
Threat Management	0.0	0.0	119.9
Frequency Management Support	99.1	111.4	105.9
IT Security	266.6	312.2	319.4
Capital Planning	195.4	348.5	265.9
Information Management Support	7.0	32.4	33.3
Data Resource Management Program	22.1	27.8	27.7
IT Security Certification & Accreditation	430.6	430.6	430.6
Electronic Records Management	139.8	162.0	165.2
Active Directory	162.6	150.3	175.5
Enterprise Resource Management	50.0	52.0	61.3
e-Authentication	0.0	39.0	41.5
NTIA Spectrum Management	190.2	164.7	152.0
IOS Collaboration	0.0	0.0	119.3
Chief Technology Officer Support	0.0	0.0	0.0
Network	0.0	212.0	228.3
Trusted Internet Connection	0.0	68.5	187.7
Data-at-Rest	0.0	55.8	5.0
Logging Extracts	0.0	21.3	44.1
OCIO Project Management Office	0.0	32.2	127.0
Radio Program Management Office	0.0	75.6	106.2
IT Asset Management	0.0	0.0	21.8
Continuous Monitoring	0.0	0.0	21.8
Two-Factor Authentication	0.0	74.0	8.6
<u>Active Directory Optimization</u>	<u>0.0</u>	<u>104.8</u>	<u>93.2</u>

Program/Project Support of Bureau, Department, and Governmentwide Costs

**Working Capital Fund Revenue
Centralized Billing
Geological Survey
(\$ in thousands)**

Activity/Office	2008 Actual	2009 Estimate	2010 Estimate
Other OS Activities – con't			
Office of the Chief Information Officer	6,804.7	6,381.7	6,628.7
Contingency Reserve	18.7	18.1	18.1
Cooperative Ecosystem Study Units	73.4	75.2	75.2
CFO Financial Statement Audit	558.6	565.6	548.9
Glen Canyon Adaptive Management	95.5	95.5	95.5
<u>Enterprise Geospatial Information Management</u>	<u>224.0</u>	<u>224.0</u>	<u>187.7</u>
Departmentwide Activities	970.2	978.4	925.4
e-Government Initiatives (WCF Contributions Only)	438.0	531.2	532.1
<u>Volunteer.gov</u>	<u>13.1</u>	<u>13.1</u>	<u>15.1</u>
Departmentwide Activities	451.0	544.3	547.2
Ethics Training	6.1	29.4	71.5
ALLEX Database	3.0	3.0	3.0
<u>FOIA Appeals</u>	<u>10.5</u>	<u>8.1</u>	<u>15.3</u>
Office of the Solicitor	19.6	40.5	89.7
Subtotal Other OS Activities	10,362.5	10,464.6	10,484.1

**Working Capital Fund Revenue
Centralized Billing
Geological Survey
(\$ in thousands)**

Activity/Office	2008 Actual	2009 Estimate	2010 Estimate
National Business Center			
Cultural Resources & Events Management	57.9	0.0	0.0
Financial Management Training	31.7	33.2	33.9
Learning and Performance Center Management	80.5	80.2	81.7
SESCDP & Other Leadership Programs	24.0	23.5	23.5
Albuquerque Learning & Performance Center	6.5	7.4	10.8
Anchorage Learning & Performance Center	8.3	11.8	13.4
Denver Learning & Performance Center	82.1	57.9	45.2
Online Learning	48.7	62.1	63.7
<u>Washington Learning & Performance Center</u>	<u>75.5</u>	<u>77.2</u>	<u>91.0</u>
NBC Human Resources Directorate	415.2	353.3	363.1
EEO Complaints Tracking System	0.0	0.0	4.2
DOI LEARN	0.0	0.0	79.9
NBC 106 Mainframe Replacement	0.0	116.7	0.0
Safety Management Information System	0.0	0.0	189.0
Labor Relations/OWCP Tracking System	0.0	0.0	6.9
NBC IT Security Improvement Plan	311.2	311.2	438.5
Voice/data Switching	1.9	2.2	2.2
Information Mgmt. - FOIA and Records Management	61.7	1.4	1.4
Telecommunication Services	7.7	9.2	9.5
Audio Visual Services	0.0	1.7	1.5
Integrated Digital Voice Communications System	3.4	4.9	5.0
SIB Cabling	0.0	2.4	0.3
<u>Desktop Services</u>	<u>22.1</u>	<u>0.0</u>	<u>23.9</u>
NBC Information Technology Directorate	408.0	449.8	762.2
FPPS/Employee Express - O&M	1,980.6	2,001.8	2,055.6
HR LoB W-2 Surcharge	115.3	126.3	84.5
<u>DOI Executive Forums</u>	<u>0.0</u>	<u>14.0</u>	<u>14.4</u>
NBC Human Resources Directorate	2,095.9	2,142.0	2,154.5
Interior Complex Management & Services	3.3	3.9	5.4
Family Support Room	0.1	0.1	0.1
Property Accountability Services	0.0	0.0	2.6
Moving Services	0.7	0.9	0.9
Shipping and Receiving	1.6	2.0	2.0
Safety and Environmental Services	0.0	0.0	2.3
Space Management	0.8	1.3	1.3
Drug Testing	8.4	8.8	9.2
Security	22.7	27.7	28.8
Federal Executive Board	32.6	32.8	33.7
Health Unit	1.1	1.3	1.4
Mail and Messenger Services	15.1	15.6	17.0

Program/Project Support of Bureau, Department, and Governmentwide Costs

**Working Capital Fund Revenue
Centralized Billing
Geological Survey
(\$ in thousands)**

Activity/Office	2008 Actual	2009 Estimate	2010 Estimate
National Business Center – con't			
Blue Pages	97.4	104.7	104.7
Mail Policy	41.2	41.5	42.7
Special Events Services	7.5	7.4	7.6
Cultural Resources & Events Management	0.0	43.6	44.5
Partnership Schools & Commemorative Programs	3.8	3.9	3.9
Departmental Museum	190.2	184.8	216.8
<u>Departmental Library</u>	<u>337.2</u>	<u>354.8</u>	<u>367.9</u>
NBC Administrative Operations Directorate	763.9	835.0	892.8
FBMS Master Data Management	0.0	0.0	208.3
Financial Systems (including Hyperion)	2,537.5	2,655.6	2,665.7
IDEAS	374.2	384.8	388.7
Quarters Program	0.9	1.1	1.3
<u>NBC FBMS Conversion</u>	<u>0.0</u>	<u>0.0</u>	<u>27.4</u>
NBC Financial Management Directorate	2,912.6	3,041.6	3,291.4
<u>Aviation Management</u>	<u>84.7</u>	<u>270.0</u>	<u>340.8</u>
NBC – Aviation Management	84.7	270.0	340.8
Subtotal National Business Center	6,680.2	7,091.6	7,804.7
Total	17,042.7	17,556.2	18,288.8

Exhibits

Direct billing is used whenever the product or service provided is again severable, but is sold through a time and materials reimbursable support agreement or similar contractual arrangement. The following tables provide the actual direct and reimbursable collections from USGS for 2008, and estimated billings and collections for 2009 and 2010.

Working Capital Fund Revenue Direct Billing Geological Survey (\$ in thousands)

Activity/ Office	2008 Actual	2009 PY Collections	2009 Estimate	2010 Estimate
Other OS Activities				
<u>Preserve America</u>	0.0	20.0	0.0	0.0
Secretary's Immediate Office	0.0	20.0	0.0	0.0
<u>Adaptive Management Guides</u>	3.9		0.0	0.0
Secretary's Immediate Office	3.9		0.0	0.0
<u>Single Audit Clearinghouse</u>	0.0	0.2	0.5	0.5
Office of Financial Management	0.0	0.2	0.5	0.5
<u>FBMS Change Orders</u>	180.0		180.0	180.0
Financial and Business Management System	180.0		180.0	180.0
Maximo Consulting Services	0.0	28.8	28.8	28.8
<u>Federal Assistance Award Data System</u>	0.0	3.9	3.9	4.1
Office of Acquisition and Property Management	0.0	32.7	32.7	32.9
DOI LEARN	0.0		8.6	8.6
HSPD-12	0.0		641.8	770.3
<u>Labor and Employee Relations</u>	5.9		0.0	0.0
Office of Human Resources	5.9		650.4	778.9
EEO Training	3.6		1.3	1.3
<u>EEO Investigations</u>	1.7		10.5	10.5
Office of Civil Rights	5.3		11.8	11.8
<u>Occupational Health and Safety - Travel</u>	0.0	1.3	0.0	0.0
Office of Occupational Health and Safety	0.0	1.3	0.0	0.0
Oracle Licenses and Support	1,572.0	914.4	942.7	942.7
Enterprise Architecture Services	427.3	0.0	0.0	0.0
Microsoft Enterprise Licenses	1,312.0	27.5	1,339.5	1,607.2
Anti-Virus Software Licenses	140.6	105.5	140.6	140.6
System Architect Licenses	4.2	3.0	0.0	0.0
IT Security Certification & Accreditation	0.0	75.2	0.0	0.0
IT Security	0.0	0.2	0.0	0.0
Enterprise Services Network	2,719.0	0.0	2,108.0	2,430.0
Federal Relay Service	0.0	0.0	20.0	20.0
Data-at-Rest Initiative	213.9	0.0	0.0	0.0
Office of the Chief Information Officer - Travel	0.2	0.0	0.0	0.0
Radio Program Management Initiative	54.3	0.0	0.0	0.0
<u>Active Directory Optimization</u>	66.8	0.0	0.0	0.0
Office of the Chief Information Officer	6,510.4	1,125.7	4,550.8	5,140.6
FY 2009 CFO Audit	0.0		30.9	24.4
FY 2008 CFO Audit	46.0		63.4	0.0

Program/Project Support of Bureau, Department, and Governmentwide Costs

**Working Capital Fund Revenue
Direct Billing
Geological Survey
(\$ in thousands)**

Activity/ Office	2008 Actual	2009 PY Collections	2009 Estimate	2010 Estimate
Other OS Activities con't				
FY 2010 CFO Audit	0.0		0.0	32.4
Central Services	46.0		94.3	56.8
Federal FSA Program	214.1		243.0	275.5
International Renewable Energy Conference	17.8		0.0	0.0
Marine Debris Campaign	50.0		0.0	0.0
Colorado School of Mines	15.2		15.2	15.2
<u>Imagery for the Nation</u>	0.0		875.0	964.5
Central Services	297.0		1,133.2	1,255.2
Subtotal Other OS Activities	7,048.5	1,180.0	6,653.7	7,456.6

Exhibits

**Working Capital Fund Revenue
Direct Billing
Geological Survey
(\$ in thousands)**

Activity/ Office	2008 Actual	2009 PY Collections	2009 Estimate	2010 Estimate
National Business Center				
Creative Communications	60.8		62.2	63.1
Facilities Reimbursable Services	1.2		0.1	0.1
<u>Reimbursable Mail Services</u>	<u>9.5</u>		<u>9.6</u>	<u>9.6</u>
NBC Administrative Operations Directorate	71.5		71.9	72.8
Financial Systems	70.0		44.4	45.7
<u>IDEAS</u>	<u>121.7</u>		<u>134.9</u>	<u>136.1</u>
NBC Financial Management Directorate	191.7		179.3	181.8
Client Liaison and Product Development Division	4.0		4.1	4.2
Personnel & Payroll Systems Division	354.6		371.7	12.6
HR Management Systems Division	0.0		66.9	172.7
<u>Quicktime Services</u>	<u>0.0</u>		<u>0.0</u>	<u>390.7</u>
NBC Human Resources Directorate	358.6		442.7	580.2
Enterprise Infrastructure Division	598.0		700.0	647.9
<u>Technology Services Division</u>	<u>0.6</u>		<u>0.8</u>	<u>0.9</u>
NBC Information Technology Directorate	598.6		700.9	648.8
Government-Wide Forums	5.7		5.8	5.8
Financial Management Intern Program VI	12.0		12.0	0.0
Washington Leadership & Performance Center	5.1		5.2	5.5
Anchorage Learning & Performance Center	4.5		4.6	4.9
<u>On-Line Learning</u>	<u>14.4</u>		<u>15.0</u>	<u>15.8</u>
NBC Human Resources Directorate	41.7		42.7	32.0
Subtotal National Business Center	1,262.1		1,437.5	1,515.5
Total	8,310.6	1,180.0	8,091.1	8,972.1

Program/Project Support of Bureau, Department, and Governmentwide Costs

Payments to other Federal agencies include the following:

	2009 Budget	2009 Revised	2010 Fixed Costs Change
Worker's Compensation Payments	\$2,995	\$2,995	+\$15
The 2009 adjustment is for actual charges through June 2008, in the costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for 2010 will reimburse the Department of Labor, Federal Employees Compensation Fund, pursuant to 5 U.S.C. 8147(b) as amended by Public Law 94-273.			
Unemployment Compensation Payments	\$625	\$625	+\$43
The 2009 adjustment is for estimated changes in the costs of unemployment compensation claims to be paid to the Department of Labor, Unemployment Trust Fund, pursuant to Public Law 96-499.			
Rental Payments to GSA and Others	\$64,312	\$64,312	+\$4,166
The adjustment is for changes in the costs payable to General Service Administration (GSA) and others resulting from changes in rates for office and non-office space as estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security; in the case of GSA space, these are paid to DHS.			

Internal Bureau Overhead/Cost Allocation Methodology

The USGS manages overhead/administrative costs at two levels—the bureau and science center. Bureau-level costs include headquarters and regional support for executive, managerial, supervisory, administrative, and financial functions and related bureauwide systems. At the bureau level, funding appropriated to the Science Support and Enterprise Information budget activities pays the bureauwide overhead costs in the same proportion as appropriated funding is to total funding. For this reason, bureauwide overhead costs collected on reimbursable support agreements are deposited within the Science Support and Enterprise Information program areas, as well.

The USGS charges a bureau overhead rate (12 percent in 2008 and 2009) on reimbursable work from non-Interior customers to cover their share of bureau-level costs. In some cases, the USGS does apply reduced or special rates when it can be demonstrated that indirect costs are substantially and consistently less than the norm and the amount collected covers the full costs, such as with pass-through funding where the Survey does not perform any of the actual work. The following table shows the funding available to the Science Support and Enterprise Information programs, including the anticipated overhead collections to pay for bureauwide costs.

Exhibits

(Dollars in Thousands)

Source of Funding	2010 Appropriation	2010 Bureau Overhead Distribution	2010 Total
Science Support Budget Activity	69,225	27,317	96,542
Enterprise Information Budget Activity	45,969	7,705	53,674
Total Funding	115,194	35,021	150,216

At the science center level, because there generally is not an appropriated funding source to pay the local overhead (common services) costs, both the appropriated and reimbursable funding are assessed a percentage to cover their share of science center level costs. Science center common services costs include center costs that are not directly attributable to a specific activity or project, such as managerial, supervisory, administrative, and financial functions and related systems, as well as costs incidental to providing services and products, such as postage, training, miscellaneous supplies and materials. The cost during 2008, for the local overhead, totaled \$158.0 million from both appropriated and reimbursable funds.

In recognition of the USGS role as the science bureau for the Department of the Interior, the USGS is continuing to give Department bureaus and offices a "preferred" customer rate on overhead charges for a significant portion of reimbursable work, to the extent that matching funds are available within the USGS budget. The maximum rate that cost centers may charge other Department bureaus for common services and bureau costs combined remains 15 percent net. In 2010, of the 15 percent, 7.5 percent is applied to bureau costs, and the remaining 7.5 percent is applied to common services costs. Cost centers must fund the common services costs not recovered (e.g., the difference between the cost center's standard common services costs and the 7.5 percent) from USGS appropriated funds. In 2005, the bureau began a glide path to share the combined 15 percent overhead more equitably. Under this distribution, the cost centers are required to fund a lesser amount from science program funds and the bureau is required to use a greater proportion of science support funding for the total bureau overhead costs. In this way, the USGS is partnering on the science needs of Interior from both the bureau and cost centers.

- The Chief Financial Officer establishes the USGS bureau special rate for each fiscal year. The special rate for 2009 is 3 percent. Cost centers do not charge more than the bureau special rate for facilities-related costs or their standard common services rate when funding is approved for a bureau-level special rate. Special rates are applied under the following circumstances.
- A bureau special rate of 3 percent net is applied to cover reduced administrative costs when the USGS receives funds from a non-USGS organization and awards a grant to a third-party entity.
- A bureau special rate of 3 percent net is applied to cover reduced administrative costs when the USGS receives funds from one or more non-USGS organizations to support, under USGS leadership, a strategic science objective which includes the USGS passing through funds to one or more third party entities.

Program/Project Support of Bureau, Department, and Governmentwide Costs

- A bureau special rate of 3 percent net is applied to cover reduced administrative costs when the USGS receives funds from a non-USGS organization for the purpose of the customer acquiring services through the Cartographic Services or the Remotely Sensed Data Contracts. The special rate helps encourage other Federal agencies to use these contracts for cartographic services and remotely sensed data, rather than establishing and managing their own contracts, and ensures greater data consistency through the use of common service providers.
- A bureau special rate of 3 percent net is applied to cover reduced administrative costs when the USGS receives funds from a non-USGS organization for the purpose of passing through the customer's funds to State and local governments for the direct purchase of geospatial data.
- Biology Cooperative Research Units (CRUs) are supported by a three-way partnership including the USGS, a State, and a university. The academic institutions where CRUs are collocated provide significant administrative support. In recognition of the direct services support received from the non-USGS partners, CRUs only recover one-half of the bureau rate (6 percent) normally recovered from reimbursable customers or partners.

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Authorizations

43 U.S.C. 31 et seq. Organic Act of March 3, 1879, as amended, establishes the United States Geological Survey. Provides, among other matters, that the USGS is directed to classify the public lands and examine the geological structure, mineral resources, and products within and outside the national domain. Establishes the Office of the Director of the United States Geological Survey under the Department of the Interior. The Director is appointed by the President by and with the advice and consent of the Senate. P.L. 102–285, Sec. 10(a) establishes the official name as United States Geological Survey.

Title 2 – The Congress

2 U.S.C. 681–688 Congressional Budget and Impoundment Control Act of 1974. Describes the general Federal budget process, including rescissions, reservations, and deferrals of budget authority.

Title 5 – Government Organization and Employees

5 U.S.C. Includes personnel matters (classification, pay rates, benefits, etc.), the Freedom of Information Act, the Privacy Act, the Computer Matching and Privacy Act, and other issues related to general Federal functions and employment. The Appendices to Title 5 include the Federal Advisory Committee Act (FACA) of 1972, Inspector General mandates, and other matters that include Federal entities such as the USGS.

Title 7 – Agriculture

7 U.S.C. 136 Federal Environmental Pesticide Control Act of 1972. Amends the program established by the Federal Insecticide, Fungicide and Rodenticide Control Act of 1947 for controlling the sale and distribution of "economic poisons." The law requires registration of pesticides to avoid unreasonable adverse effects to humans or the environment.

7 U.S.C. 2201 Department of Agriculture Organic Act of 1956. Requires the Secretary of Agriculture to obtain the advice of the Secretary of the Interior as to whether certain lands that are being patented, disposed of, or exchanged are mineral in character.

7 U.S.C. 2204(b) Rural Development and Policy Act of 1980. Authorizes the Secretary of Agriculture to enter cooperative agreements with other Federal agencies and other organizations concerning water management for rural areas.

Title 15 – Commerce and Trade

15 U.S.C. 631, 631(a) Small Business Act. Fosters the economic interests of small businesses and sets forth procedures. Encourages Federal agencies to use small businesses and women-owned businesses for services and other contracted activities.

15 U.S.C. 2901–2908 The National Climate Program Act of 1978. Establishes a national climate program to assist the Nation and the world in understanding and responding to natural

Authorizations

and human-induced climate processes and their known and potential effects. The Department of the Interior has a mandated role in this Program.

15 U.S.C. 2921 et seq. The Global Change Research Act of 1990. Establishes the United States Global Change Research Program aimed at understanding and responding to global change, including the cumulative effects of human activities and natural processes on the environment, to promote discussions toward international protocols in global change research, and for other purposes.

15 U.S.C. 5631 et seq. Land Remote Sensing Policy Act of 1992. Enables the United States to maintain leadership in land remote sensing by providing data continuity for the Landsat program. Assigns responsibility for the "National Satellite Land Remote Sensing Data Archive" to the Department of the Interior. Authorizes and encourages the Department of the Interior and other Federal agencies to carry out research and development programs in applications of these data and makes Landsat data available to the public.

Title 16 – Conservation

16 U.S.C. 17 et seq. National Park Service Organic Act of 1916. Parts of Title 16, Conservation, as amended and supplemented, apply to the USGS. Notably, the Outdoor Recreation Act of 1936 authorizes the Secretary of the Interior to sponsor, engage in, and assist in research relating to outdoor recreation, directly or by contract or cooperative agreements, and make payments for such purposes; undertake studies and assemble information concerning outdoor recreation; and cooperate with educational institutions and others to assist in establishing education programs and activities and to encourage public use and benefits from outdoor recreation.

16 U.S.C. 661 et seq. Fish and Wildlife Coordination Act of 1934. Authorizes the Secretary of the Interior to prepare plans to protect wildlife resources, to conduct surveys on public lands, and to accept funds or lands for related purposes; authorizes the investigation and reporting of proposed Federal actions that affect the development, protection, rearing, and stocking of all species of wildlife and their habitat in controlling losses, minimizing damages, and providing recommendations to minimize impacts on fish and wildlife resources. National Wildlife Refuge System Improvement Act of 1997 (P.L. 105–57) amends the National Wildlife Refuge System Administration Act of 1966 to improve the management of the National Wildlife Refuge System, and for other purposes.

16 U.S.C. 703–712 Migratory Bird Treaty Act of 1918, as amended. Implements four international treaties that individually affect migratory birds common to the United States, Canada, Mexico, Japan, and the former Soviet Union. Establishes Federal responsibility for protection and management of migratory and nongame birds, including the establishment of season length based on scientific information relative to zones of temperature, distribution, abundance, breeding habits and times and lines of migratory flight of migratory birds. Establishes the Secretary of the Interior's responsibility for bag limits and other hunting regulations and issuance of permits to band, possess, or otherwise make use of migratory birds.

16 U.S.C. 715 Migratory Bird Conservation Act of 1900. Establishes the Migratory Bird Conservation Commission; authorizes the Secretary of the Interior to conduct investigations and publish documents related to North American birds.

16 U.S.C. 742(a) et seq. Fish and Wildlife Act of 1956. Authorizes the Secretary of the Interior to conduct investigations, prepare and disseminate information, and make periodic reports to the public regarding the availability and abundance and the biological requirements of fish and wildlife resources; provides a comprehensive national fish and wildlife policy and authorizes the Secretary of the Interior to take steps required for the development, management, advancement, conservation, and protection of fisheries and wildlife resources through research, acquisition of refuge lands, development of existing facilities, and other means.

16 U.S.C. 742(l) Fish and Wildlife Improvement Act of 1978, as amended by P.L. 95–616. Authorizes the Secretary of the Interior to enter into cooperative agreements with colleges and universities, State fish and game agencies, and nonprofit organizations for the purpose of developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources.

16 U.S.C. 797(c) Following language supports Appropriations language "and Federal Energy Regulatory Commission licensees." States that, "To cooperate with the executive departments and other agencies of States or National Governments in such investigations; and for such purposes the several departments and agencies of the National Government are authorized and directed upon the request of the commission, to furnish such records, papers and information in their possession as may be requested by the commission, and temporarily to detail to the commission such officers or experts as may be necessary in such investigations."

16 U.S.C. 931–939 Great Lakes Fishery Act of 1956. Implements the Convention on Great Lakes Fisheries between the United States and Canada; authorizes construction, operation, and maintenance of sea lamprey control works; sets forth procedures for coordination and consultation with States and other Federal agencies; and establishes the Great Lakes Fisheries Commission.

16 U.S.C. 1131 and 1133 Wilderness Act of 1964, as amended. Requires the USGS to assess the mineral resources of each area proposed or established as wilderness. The studies are to be on a planned and recurring basis. The original series of studies has been completed, and no recurring studies have been requested or funded.

16 U.S.C. 1361 et seq. Marine Mammal Protection Act of 1972, as amended. Establishes a responsibility to conserve marine mammals with management authority vested in the Department of the Interior for the sea otter, walrus, polar bear, dugong, and manatee.

16 U.S.C. 1451 et seq. Coastal Zone Management Act of 1976. Provides that each department, agency, and instrumentality of the Executive Branch of the Federal Government may assist the Secretary of Commerce, on a reimbursable basis or otherwise, in carrying out research and technical assistance for coastal zone management.

16 U.S.C. 1531 et seq. Endangered Species Act of 1973, as amended. Provides for the conservation of threatened and endangered species of fish, wildlife, and plants, and authorizes establishment of cooperative agreements and grants-in-aid to States that establish and maintain active and adequate programs for endangered and threatened wildlife and plants.

16 U.S.C. 1604. Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976. The USGS is a party in an interagency agreement with the Forest Service to assess the mineral resources of National Forests.

Authorizations

16 U.S.C. 2801 et seq. National Aquaculture Act of 1980. Directs the Secretary of the Interior to participate in the development of a National Aquaculture Development Plan and authorizes research, development, and other activities to encourage the development of aquaculture in the United States.

16 U.S.C. 3141 et seq. Alaska National Interest Lands Conservation Act of 1980. Designates certain public lands in Alaska as units of the National Park, National Wildlife Refuge, Wild and Scenic Rivers, National Wilderness Preservation and National Forest Systems, resulting in general expansion of all systems and provided comprehensive management guidance for all public lands in Alaska. Section **3141** requires the Secretary of the Interior to assess the oil and gas potential of Federal lands (other than submerged lands on the Outer continental Shelf) in Alaska north of 68 degrees north latitude and east of the western boundary of the National Petroleum Reserve–Alaska (NPPRA), other than lands included in the NPPRA and in conservation system units established by the Act. Also authorizes the Secretary of the Interior to initiate and carry out a study of all Federal lands in designated areas of Alaska; the study is to assess the potential oil and gas resources of these lands; review the wilderness characteristics; and study the wildlife resources of these lands. Section **3142** provides for a comprehensive and continuing inventory and assessment of the fish and wildlife resources of the coastal plain of the Arctic National Wildlife Refuge. Also states that the USGS "has made and may be called upon to make water studies pertinent to implementation of the Act." Section **3148** authorizes the Secretary to conduct studies, or collect and analyze information obtained by permittees, of the oil and gas potential of non-North Slope Federal lands and environmental characteristics and wildlife resources that would be affected by the exploration for and development of such oil and gas. Section **3150** requires that the Secretary of the Interior assess the oil, gas, and other mineral potential on all public lands in the State of Alaska to expand the database with respect to the mineral potential of such lands. This responsibility has been delegated to the USGS. Section **3151** requires an annual minerals report be presented to Congress; the preparation of this report was delegated to the USGS. The annual reporting requirement was terminated, effective May 15, 2000, pursuant to section 3003 of P.L. 104–66, as amended.

16 U.S.C. 3501 et seq. Coastal Barrier Resources Act of 1982. Designates various underdeveloped coastal barrier islands depicted by specific maps for inclusions in the Coastal Barrier Resource System. **P.L. 106–514** Coastal Barrier Resources Reauthorization Act of 2000. Reauthorizes and amends the Coastal Barrier Resources Act of 1999. Section **6** authorizes cooperative efforts between the Secretary of the Interior and the Director of FEMA to provide existing digital spatial data, including digital orthophotos, and shoreline, elevation, and bathymetric data of the John H. Chafee Coastal Barrier Resource System maps. If data do not exist to carry out this pilot project, the USGS, in cooperation with other Federal agencies, as appropriate, will obtain and provide the data required to the Secretary. In addition, all data used or created to carry out this section shall comply with the National Spatial Data Infrastructure established by Executive Order 12906 (59 Fed. Reg. 17671 (April 13, 1994)); and any other standards established by the Federal Geographic Data Committee established by Office of Management and Budget Circular A–16.

16 U.S.C. 4701 et seq. Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. Establishes a Federal program to prevent introduction and control the spread of introduced aquatic nuisance species.

Title 22 – Foreign Relations and Intercourse

22 U.S.C. 3201 et seq. Nuclear Non-Proliferation Act of 1978. Provides that under Title V, United States Assistance to Developing Countries, the USGS assists, through the State Department and the Agency for International Development, in evaluation of nuclear facilities sites in other countries.

Title 25 – Indians

25 U.S.C. 450 et seq. Tribal Self-Governance Act of 1994. The USGS participates in the Tribal Self-Governance Program by identifying USGS activities that may be available for tribal operation under the Self-Governance Act. The USGS discusses programs and activities with interested tribal governments.

Title 29 – Labor

29 U.S.C. 651 Occupational Safety and Health Act of 1970. Provides criteria "... to assure so far as possible every working man and woman in the Nation safe and healthful working conditions"

Title 30 – Mineral Lands and Mining

30 U.S.C. 21(a) Mining and Minerals Policy Act of 1970. Emphasizes Department of the Interior responsibility for assessing the mineral resources of the Nation.

30 U.S.C. 201 Federal Coal Leasing Amendments Act of 1976. Provides that no lease sale may be held on Federal lands unless the lands containing the coal deposits have been included in a comprehensive land-use plan. Provides that the Secretary is authorized and directed to conduct a comprehensive exploratory program designed to obtain sufficient data and information to evaluate the extent, location, and potential for developing the known recoverable coal resources within the coal lands. The USGS provides data and information from coal research and field investigations, which are useful to the BLM to meet the requirements of the coal leasing program. Further, the Secretary, (**Sec. 208–1(b)**) through the USGS, "... is authorized to conduct seismic, geophysical, geochemical, or stratigraphic drilling, or to contract for or purchase the results of such exploratory activities from commercial or other sources which may be needed to implement the ..." exploratory program.

30 U.S.C. 641 Following language supports Appropriations language "administer the minerals exploration program." Provides that, "The Secretary of the Interior is hereby authorized and directed, in order to provide for discovery of additional domestic mineral reserves, to establish and maintain a program for exploration by private industry within the United States, territories and possessions for such minerals, excluding organic fuels, as he shall from time to time designate, and to provide Federal financial assistance on a participating basis for that purpose." (P.L. 85–701.)

30 U.S.C. 1026 Section 6 of the Geothermal Steam Act Amendments of 1988. Requires the Secretary of the Interior to (1) maintain a monitoring program for significant thermal features within units of the National Park System and (2) establish a research program to collect and assess data on the geothermal resources within units of the National Park System with significant thermal features in cooperation with the USGS. Section 8 requires the USGS to conduct a study of the impact of present geothermal development in the vicinity of Yellowstone National Park on the thermal features within the park.

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30 U.S.C. 1028 Energy Policy Act of 1992. Directs the Secretary of the Interior, through the USGS and in consultation with the Secretary of Energy, to establish a cooperative government-private sector program with respect to hot dry rock geothermal energy resources on public lands. Supports recurring assessments of the undiscovered oil and gas resources of the United States.

30 U.S.C. 1101, 1121, 1123 Geothermal Energy Research, Development, and Demonstration Act of 1974. Provides that the Department of the Interior is responsible for the evaluation and assessment of the geothermal resource base and the development of exploration technologies. The Chairman, acting through the USGS and other appropriate agencies, shall develop and carry out a plan for the inventorying of all forms of geothermal resources of Federal lands; conduct regional surveys; publish and make available maps, reports, and other documents developed from the surveys; and participate with non-Federal entities in research to develop, improve, and test technologies for the discovery and evaluation of geothermal resources.

30 U.S.C. 1201–1202, 1211 Surface Mining Control and Reclamation Act of 1977, as amended. Establishes the Office of Surface Mining Reclamation and Enforcement (OSM). OSM depends in part upon the USGS for a determination of the probable hydrologic consequences of mining and reclamation operations.

30 U.S.C. 1419 et seq. Deep Seabed Hard Mineral Resources Act of 1980. Provides authorization for conducting a continuing program of ocean research that "shall include the development, acceleration, and expansion, as appropriate, of the studies of the ecological, geological, and physical aspects of the deep seabed in general areas of the ocean where exploration and commercial development are likely to occur" The USGS, based on expertise developed in regional offshore geologic investigations, provides geological and mineral resource expertise in responding to the requirements of the Act.

30 U.S.C 1601 et seq. National Materials and Minerals Policy, Research and Development Act of 1980. Reemphasizes the responsibility of the Department of the Interior to assess the mineral resources of the Nation.

30 U.S.C. 1901–1902 Methane Hydrate Research and Development Act of 2000. Authorizes appropriations for the establishment of a methane hydrate research and development program within the DOE. The DOE is directed to carry out this program in consultation with the U.S. Navy, USGS, Minerals Management Service, and NSF, through grants, contracts, and cooperative agreements with universities and industrial enterprises. Provides for the study of the use of methane hydrate as a source of energy. Sunsets the methane hydrate research and development program at the end of FY 2005.

Title 31 – Money and Finance

31 U.S.C. 501, 901–903 note Chief Financial Officers (CFO) Act of 1990. Section **501** refers to findings and purpose for the CFO Act. Sections **901–903** provide for establishment of a CFO in each agency, describe the authority and functions of agency CFOs, and provide for the establishment of agency Deputy CFOs.

31 U.S.C. 1535 Economy Act of 1932, as amended. Authorizes any agency to obtain goods and services from and reimburse any other agency if certain criteria are met.

31 U.S.C. 3302 The custody and possession of public money by Federal officials is dealt with in this section. (P.L. 97–258.)

31 U.S.C. 3501 et seq. Budget Accounting and Procedures Act of 1950. Federal Managers' Financial Integrity Act of 1982.

31 U.S.C. 3512 Federal Financial Management Improvement Act of 1996. Provides for the implementation of financial management systems that comply with Federal financial management systems requirements, applicable Federal accounting standards, and the U.S. Government Standard General Ledger at the transaction level.

31 U.S.C. 3701–3720(e) Debt Collection Improvement Act of 1996. Maximizes collections of delinquent debts owed to the Federal Government; describes policies and requirements.

31 U.S.C. 3901–3907 Prompt Payment Act of 1982, as amended. Requires Federal agencies to pay interest penalties on overdue payments to businesses for property or services, and requires the Office of Management and Budget to prescribe regulations to implement provisions of the act and subsequent amendments.

31 U.S.C. 6301–6308 Federal Grant and Cooperative Agreement Act of 1977. Provides criteria for distinguishing between contract, grant, and cooperative agreement relationships and provides discretionary authority to vest title to equipment or other tangible personal property purchased with contract, grant, or cooperative agreement funds in nonprofit research or higher education institutions.

31 U.S.C. 7501 Single Audit Act of 1984, as amended. Provides for audits of Federal awards administered by non-Federal entities.

31 U.S.C. 9701 Independent Office Appropriations Act of 1952; Title 5, Fees and charges for Government services and things of value. Encourages Federal services and products ("things of value") to be as financially self-sustaining as possible. Authorizes costs to be charged for Federal services and products based on the costs to the Government, the value of the service or thing to the recipient, and the public policy or interest served.

Title 33 – Navigation and Navigable Waters

33 U.S.C. 883(a) Great Lakes Shoreline Mapping Act of 1987. Section **3202(a)** requires that the Director of the National Oceanic and Atmospheric Administration "... in consultation with the Director of the United States Geological Survey, shall submit to the Congress a plan for preparing maps of the shoreline of the Great Lakes under section 3203." Section **3203** requires that "... subject to authorization and appropriation of funds, the Director, in consultation with the Director of the United States Geological Survey, shall prepare maps of the shoreline areas of the Great Lakes."

33 U.S.C. 1251–1274, 2901 Federal Water Pollution Control Act Amendments of 1972, Clean Water Act of 1977, and Water Quality Act of 1987, authorize extensive water quality planning, studies, and monitoring under the direction primarily of the EPA. Section **1254** authorizes the Administrator of the EPA to establish national programs for the prevention, reduction, and elimination of pollution including the establishment of a water quality surveillance system for the purpose of monitoring the quality of the navigable waters and ground waters, utilizing the resources of the USGS and others. The USGS is called upon to participate in many of these

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activities, partly by the EPA and partly by State agencies in the Federal-State Cooperative Program [now called the Cooperative Water Program]. The Act of 1987 includes water quality work in Chesapeake Bay, the Great Lakes, Estuary and Clean Lakes Programs, and studies of water pollution problems in aquifers. Estuaries and Clean Waters Act of 2000. Amends the Federal Water Pollution and Control Act (commonly known as the Clean Water Act) to include authorization for the following: Title I, Estuary Restoration; Title II, Chesapeake Bay Restoration; Title III, National Estuary Program; Title IV, Long Island Sound Restoration; Title V, Lake Pontchartrain Basin Restoration; Title VI, Alternative Water Sources; Title VII, Clean Lakes; and Title VIII, Tijuana River Valley Estuary and Beach Cleanup. (The Clean Water Act charges States and Tribes with setting specific water-quality criteria appropriate for their waters and for developing pollution control programs to meet the criteria. States and Tribes utilize USGS hydrologic data collection and monitoring to help meet Clean Water Act requirements. The USGS also is a key Federal partner in both the Chesapeake Bay Program and the National Estuary Program.)

33 U.S.C. 1271 Water Resources Development Act of 1992. Establishes a National Contaminated Sediment Task Force, with USGS as a member, to conduct a comprehensive national survey of aquatic sediment quality.

33 U.S.C. 2201 et seq. Water Resources Development Act of 1990. Authorizes a program for planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement; cooperative effort and mutual assistance for use, protection, growth, and development of the Upper Mississippi River system; implementation of a long-term resource monitoring program; and implementation of a computerized inventory and analysis systems.

33 U.S.C. 2701, 2761 Oil Pollution Act of 1990. Section **2761** authorizes the establishment of an Interagency Coordinating Committee on Oil Pollution Research, of which the Department of the Interior is a member, to develop a plan for the implementation of the oil pollution research, development, and demonstration program.

Title 40 – Public Buildings, Property, and Works

40 U.S.C. 471 Federal Property and Administrative Services Act of 1949. Provides for management, utilization, and disposal of government property.

40 U.S.C. 601 Public Buildings Amendment Act of 1972. Prohibits construction of buildings except by the Administrator of General Services.

40 U.S.C. 606 Public Buildings Act of 1959. Establishes criteria for the approval of proposed construction, alteration, acquisition, and lease of public buildings by Congress, over a designated threshold of cost.

40 U.S.C. 1401 Clinger-Cohen Act, formerly known as the Information Technology Management Reform Act of 1996, along with the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Provides the opportunity to improve significantly the way the Federal Government acquires and manages information technology. Agencies have the clear authority and responsibility to make measurable improvements in mission performance and service delivery to the public through the strategic application of information technology. Executive Order 13011, July 16, 1996, provides policy and procedures regarding implementation of this Act.

Title 41 – Judicial Review of Administrative Decisions

41 U.S.C. 251 et seq. Competition in Contracting Act of 1984. Provides direction regarding agency procurements, including support for small businesses, acquisition thresholds regarding soliciting bids, etc.

41 U.S.C. 433 Federal Acquisition Reform Act of 1996. Mandates the continued career development and training of the acquisition workforce.

41 U.S.C. 601–613 Contract Disputes Act of 1978. Describes procedures regarding the resolution of contract disputes.

Title 42 – The Public Health and Welfare

42 U.S.C. 300(f) et seq. Safe Drinking Water Act Amendments of 1996. Authorizes research "... relating to the causes, ... treatment, ... prevention of ... impairments of man resulting directly or indirectly from contaminants in water, or to the provision of a dependably safe supply of drinking water" The USGS and EPA have an interagency agreement covering aquifer studies conducted by the USGS relating to sole source aquifers.

42 U.S.C. 2021(b) et seq. Low-Level Radioactive Waste Policy Act of 1980. Requires intra-State or regional arrangements for disposal of low-level radioactive waste by July 1986. The USGS provides geohydrologic research and technology to Federal and State agencies developing plans for low-level waste management. The amending Act of 1985 included approval of seven interstate compacts.

42 U.S.C. 2210(b), 2231 Nuclear Regulatory Commission Authorization Act. Requires the Secretary of Energy to monitor and report to the President and Congress on the viability of the domestic uranium industry. Under a Memorandum of Understanding between the Department of Energy and the Department of the Interior, the USGS provides information on domestic uranium resources to the Energy Information Agency.

42 U.S.C. 4321 et seq. National Environmental Policy Act of 1969, as amended. Requires prior-to-action determination that any major Federal action will not have a significantly adverse effect upon the environment. The USGS is called upon to provide technical review or inputs to resource-related actions proposed by other Federal agencies.

42 U.S.C. 5121, 5132 Disaster Relief Act of 1974, Section **202(a)**. States that "The President shall ensure that all appropriate Federal agencies are prepared to issue warnings of disasters to State and local officials." In addition, Section **202(b)** states that "The President shall direct appropriate Federal agencies to provide technical assistance to State and local governments to insure that timely and effective disaster warning is provided."

42 U.S.C. 5845(c) Energy Reorganization Act of 1974. Directs all other Federal agencies to "... (2) ... furnish to the (Nuclear Regulatory) Commission ... such research services ... for the performance of its functions; and (3) consult and cooperate with the Commission on research development matters of mutual interest and provide such information and physical access to its facilities as will assist the Commission in acquiring the expertise necessary to perform its licensing and related regulatory functions." The USGS conducts geological mapping in areas where nuclear reactor construction is anticipated and conducts investigations of geologic processes that could imperil the safe operation of the reactors or other critical energy facilities.

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42 U.S.C. 6217 Energy Act of 2000. Extends energy conservation programs under the Energy Policy and Conservation Act through FY 2003. Specifically for the USGS, Section **604**, "Scientific Inventory of Oil and Gas Reserves," instructs the Secretary of the Interior, in consultation with the Secretaries of Agriculture and Energy, to conduct and update regularly an inventory of all onshore Federal lands. The inventory will identify (1) USGS reserve estimates of the oil and gas resources underlying these lands, (2) restrictions or impediments to development of such resources, and (3) furnish such inventory data to the House Committee on Resources and the Senate Committee on Energy and Natural Resources. Authorizes appropriations as necessary for implementation.

42 U.S.C. 6901 et seq. Resource Conservation and Recovery Act of 1976 and Hazardous and Solid Waste Amendments of 1984. Requires the EPA to promulgate guidelines and regulations for identification and management of solid waste, including disposal. The expertise of the USGS is a present and potential source of assistance to the EPA in defining and predicting the hydrologic effects of waste disposal.

42 U.S.C. 7418, 7401, 7470. Clean Air Act of 1977, as amended. Requires Federal facilities to comply with air quality standards to the same extent as non-governmental entities. Establishes requirements to prevent significant deterioration of air quality and to preserve air quality in national parks, national wilderness areas, national monuments and national seashores.

42 U.S.C. 7701 et seq. Earthquake Hazards Reduction Act of 1977. Sets as a national goal the reduction in the risks of life and property from future earthquakes in the United States through the establishment and maintenance of a balanced earthquake program encompassing prediction and hazard assessment research, seismic monitoring and information dissemination. Subsequent public laws established a National Earthquake Hazards Reduction Program, of which the USGS is a part. P.L. 96-472 authorizes the establishment of a National Earthquake Prediction Evaluation Council. P.L. 101-614 (National Earthquake Hazards Reduction Program Reauthorization Act), P.L. 105-47, and P.L. 106-503 (Earthquake Hazards Reduction Authorization Act of 2000) reauthorize the 1977 Act, repeal some sections, and add new language in some sections including the establishment of an Advanced National Seismic Research and Monitoring System.

42 U.S.C. 8901 et seq. Acid Precipitation Act of 1980. Authorizes an "Acid Precipitation Program and Carbon Dioxide Study," including the establishment of an Acid Precipitation Task Force (of which the Department of the Interior is a member) and a comprehensive 10-year research program. Title IX of the Clean Air Act Amendments of 1990 (P.L. 101-549) calls for continuation of the National Acid Precipitation Assessment Program (NAPAP) established under the Acid Precipitation Act of 1980. The USGS is an active participant in the research program and coordinates interagency monitoring of precipitation chemistry. The USGS National Coal Resources Data System was named by the EPA as the official database for information on coal quality. The EPA, utility companies, and coal mining industries use the database to estimate the amount of air pollution derived from coal combustion. The USGS is a participant in studies of acid precipitation as a result of prior work in this field.

42 U.S.C. 9601 et seq. Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Establishes a Hazardous Substance Superfund (26 U.S.C. 9507) to help finance the massive cleanup programs needed at sites that are heavily contaminated with toxic wastes. The USGS is called upon by the EPA and State agencies to investigate and determine the extent of contamination and remedial measures at some of these sites.

42 U.S.C. 10101 et seq. Nuclear Waste Policy Act of 1982. Defines the DOE as lead agency with responsibility for siting, building, and operating high-level radioactive waste repositories. Requires participation by the USGS in a consultative and review role to the DOE. The Nuclear Waste Policy Amendments Act of 1987 (Title V of the Omnibus Budget Reconciliation Act of 1987) identifies Yucca Mountain, NV, as the first site to be studied to ascertain suitability for disposal of high level nuclear waste. The 1987 Act provides that the DOE conduct a survey of potentially suitable sites for a monitored retrievable storage facility.

42 U.S.C. 10301 et seq. Water Resources Development Act of 1986. Amends the Water Resources Research Act of 1984 (P.L. 98–242) by adding a new Title III, "Ogallala Aquifer Research and Development." P.L. 109–471 amends the act to extend authorization of appropriations through FY 2010. The Water Resources Research Act of 1984, as amended, provides for water resources research, information transfer, and student training in grants and contract programs that will assist the Nation and the States in augmenting their science and technology to discover practical solutions to water shortage and quality deterioration problems. Establishes a Federal-State partnership in water resources research, education, and information transfer through a matching grant program that authorizes State Water Resources Research Institutes at land grant universities across the Nation.

Title 43 – Public Lands

43 U.S.C. 31 et seq. Organic Act of March 3, 1879, as amended, establishes the United States Geological Survey. Provides, among other matters, that the USGS is directed to classify the public lands and examine the geological structure, mineral resources, and products within and outside the national domain. Establishes the Office of the Director of the United States Geological Survey under the Department of the Interior. The Director is appointed by the President by and with the advice and consent of the Senate. P.L. 102–285, Sec. 10(a) establishes the official name as the United States Geological Survey.

Particularly: Section 4 of the Continental Scientific Drilling and Exploration Act of 1988. Requires that "The Secretary of the Department of Energy, the Secretary of the Department of the Interior through the United States Geological Survey, and the Director of the National Science Foundation assure an effective, cooperative effort in furtherance of the Continental Scientific Drilling Program of the United States."

And: 43 U.S.C. **31(a–h)**. National Geologic Mapping Act of 1992. Establishes in the USGS a National Cooperative Geologic Mapping Program. States "The objectives of the geologic mapping program shall include (1) determining the Nation's geologic framework through systematic development of geologic maps at scales appropriate to the geologic setting and the perceived applications, such maps to be contributed to the national geologic map database; (2) development of a complementary national geophysical-map database, geochemical-map database, and a geochronologic and paleontologic database that provide value-added descriptive and interpretive information to the geologic-map database; (3) application of cost-effective mapping techniques that assemble, produce, translate and disseminate geologic-map information and that render such information of greater application and benefit to the public; and (4) development of public awareness for the role and application of geologic-map information to the resolution of national issues of land use management." Section **31(g)** requires the Secretary of the Interior to provide biennial reports on the status of the program, progress in developing the national geologic map database, and any recommendations the Secretary may have for legislative or other action to achieve the purposes of the Act to the Committee on Resources of the House of Representatives and the Committee

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on Energy and Natural Resources of the Senate. The Act was reauthorized in 1997 (P.L. 105–36) and 1999 (P.L. 106–148). **31(i)** Requires the National Academy of Sciences to review and report on the resource research activities of the USGS. **31(j)** FY 1997 Omnibus Appropriations Act. Requires that, beginning in FY 1998 and once every five years thereafter, the National Academy of Sciences shall review and report on the biological research activity of the USGS.

43 U.S.C. 32 Authorizes the Secretary of the Interior to authorize one of the geologists to act as Director of the USGS in his/her absence.

43 U.S.C. 34 States that the scientific employees of the USGS shall be selected by the Director, subject to the approval of the Secretary of the Interior exclusively for their qualifications as professional experts.

43 U.S.C. 36 Authorizes the purchase of professional and scientific books and periodicals needed for statistical purposes by the scientific divisions of the USGS and that the purchases may be paid for out of appropriations made for the USGS. **36(a)** The Director of the USGS is authorized "... to acquire for the United States, by gift or devise, scientific or technical books, manuscripts, maps, and related materials, and to deposit the same in the library of the United States Geological Survey for reference and use as authorized by law." **36(b)** "The Secretary of the Interior may, on behalf of the United States and for the use by the United States Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation" Following language supports Administrative Provisions language "acquisition of lands for gauging stations and observation wells;": Provides that, "The Secretary of the Interior may, on behalf of the United States and for the use by the Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation" **36(c)** Acceptance of contributions from public and private sources; cooperation with other agencies in prosecution of projects. States that "In fiscal year 1987 and thereafter the United States Geological Survey is authorized to accept lands, buildings, equipment, and other contributions from public and private sources and to prosecute projects in cooperation with other agencies, Federal, State, or private."

43 U.S.C. 38 Topographic surveys; marking elevations. Provides for the establishment and location of permanent benchmarks used in the making of topographic surveys.

43 U.S.C. 41 Publications and reports; preparation and sale. Provides for the publication of geological and economic maps, illustrating the resources and classification of the lands, and reports upon general and economic geology and paleontology. Provides for the scientific exchange and sale of such published material.

43 U.S.C. 42 et seq. Distribution of maps and atlases, etc. Authorizes and directs the Director, USGS, upon the approval of the Secretary of the Interior, to distribute topographic and geologic maps and atlases of the United States. The prices and regulations are to be fixed by the Director with the approval of the Secretary. Provides that copies of each map or atlas, not to exceed five hundred, shall be distributed gratuitously among foreign governments, departments of our own Government, literary and scientific associations, and to educational institutions or libraries. States that "In fiscal year 1984 and thereafter, all receipts from the sale of maps sold or stored by the United States Geological Survey shall be available for map printing and distribution to supplement funds otherwise available, to remain available until expended."

43 U.S.C. 43 Copies to Senators, Representatives and Delegates. Provides that one copy of each map and atlas shall be sent to each Senator, Representative, and Delegate in Congress, if published within his term, and that a second copy be placed at the disposal of each.

43 U.S.C. 44 Sale of transfers or copies of data. Provides that the USGS may furnish copies of maps to any person, concern, institution, State, or foreign government.

43 U.S.C. 45 Production and sale of copies of photographs and records; disposition of receipts. Authorizes the USGS to produce and sell on a reimbursable basis, copies of aerial or other photographs, mosaics, and other official records. Discusses disposition of receipts from sales.

43 U.S.C. 49 Extension of cooperative work to Puerto Rico. Authorizes the making of topographic and geological surveys and conducting investigations relating to mineral and water resources in Puerto Rico by the USGS.

43 U.S.C. 50 Provides that the share of the USGS in any topographic mapping or water resources investigations carried on in cooperation with any State or municipality shall not exceed 50 percent of the cost thereof. **50(b)** Recording of obligations against accounts receivable and crediting of amounts received; work involving cooperation with State, Territory, etc. "Before, on, and after October 18, 1986, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the United States Geological Survey may, notwithstanding any other provision of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation." (Note U.S.C. states that "this appropriation" refers to USGS annual appropriation as contained in the Department of the Interior and Related Agencies Appropriations Act.) Following language supports Appropriations language "Provided further, that, heretofore and hereafter, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the Geological Survey may, notwithstanding any other provisions of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation." **50(c)** Payment of costs incidental to utilization of services of volunteers. "Appropriations herein and on and after December 22, 1987, made shall be available for paying costs incidental to the utilization of services contributed by individuals who serve without compensation as volunteers in aid of work of the United States Geological Survey, and ... Survey officials may authorize either direct procurement of or reimbursement for expenses incidental to the effective use of volunteers such as, but not limited to, training, transportation, lodging, subsistence, equipment, and supplies: Provided further, That provision for such expenses or services is in accord with volunteer or cooperative agreements made with such individuals, private organizations, educational institutions, or State or local government." **50(d)** Services of students or recent graduates. "The United States Geological Survey may on and after November 19, 1999, contract directly with individuals or indirectly with institutions or nonprofit organizations, without regard to section 5 of title 41, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purposes of chapters 57 and 81 of title 5, relating to compensation for travel and work injuries, and chapter 171 of title 28, relating to tort claims, but shall not be considered to be Federal employees for any other purposes."

43 U.S.C. 51 Funds for mapping and investigations considered intragovernmental funds. "Beginning October 1, 1990, and thereafter, funds received from any State, territory, possession, country, international organization, or political subdivision thereof, for topographic, geologic, or water resources mapping or investigations involving cooperation with such an entity

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shall be considered as intragovernmental funds as defined in the publication titled 'A Glossary of Terms Used in the Federal Budget Process.'

43 U.S.C. 364 et seq. Board on Geographic Names, 1947. Establishes the Board on Geographic Names to provide for uniformity in geographic nomenclature and orthography throughout the Federal Government and to promulgate in the name of the Board decisions with respect to geographic names and principles of geographic nomenclature and orthography.

43 U.S.C. 371 Reclamation Projects Authorization and Adjustment Act of 1992. Public Law 104-46 amends the 1992 law to add Section **3001**, "Western Water Policy Review Act of 1992." Directs the President to undertake a comprehensive review of Federal activities in the 19 western States that directly or indirectly affect the allocation and use of resources, whether surface or subsurface. The Secretary of the Interior, "... given ... responsibilities for ... investigations and reviews into ground water resources through the Geologic Survey (now United States Geological Survey) ..." and the Secretary of the Army "have the resources to assist in a comprehensive review"

43 U.S.C. 1334 et seq. Outer Continental Shelf (OCS) Lands Act. Authorizes the Secretary of the Interior to prescribe rules and regulations to provide for the prevention of waste and conservation of the natural resources of the OCS; to conduct geological and geophysical explorations of the OCS; directs the Secretary of the Interior to conduct a study of any region in any gas and oil lease sale to obtain information necessary for assessment and management of environmental impacts on human, marine and coastal areas which may be affected by oil and gas development on such areas.

43 U.S.C. 1801 et seq. OCS Lands Act Amendments of 1978. Provides for management of oil and natural gas in the Outer Continental Shelf and for other purposes. The Minerals Management Service is responsible for carrying out all functions in direct support of management of the OCS program. The USGS provides indirect support to the Department's management activities through the basic mission to examine the geological structure, mineral resources, and products of the national domain, which, offshore, includes the EEZ.

Title 44 – Public Printing and Documents

44 U.S.C. 1318 Classes and sizes of publications; report of mineral resources; number of copies; reprints; distribution. Provides for publication, by the Geological Survey, of various reports, including a report of mineral resources of the United States, bulletins and professional papers, and monographs. Also specifies, in some instances, numbers of copies to be printed and the distribution thereof.

44 U.S.C. 1319 Specific appropriations required for monographs and bulletins. Scientific reports known as monographs and bulletins of the USGS may not be published until specific, detailed estimates, and specific appropriations based on these estimates, are made for them.

44 U.S.C. 1320 Distribution of publications to public libraries. The Director of the USGS shall distribute to public libraries that have not already received them, copies of sale publications on hand at the expiration of 5 years after date of delivery to the Survey document room, excepting a reserve number not to exceed two hundred copies.

44 U.S.C. 1903 Distribution of publications to depositories; notice to Government components; cost of printing and binding. Upon request of the Superintendent of Documents, components of

the Government ordering the printing of publications shall either increase or decrease the number of copies of publications furnished for distribution to designated depository libraries and State libraries so that the number of copies delivered to the Superintendent of Documents is equal to the number of libraries on the list.

44 U.S.C. 3105–3107, 3301–3324 Federal Records Act, as amended. Establishes procedures for records management by Federal agencies, including disposal of records.

44 U.S.C. 3501 Paperwork Reduction Act. Establishes polices regarding Federal information, including minimizing the paperwork burden for all persons and organizations.

44 U.S.C. 3504 Government Paperwork Elimination Act of 1998, Title XVII of the Omnibus Consolidated and Emergency Supplemental Appropriations Act of 1999. Provides for development of procedures for electronic signatures by executive agencies.

Title 50, Appendix – War and National Defense

50 U.S.C. 98 Strategic and Critical Materials Stock Piling Act of 1946 as amended by the Revision Act of 1979. Supports the USGS programs for assessment of domestic minerals, especially for strategic and critical minerals, to complement the Federal mineral stockpile program. Section **98(g)** following language supports Appropriations language "and to conduct inquiries into the economic conditions affecting mining and materials processing industries ... and related purposes as authorized by law and to publish and disseminate data" Provides for scientific, technologic, and economic investigations concerning the development, mining, preparation, treatment, and utilization of ore and other mineral substances.

Public Laws

P.L. 81–82, P.L. 82–231 Arkansas River Compact and Yellowstone River Compact, respectively. Congress has granted consent to many interstate water compacts. For such compacts, the USGS provides administrative support for the Federal representative, usually appointed by the President. Also, the USGS collects hydrologic data for 25 interstate compacts. The data collection is supported partly by the Federal Program and partly by the Water Resources Investigations Activity.

P.L. 93–322 Special Energy Research and Development Appropriation Act of 1975. Provides funds "for energy research and development activities of certain departments" The USGS water resources investigations in coal hydrology support that legislation.

P.L. 106–291 FY 2001 Interior and Related Agencies Appropriations Act. Supports Appropriations language "of which () shall be available until September 30, (), for the operation and maintenance of facilities and deferred maintenance"

P.L. 106–498 Klamath Basin Water Supply Enhancement Act of 2000. Authorizes the Bureau of Reclamation to conduct feasibility studies to augment water supplies for the Klamath Project, Oregon and California, and for other purposes. The Secretary of the Interior is directed to complete ongoing hydrologic surveys in the Klamath River Basin that are currently being conducted by the USGS. Since 1992, USGS scientists have been conducting hydrological and biological research on many of the factors affecting Klamath Basin water resources. These studies include water-quality and quantity issues, endangered species and other fishery issues, and decreased water supply to wetland areas in National Wildlife Refuges.

Authorizations

P.L. 106–541 Water Resources Development Act of 2000. Authorizes appropriations to the Secretary of the Army for the conservation and development of water and related resources to construct various projects for improvements to rivers and harbors of the United States, and for other purposes. Sections of interest to the USGS: Section **403** (33 U.S.C. 652) Upper Mississippi River Basin Sediment and Nutrient Study. Section **509**, CALFED Bay-Delta Program Assistance, California. Section **542**, Lake Champlain Watershed, New York and Vermont. Section **601**, Comprehensive Everglades Restoration Plan. Section **701**, Missouri River Valley, Missouri (Missouri River Valley Improvement Act).

P.L. 107–63 FY 2002 Interior and Related Agencies Appropriations Act.

P.L. 107–347 E-Government Act of 2002. Establishes a broad framework of measures that require using Internet-based information technology to enhance citizen access to Government information and services. Title III, the Federal Information Security Management Act of 2002, lays out a framework for ensuring the effectiveness of information security controls over information resources that support Federal operations and assets and for other purposes.

P.L. 108–7 FY 2003 Interior and Related Agencies Appropriations Act. Consolidated Appropriations Resolution, 2003. Following language included in Administrative Provisions of the USGS part of the public law: "Provided further, that notwithstanding the provisions of the Federal Grant and Cooperative Agreement Act of 1977 (31 U.S.C. 6301–6308), the United States Geological Survey is authorized to continue existing, and hereafter, to enter into new cooperative agreements directed towards a particular cooperator, in support of joint research and data collection activities with Federal, State, and academic partners funded by appropriations herein, including those that provide for space in cooperator facilities."

P.L. 108–108 FY 2004 Interior and Related Agencies Appropriations Act.

P.L. 108–360 Earthquake Hazards Reduction Authorization Act of 2004. Authorizes appropriations through fiscal year 2009 and establishes an Interagency Coordinating Committee on Earthquake Hazards Reduction, of which the USGS is a member.

P.L. 108–447 FY 2005 Consolidated Appropriations Act. Division E contains the Department of the Interior and Related Agencies Appropriations Act, 2005. Following language is included: "of which \$1,600,000 shall be available until expended for the deferred maintenance and capital improvement projects that exceed \$100,000 in cost...."

P.L. 109–54 Department of the Interior, Environment, and Related Agencies Appropriations Act, 2006.

P.L. 110–140 Renewable Fuels, Consumer Protection, and Energy Efficiency Act of 2007 – Title I: Biofuels for Energy Security and Transportation - Biofuels for Energy Security and Transportation Act of 2007 - Subtitle A: Renewable Fuel Standard - (Sec. 111) Directs the President to promulgate regulations to ensure that motor vehicle fuel and home heating oil sold or introduced into commerce in the United States on an annual average basis, contains the applicable volume of renewable fuel determined in accordance with a specified calendar year schedule for 2008–22.

P.L. 111-11, 123 Stat. 991 Omnibus Public Land Management Act of 2009.

**American Recovery and Reinvestment Act of 2009
Program Plan for**

The United States Geological Survey (USGS)



April 10, 2009

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Part I: Overview: Recovery Act Implementation at the Department of the Interior

Background

The American Recovery and Reinvestment Act of 2009 (the Recovery Act) is an unprecedented investment in our country's future. Funding is to support job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, and State and local fiscal stabilization.

President Obama has set out specific goals in implementing the Recovery Act, including:

- Create or save more than 3.5 million jobs government-wide over the next two years;
- Revive the renewable energy industry and provide the capital over the next three years to eventually double domestic renewable energy capacity;
- As part of the \$150 billion investment in new infrastructure, enact the largest increase in funding of our nation's roads, bridges, and mass transit systems since the creation of the national highway system in the 1950's; and
- Require unprecedented levels of transparency, oversight, and accountability.

The Department of the Interior will play an important role in this effort. Investments will focus on job creation, infrastructure needs, and creating lasting value. Priority objectives achieved with Recovery Act funding will:

- Accelerate a move toward a clean energy economy;
- Provide jobs that build employable skills and develop an appreciation for environmental stewardship in young adults; and
- Preserve and restore the nation's iconic and treasured structures, landscapes, and cultural resources.

Project Selection

Criteria

In recognition of the urgency to select and execute projects expeditiously, the Department established unified priorities and formulated guidance to lead the bureaus in the project selection process. The guidance prescribed that the following framework be used to assess a project's suitability for Recovery Act funding:

- **Expediency of implementation.** The first consideration was a practical one – can the project be responsibly executed within the time limitations of the Recovery Act? With a few exceptions, Recovery Act funds are available for obligation through September 30, 2010. Section 1602 of the Act reads "...recipients shall give preference to activities that can be started and completed expeditiously, including a goal of using at least 50 percent of the funds for activities that can be initiated no later than 120 days after the date of enactment." This criterion was a limiting factor that impacted meritorious projects that were not ready for implementation.

- **Addresses high priority mission needs.** Does the project target the bureau's highest priorities within the categories specified in the legislation? Has the project been evaluated through established procedures to address high priority needs? Are public lands, parks, refuges and resources renewed as a result of the project? With respect to deferred maintenance and line item construction, is the ranking consistent with existing priorities and processes?
- **Job creation potential.** Pursuant to the primary goal of the Recovery Act, what is the potential of the project to quickly create jobs and stimulate local economies?
- **Merit-based.** Was the project selected using merit-based and transparent criteria? Are competitive awards used to the maximum extent possible? Do the criteria incorporate existing prioritization processes?
- **Long-term value.** To what extent does the project create long-term value for the American public through improved energy independence, restoration of treasured landscapes or other lasting benefits?
- **Energy objectives.** For proposed construction or deferred maintenance projects, do they incorporate energy efficient and renewable energy technologies? Do they have a component that will further clean energy and independence goals?
- **Opportunities for youth.** Does the project engage young adults and instill education about our public lands and cultural resources?
- **Future cost avoidance.** Does the project create new operational requirements in future years? Or, conversely, will the project decrease operating costs through energy improvements or disposal of unneeded and costly assets?

Priorities

As part of the Department's standard capital asset planning process, the bureaus develop 5-Year plans identifying deferred maintenance and construction needs. The 5-Year Deferred Maintenance (DM) and Capital Improvement Planning process is the backbone of the Department's Asset Management and Bureau Asset Management Plans which are used to formulate the Department's budget requests. The plans are developed, and updated, on an annual basis at the bureau level using a Department-wide process that ranks both DM and Capital Improvement Projects using uniform criteria. Categories for ranking projects include Critical Health Safety, Critical Resource Protection, Energy, Critical Mission, Code Compliance, and Other Deferred Maintenance.

The categories used in the rating process are weighted so that projects that address critical health and safety needs will receive the highest score. The final score of a project also takes into account the asset priority for the project. The Department's goal in the 5-year planning process is to focus its limited resources on projects that are both mission critical and in the most need of repair/replacement.

To the extent practicable, Recovery Act projects in deferred maintenance and construction were drawn from the 5-Year lists. Each bureau's detailed Recovery Act

plan indicates the extent to which selected projects were derived from existing capital plans and provides the rationale for any exceptions.

There are several reasons why a Recovery Act project might not come from a 5-Year Plan. In many cases, it reflects timing. The Recovery Act requires the obligation of funds by September 20, 2010. Projects involving complicated procurements, significant environmental considerations, or with considerable planning and design components, may not be good Recovery Act investments because of the need to obligate project funds quickly. Additionally, Secretary Salazar has challenged each bureau to select projects that can also be completed within the timeframe of the Recovery Act in order to maximize the beneficial impact to the economy further refining the list of eligible projects.

The scope of the 5-Year plans is also limited. Each 5-Year Plan assumes a five year funding level consistent with prior appropriations. For some bureaus, the Recovery Act funding exceeds the total amounts assumed in the 5-Year Plans. In addition, two years of the available 5-Year Plans will be addressed through the regular FY 2009 and FY 2010 appropriation processes. In cases where the 5-Year Plan has been exhausted, the bureau has selected Recovery Act projects from other existing capital planning lists.

Contingency Projects

As part of the Department's internal process, each bureau has identified a list of eligible projects for Secretarial approval larger than the amount of available Recovery Act funding. Getting advance approval for a larger universe of eligible projects will expedite the deployment of alternate projects should a Recovery Act project experience delays in execution. These projects are referred to as identified contingency and are included in the funding table of each bureau's detailed Recovery Act Plan.

Implementation of Recovery Act

Monitoring and Evaluation

The establishment of meaningful and measurable outcomes is an important component of Interior's Recovery Act reporting. Performance monitoring and oversight efforts are designed to ensure that the Department meets the accountability objectives of the Recovery Act.

These efforts include tracking the progress of key goals. The Department is defining a suite of performance measurements to monitor progress to ensure objectives are met. In addition, the Department's Recovery Act Coordinator is collaborating with senior Departmental officials, the Office of Management and Budget, and the Office of Inspector General to ensure oversight of the program from the first phase of project selection, through implementation and execution. The Coordinator, with the assistance of the Recovery Act Board, will be evaluating processes to ensure that adequate mechanisms are in place and identify and share best practices to promote:

- Maximized use of competitive awards
- Timely award of dollars
- Timely expenditure of dollars
- Timely completion of planned work
- Minimized cost overruns
- Minimized improper payments

Measurement and reporting is a crucial component of Interior's oversight strategy. The information received will serve as an indicator of progress enabling the Department's governance entities to manage risk and ensure successful implementation of the Recovery Act. Department-wide, consistent guidance will guide efforts in this regard, including for example, development of a risk management program.

Accountability and Transparency

The President and Congress have made it clear that the Act must be carried out with unparalleled levels of accountability and transparency. The President's commitment to manage these investments transparently will be met through Agency reporting on performance metrics and the execution of the funds on recovery.gov. Reporting requirements related to major contract actions and financial status, including obligations and outlays, are being instituted. Periodic reviews of implementation progress at both the bureau and Departmental levels will identify the need to realign resources to expedite projects, to modify project plans or to select contingency projects to ensure funds are obligated within the time limitation. The selection of contingency projects will be included as part of regular reporting through recovery.gov.

The Recovery Coordinator will oversee bureau implementation to ensure projects address the Department's high priority goals and objectives, while also working to ensure that department-wide performance objectives, including timeliness and cost and risk management are met throughout the process.

The Office of Inspector General will be working closely with the Department from the start to review and propose effective processes to manage risks, monitor progress and to improve overall performance and accountability.

As part of routine reporting, the Department is also carefully tracking all projects subject to the National Environmental Policy Act (NEPA). During the project selection phase the Department identified which projects had already completed NEPA planning, which are in progress, and which ones still need to begin the NEPA process. The Department will track the status of all NEPA compliance activities associated with projects or activities and report quarterly to the Council on Environmental Quality.

Administration

The Department's oversight and administration is led by the Secretary with leadership by the Recovery Act Coordinator. He utilizes an Executive Board and Department-wide Task Force to assist. The Executive Board is the entity responsible for ensuring compliance with the Recovery Act execution reporting, and audit requirements. The Board will be convened once project decisions are made and plans are finalized. The Board consists of nine members, and is chaired by the Department's Chief of Staff. The other board members are the Recovery Act Coordinator, Solicitor, Inspector General, and the four programmatic Assistant Secretaries within Interior and the Assistant Secretary for Policy, Management and Budget.

The Recovery Act Task Force ensures consistent implementation of the Recovery Act, promotes collaboration and sharing of skills and best practices among bureaus, develops implementation guidance, oversees the process for completion of Recovery Act plans and project lists, and develops the infrastructure needed for on-going

monitoring of progress and performance. It is co-chaired by the Recovery Act Coordinator and the Assistant Secretary for Policy, Management and Budget, and is responsible for implementation of the Recovery Act. The Task Force has representatives from each bureau, as well as all the functional areas across the Department.

There are workgroups reporting to the Task Force that are developing processes and guidance on reporting, performance, communications, project approval, administration, risk management, acquisitions, and youth involvement. As implementation progresses,, workgroups will be disbanded and others may be established.

In addition to these Departmental groups, each bureau has established its own governance structure. Bureau task forces and boards will ensure that programs execute projects effectively and meet the accountability and transparency objectives of the Act. A Recovery Act coordinator has been designated for each bureau.

The bureau task forces have responsibilities from the development of project lists through completion. They develop the project lists, establish the necessary controls, and develop tracking mechanisms to ensure they are managing schedules and performance, and meeting the reporting requirements. The task forces meet regularly to ensure proper oversight. Each bureau has developed a leadership structure to manage the Recovery Act implementation. Responsibility for key components, such as reporting and oversight, has been delegated to the bureaus' senior management officials. The bureaus will also use staff in the field to provide direct oversight and leadership and provide reports to their executive leadership.

Barriers to Effective Implementation

The volume of funding provided in the Recovery Act and the contracts that will be awarded to execute these resources will challenge Interior's current procurement processing capacity. Interior's FY 2009 appropriation was \$11.3 Billion. The Recovery Act supplements this request by \$3 billion over two years, an increase of 27% over the enacted amount for FY 2009. Interior has taken a common-sense approach to best utilize existing resources to implement the Recovery Act. However, the investment required to handle the increase in funding will strain Interior's on-board resources. While the Act authorizes the set-aside of monetary resources to alleviate the administrative burden (e.g. hiring additional contracts staff), the real management issue is ensuring that procurement resources, no matter how plentiful, are knowledgeable and responsible. The Department plans to meet these resource challenges by sharing staff and expertise across bureaus, hiring term and temporary staff, and reemploying knowledgeable annuitants.

In addition to expanding resources to implement the Recovery Act, Interior is also working to streamline business processes to help alleviate resource challenges. The bureaus are encouraged to make use of techniques such as the grouping of like work orders into a single project to reduce acquisition time. Another example that is currently under consideration is the consolidation of procurement functions related to the Recovery Act. This strategy would relieve seasoned acquisition staff of their routine duties to have them focus on Recovery Act procurements. The regular duties would be assumed by alternative DOI acquisition staff. Concentrating Recovery Act procurement expertise would result in processing efficiencies and expedite the use of funds.

American Recovery and Reinvestment Act

Considerations such as these illustrate Interior's drive to get the work of the Recovery Act done.

Interior's governance bodies, such as the Recovery Act Task Force and the subsidiary acquisition workgroup, will handle resource issues raised by its members and the bureaus to ensure adequate staffing for the Recovery Act implementation.

Part II: Executive Summary: Recovery Act Implementation at the USGS

Overview

The American Recovery and Reinvestment (ARRA) Act of 2009 (P.L. 111-5) provided appropriations for the U.S. Geological Survey (USGS). The language states:

“...for an additional amount for “Surveys, Investigations, and Research”, \$140,000,000, for repair, construction and restoration of facilities; equipment replacement and upgrades including streamgages, and seismic and volcano monitoring systems; national map activities; and other critical deferred maintenance and improvement projects.”

USGS has completed condition assessment at its facilities and developed an inventory of deferred maintenance projects at its owned facilities; abandoned groundwater wells that have not been remediated; streamgages and cableways that have been discontinued and should be removed; overdue upgrades to monitoring capabilities for earthquakes and volcanoes; streamgage modernization and collection of much-needed elevation data, especially in coastal areas.

The Recovery Act provides unprecedented support for priority research and monitoring needs. USGS will meet the 2013 deadline of the requirement to upgrade radio transmission on streamgages to be able to use a new NOAA satellite. Approximately one-fourth of the stations in the Advanced National Seismic System (ANSS) will be upgraded to meet goals set for implementation of ANSS. The National Volcano Early Warning System will begin a robust upgrade to digital systems and implementation of newly developed instruments. Critical elevation data along the United States coasts will be gathered and archived, and data preservation will be advanced by digitizing historic records. USGS will address a large proportion of its inventory of facilities repair in order to provide functional and technical workspace needed to advance its program missions.

The following plan outlines the projects the USGS proposes to implement with the ARRA funding. In addition to addressing key mission needs, these projects will create or retain jobs, engage youth during project implementation, reduce energy consumption in Federal facilities, and utilize renewable energy in comprehensive monitoring systems. Furthermore, ARRA projects that collect or generate new data sets will make this information available through recovery.gov, as well as the Administration’s new government-wide data portal, data.gov.

Bureau Accountable Official

Robert Doyle, Deputy Director; bdoyle@usgs.gov; 703-648-7412

Funding Categories

USGS plans to use Recovery Act funds to address eight program areas:

- 1) **Deferred Maintenance-Facilities (DM); (Budget Subactivity: Facilities) +\$29.4 million:** USGS will address the highest priority deferred maintenance projects at its owned facilities. These projects will address health and safety issues, functional needs such as improved laboratory space; make facilities more energy efficient, and

incorporate sustainable design criteria in project implementation. In the annual budget, \$2.0 million is planned for USGS deferred maintenance and capital improvement. One such project at the Conte Anadromous Fish Laboratory in Turners Falls, MA is to replace tent-covered fish tanks and storage with a permanent storage building that will have a solar roof to generate power, significantly reducing annual heating costs. This project will improve USGS' ability to conduct research on Atlantic salmon that spend part of their life in fresh water and the rest of their life in salt water (anadromous fishes). Research is directed at restoring and protecting these fisheries for the ecological and economic benefit of the region.

- 2) **Construction (C); (Budget Subactivity: Facilities) +\$17.8 million:** The USGS Investment Review Board (IRB) has reviewed projects where construction is the preferred alternative to eliminate deferred maintenance and address other health and safety issues. Three construction projects were approved by the IRB as the most cost effective way to address the issues at research centers. They are part of the ARRA project list, including the Patuxent Wildlife Refuge Research Center in Patuxent, MD; the Columbia Environmental Research Center (CERC) in Columbia, MO; and the Upper Midwest Environmental Services Center (UMESC) in LaCrosse, WI. Recovery Act funding will make it possible to begin work on these projects immediately. Work at these centers will improve the ability of scientists to conduct innovative research on contaminants and wildlife, endangered species, wind power and wildlife, adaptive management, wildlife disease and much more. The rehabilitation of these facilities will support jobs for the local community, a key goal of the economic stimulus package, improve functionality, and also reduce long-term operating costs.
- 3) **Deferred Maintenance – Streamgages, Cableways, and Wells (ER); (Budget Subactivity: Facilities) +\$14.6 million:** USGS operates streamgages and wells with state and local funding partners; when partners no longer co-fund the streamgages and wells, sites are usually closed and remediated. Over the past decades, funds were not available to remediate some of these sites or to adequately maintain some currently operated sites. Discontinued streamgages, cableways, and ground-water wells that have not been remediated potentially pose public health and safety issues until they are remediated. Funding for remediation will be used to remove structures that are no longer in use, which will in turn make these sites safer for public enjoyment and support local economies.
- 4) **Upgrades to Streamgages (SG); (Budget Subactivity: National Streamflow Information System) +\$14.6 million:** The USGS national streamgage network (NSN) (7,500 sites) is dependent on a NOAA-operated satellite, which is scheduled for conversion to new high-data rate radio (HDR) technology in 2013. USGS will use Recovery Act funding to upgrade to HDR technology and upgrade streamgages with new technologies for streamflow measurement. With Recovery Act funding and current appropriation plans, all 7,500 streamgages will be upgraded by 2012. The HDR radios will provide improved data quality to data users through more timely data transmissions (1 transmission every hour instead of 1 transmission every 4 hours.) This is particularly important during periods of flooding when emergency and water managers critically need timely information to warn surrounding communities affected by water surge.
- 5) **Earthquake Monitoring (SV); (Budget Subactivity: Earthquake Hazards) +\$29.4 million:** USGS will use Recovery Act funding to make a substantial impact on the modernization component of the Advanced National Seismic System (ANSS) by

doubling the number of ANSS-quality stations and upgrading seismic networks nationwide, to bring the total from approximately 800 to 1600. These improved networks will deliver faster, more reliable and more accurate information – helping to save lives by providing better situational awareness in the wake of the damaging earthquakes that can strike this nation at any time. Earthquakes are one of the most costly natural hazards faced by the Nation, posing a significant threat to 75 million Americans in 39 states. The delivery of earthquake information will be more timely with investments in modern seismic networks and data processing centers.

- 6) **Volcano Monitoring (SV); (Budget Subactivity: Volcano Hazards) +\$15.2 million:** USGS will use Recovery Act funding to modernize equipment in the National Volcano Early Warning System (NVEWS) through modernization of monitoring equipment at all USGS volcano observatories. The U.S. and its territories are one of the most volcanically-active regions in the world, with 169 active volcanoes. As many as 54 of these potentially dangerous volcanoes need improved monitoring. Volcano monitoring can protect lives and avoid significant economic losses. Twenty years ago, a KLM Airlines Boeing 747 filled with passengers flew head-on into a 40,000-ft high cloud of volcanic ash west of Anchorage, Alaska. The encounter shut down all four of the plane's engines. Fortunately the aircraft was able to restart, averting tragedy, and the loss of the plane valued at more than \$80.0 million.
- 7) **Imagery and Elevation Data for Mapping (NM); (Budget Subactivity: National Geospatial Program) +\$14.6 million:** USGS maps are used in myriad ways: hazard response, vegetation change, land cover assessment, coastal erosion change, and determining boundaries. Recovery Act funding will allow USGS to improve mapping data, which will then be made available for multiple uses including flood mapping, emergency operations, and natural resource management. USGS will upgrade existing imagery and elevation map data and collect additional higher resolution elevation and orthoimagery data in critical areas of the United States. Elevation data and orthoimagery are used in applications ranging from flood forecasting and modeling sea-level rise to improving understanding of key natural resource issues. According to the USGS National Map's Tactical Plan, the highest priority areas that need elevation data are over coastal areas of the United States that are most susceptible to storm and hurricane flooding, earthquake damage, and coastal erosion. The USGS will coordinate the collection of elevation and orthoimagery data with other Federal agencies and State governments, leveraging use of Recovery Act funds to obtain data which will be suitable for use by a variety of organizations.
- 8) **Data Preservation (DP); (Budget Subactivity: Facilities) +\$448,000:** Researchers and resource managers across the country utilize bird banding information to track the populations, flight patterns and resting areas of migratory birds. The USGS Bird Banding Laboratory (BBL) located at the Patuxent Wildlife Research Center in Maryland manages all marking and recovery information for migratory birds for the U.S. It also processes banding and recovery data for migratory birds from Canada and Mexico. Since 1908, more than 66 million birds have been banded and 4.1 million have been recovered. Recovery Act funding will make it possible to digitize and make available to the public via the Internet, the historical banding recovery and bird banding records. Bird banding data have a wide variety of uses including applications for disease research. Sampling wild birds for serious disease helps determine the prevalence of the disease in the population and any of these birds with bands can be traced back to when and where the bird was banded. Digitizing these records would allow the BBL to eliminate the need

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for off-site record storage and the associated storage costs. Recovery Act funding will save resources by allowing more work to be accomplished in a shorter amount of time, and improve access to this information which is widely used by bird management and conservation programs.

USGS Funding Table

Surveys, Investigations, and Research	Funding Amount (000's)	# of Projects Per Category	Contingency Projects Funding (000's) ¹	# Contingency Projects ¹
Deferred Maintenance – Facilities (DM)	\$29,403	67	\$7,392	22
Construction (C)	\$17,791	3	0	0
Deferred Maintenance - Streamgages, Cableways, and Wells (ER)	\$14,625	183	\$8,551	85
Upgrades to Streamgages (SG)	\$14,625	52	\$3,000	3
Earthquake Monitoring (SV)	\$29,445	3	\$6,000	1
Volcano Monitoring (SV)	\$15,210	6	\$3,000	1
Imagery and Elevation maps (NM)	\$14,625	2	\$3,000	2
Data Preservation (DP)	\$488	1	0	1
Administrative Costs²	\$3,788			
TOTAL	\$140,000	317	\$30,943	115

¹“Contingency” funding and projects refer to ranked projects meeting the ARRA criteria and ready to be instituted should a project ranked higher experiences delays.

²The amount of “Administrative Costs” for DM and C is shown at 3% of the total funding provided for these categories; the amount of “Administrative Costs” for other project categories (ER, SG, SV, SV, NM and DP) is shown at 2.5% of the total funding. There could be administrative costs not to exceed 5% in total.

Process for Allocating Between Categories

USGS received direction in Recovery Act language that identified project categories. Given its strong tradition and practice of science planning and administrative reviews, USGS used existing plans and processes to focus on each category in the legislation and determine how the funds could best be used to respond to the intent of the Act and advance programs and planning efforts already underway or ready to be implemented in USGS. USGS made the funding level determination for each category using a combination of: work that could be implemented within the time frame of the Act; existing national, merit-based priorities; projects which would not generate future year operation and maintenance costs that could not be met with current funding; and projects that would address long-standing needs. Once funding levels were determined by category experts, staff were engaged to examine existing plans and project priorities to recommend individual projects to be funded. From this process emerged a set of projects ranked in priority order and evaluated according to the relevance, expected outcomes and benefits compared to the other projects. USGS has identified a total of \$140.0 million in projects to be executed under the authorization of the Recovery Act. Throughout the execution of the program, USGS will monitor schedules and costs for the projects. If it is determined that a project cannot be completed in a timely fashion, USGS will redeploy funds to another project that has undergone the same priority ranking processes. USGS has developed a list of projects totaling \$30.0 million for this purpose.

Part III: Deferred Maintenance - Facilities

Program	Funding Amount	# of Projects
Deferred Maintenance – Facilities (DM)	\$29,403,000	67

Program Manager

Paul Gargano; AGargano@usgs.gov; (703) 648-7505.

Objectives

The overall objective for the USGS Facilities program is to provide a safe, reliable, energy-efficient, and right-sized portfolio of infrastructure for employees, visitors, and contractors at USGS facilities. One means of achieving this objective is by completing deferred maintenance projects for mission critical and mission dependent facilities and disposing of assets no longer needed to support the mission. By addressing projects that were planned for future years in the USGS 5-year plan, USGS will protect the health and safety of the public and employees, sustain the assets through their remaining useful life, and ensure compliance with building codes and industry standards.

The USGS Facilities program ensures that assets required to accomplish science mission objectives are maintained. USGS is a leader in understanding complex natural science questions of the day; performing objective, policy-neutral analysis; and providing the scientific products to lead to solutions. For more than a century, natural resource managers, emergency response organizations, land use planners, decision-makers at all levels of government, and citizens in all walks of life have come to depend on the USGS for reliable information to address pressing societal issues such as public safety and health, natural resource management, and environmental protection.

The USGS utilizes its facilities condition assessment program to identify and document deferred maintenance. This program includes annual surveys and a cyclic process for comprehensive on-site condition inspections. These condition assessments are vital to establishing core data on the condition of the USGS constructed assets. This program tracks the facilities condition, as measured by the Facilities Condition Index (FCI). This index is calculated by dividing the deferred maintenance backlog (DM) by the current replacement value (CRV). $FCI = DM / CRV$.

Completion of the ARRA Deferred Maintenance-Facilities projects will support the advancement of USGS asset management and science programs by reducing deferred maintenance on high priority facilities. Facilities will be decommissioned which will “right-size” the overall portfolio of assets which will be illustrated through improving the bureau’s overall FCI. Additionally, the program will improve the longevity of systems and maximize the efficiencies of the real property assets and equipment used to carry out the science mission. Six projects will include disposal of existing assets. The USGS 5-year plan for 2010-2014 included a total of \$17.7 million in deferred maintenance associated with the projects. ARRA funding will complete approximately \$16.5 million of this set of priority projects.

For example, the research vessels on the Great Lakes have deferred maintenance issues. Their replacement will address deferred maintenance projects and result in energy efficiency and a safer work environment along with disposal of assets which have far exceeded the end of their life expectancy.

Activities

Examples of ARRA projects:

- Energy efficient roofing project
- Energy Star HVAC system replacement
- Fire alarm and sprinkler system installation
- Paving roadways and sidewalk replacement
- Replacement of water towers and water supply lines

Selection Criteria

Selection Process: Initially, the USGS used existing projects in 5-year plans for deferred maintenance. Deferred maintenance (DM) projects for facilities are ranked using a consistent score that was established by the Department of the Interior (DOI). The projects on the 5-year plan are the highest ranking projects that were slated for 2010 – 2014. Additional projects beyond the current 5-year lists were compiled at the regional level using the same priority-ranking criteria.

Selection Factors: To provide consistency Department-wide and address a consistent set of priorities for DM, all DM projects are ranked using a consistent weighting process: percentage of work that falls in each of nine categories of facilities maintenance and construction needs.

These are listed below (weighting factors shown to the right):

Critical Health & Safety Deferred Maintenance (CHSdm)	10
Critical Health & Safety Capital Improvement (CHSci)	9
Critical Resource Protection Deferred Maintenance (CRPdm)	7
Critical Resource Protection Capital Improvement (CRPci)	6
Energy Policy, High Performance, Sustainable Buildings C I (EHPBSci)	5
Critical Mission Deferred Maintenance (CMdm)	4
Other Deferred Maintenance (Odm)	3
Code Compliance Capital Improvement (CCci)	4
Other capital improvements (Oci)	1

All projects are ranked using the following calculation:

$$(\%CHSdm \times 10) + (\%CHSci \times 9) + (\%CRPdm \times 7) + (\%CRPci \times 6) + (\%EHPBSci \times 5) + (\%CMdm \times 4) + (\%Odm \times 3) + (\%CCci \times 4) + (\%Oci \times 1) = \text{TOTAL SCORE}$$

This ranking formula was designed to accommodate many project types and sizes. It places the highest priority on facility-related Critical Health and Safety and Critical Resource Protection deferred maintenance needs. Capital improvement projects that also eliminate substantial amounts of deferred maintenance receive higher rank score than projects that do not. A project example is described below along with its total score calculation:

Description: Rehabilitate to correct critical health and safety deficiencies by:

- (1) Providing fire alarm system (now lacking) for new HQ office annex,
- (2) Providing fire suppression systems for storage rooms in old HQ building,
- (3) Installing fume hood,
- (4) Installing eye wash station, and
- (5) To comply with National Electrical Code, project includes replacing and repairing portions of electrical system in old HQ building.

Percentages of this project applied to weighting categories:

70% CHSdm and 30% CCci

Project's total score would be: $(70 \times 10) + (30 \times 3) = 790$.

In preparation of the 5-year plan, Facilities Managers submit scored projects, USGS then uses a DM team that has membership from each Region and Headquarters, to review all project scoring. The Team ensures consistency in USGS scoring and ranking and develops the USGS DM 5-year plan.

Characteristics (Types of Financial Awards to be Used)

Type of Award	# of projects in this category	\$ Value of projects	Targeted type of recipients	Award Selection Types
In-House Activity	1	972,000	Acquisitions and Project Managers	Administrative support
Contracts	67	29,403,000	Small Businesses, Large Businesses	Criteria based on statement of work, successful record of past performance and adherence to cost schedule
Grants				NONE CONTEMPLATED
Cooperative Agreements				NONE CONTEMPLATED

Performance Measures

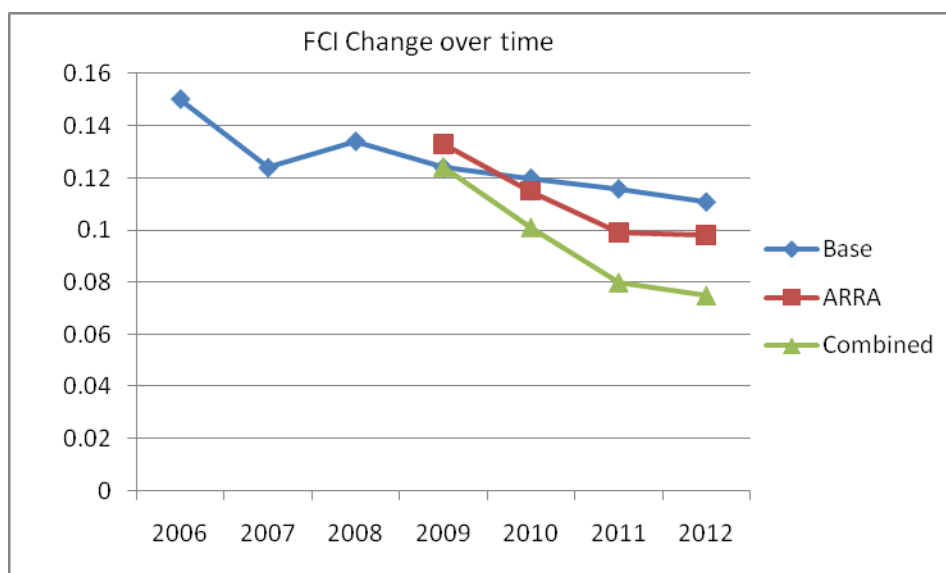
Performance Measure # 1***

Description of Measure	Improvement in Bureau Facilities Condition Index (FCI)*
Length of Period between Measurement	Reported Quarterly
Measurement Methodology	Annual Federal Real Property Profile (FRPP) FCI will be compared against baseline FY08 FRPP FCI (facility condition improves as FCI gets smaller)
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	0.134 base
2009 Performance Target	0.133 ARRA; .124 base; .124 combined**
2010 Performance Target	0.115 ARRA; .12 base; .101 combined**
2011 Performance Target	0.099 ARRA; .116 base; 0.08 combined**
2012 Performance Target	0.098 ARRA; .111 base; 0.075 combined**

*FCI is determined by combining funding for Deferred Maintenance – Facilities (\$29.4M) and Construction (\$18.3M).

**The combined impact of using base funding and ARRA funding on the FCI is greater than the sum of the two.

***The ARRA "subset" of projects are those requiring immediate attention from a health and safety standpoint



American Recovery and Reinvestment Act

A declining FCI signals improved condition of facilities. The infusion of ARRA funds will accelerate USGS ability to improve the condition of its facilities.

Project Milestones and Completion

Types of Projects

Type	Description of Project Types	# of Projects	\$ Value of Projects
Less than or equal to \$100k	Deferred Maintenance	25	\$1,850,000
Greater than \$100k and less than \$2M	Deferred Maintenance	38	\$15,657,000
Greater than or equal to \$2M	Deferred Maintenance	4	\$11,896,000

Completion Rate

Quarter	# of Projects Completed (Less than or equal to \$100k)	# of Projects Completed (Greater than \$100k and less than \$2M)	# of Projects Completed (Greater than or equal to \$2M)	Total # of Projects Completed per Quarter	Cumulative % of Projects Completed
FY 2009 Q4	1			1	1%
FY 2010 Q1	3	2		5	10%
FY 2010 Q2	3	3		6	18%
FY 2010 Q3	3	2		5	25%
FY 2010 Q4	5	3		8	37%
FY 2011 Q1	3	7		10	52%
FY 2011 Q2	2	7	1	10	67%
FY 2011 Q3	0	4		4	73%
FY 2011 Q4	5	10	3	18	100%

Less than or equal to \$100.000 -- Key Milestones

Milestones	Avg. Length of Completion (months)
Planning	1
Award design	1
Design	3
Award Construction	2
Construction	10.5
Closeout	1
<i>Total</i>	18.5

Greater than \$100,000 but less than \$2.0M -- Key Milestones

Milestones	Avg. Length of Completion (months)
Planning	1
Award design	1
Design	2
Award Construction	6
Construction	11.5
Closeout	1
<i>Total</i>	22.5

Equal to or greater than \$2.0M -- Key Milestones

Milestones	Avg. Length of Completion (months)
Planning	1
Award design	1
Design	4
Award Construction	6
Construction	15.5
Closeout	1
<i>Total</i>	28.5

Large Deferred Maintenance Projects (Greater than \$800,000)

Project Information		Duration of Activities (in months)					Total Months to Complete
Name of Project	\$ Value of Project	Planning	Permitting/ Pre-Contract Award	Design	Construction	Close-Out	
NWHC – Replace Exhaust Fans, Ducting and Filter Housing (TIB Building)	\$2,608,000	1	3	4	19	3	30
UMESC – Replace Existing Water Tower	\$2,288,000	1	2	3	21	3	30
CERC – Renovate Pond Banks, Kettles and Piping	\$1,382,000	1	3	4	19	3	30
NWHC – Replace Exhaust Fans, Ducting and Filter Housing (Main Building)	\$1,301,000	1	3	4	19	3	30
NWHC –Replace building Control System	\$825,000	1	3	4	19	3	30
Replace Musky Research Vessel	\$3,500,000	1	3	3	21	2	30
Replace Kaho Research Vessel	\$3,500,000	1	3	3	21	2	30

Mission/Savings/Costs Implications

Keeping employees who work at and the public who visits USGS facilities safe is key to successful conduct of the Bureau’s mission. In addition, fixing and maintaining these facilities will save money in the future as well provide jobs now to local contractors. The USGS expects future reductions in annual operations and maintenance costs through the installation of new energy efficient equipment and upgrade of facilities. In 2008, the annual operating cost for owned assets in the Federal Real Property Profile was \$14.2M. An estimated reduction of \$283,000 each year is expected after completion of the proposed projects. The ARRA funded deferred maintenance projects should reduce both the utility consumption and cost as well as reduce expenditures on unscheduled maintenance.

Part IV: Construction

Program	Funding Amount	# of Projects
Construction	\$17,791,000	3

Program Manager

Paul Gargano; AGargano@usgs.gov; (703) 648-7505

Objectives

Construction funding for USGS facilities provides for the construction, rehabilitation and replacement of assets required to accomplish mission objectives. USGS is a leader in understanding complex natural science questions of the day; performing objective, policy-neutral analysis; and providing the scientific products to lead to solutions. For more than a century, natural resource managers, emergency response organizations, land use planners, decision-makers at all levels of government, and citizens in all walks of life have come to depend on the USGS for reliable information to address pressing societal issues such as public safety and health, natural resource management, and environmental protection.

It is USGS policy to manage its real property and other constructed assets in an economic and effective manner and to exercise responsible stewardship of these assets in compliance with Departmental guidance on capital improvements. To adequately meet science mission needs, USGS uses construction funding for the repair, modernization and construction of buildings and other facilities that are in a state of disrepair, beyond their useful lives, or otherwise no longer cost-effective to operate. All construction projects are reviewed and selected by the USGS Investment Review Board.

Completion of the ARRA construction projects will modernize assets and infrastructure, eliminate overcrowding and dispose of assets that are no longer cost effective to operate and maintain. This will improve the overall USGS asset management program in the areas of operating costs, utilization, facilities condition index, and the disposition of assets. All of these are key elements of an asset management program as identified by the Federal Real Property Council.

Activities

Examples of ARRA projects:

- Demolition of existing administration and research buildings
- Demolition of existing water and sewer piping systems
- Design sustainable building and scope of work for construction
- Modernization of water and sewer piping systems

Selection Criteria

Construction projects were identified for inclusion in the Recovery Act using the USGS Investment Review Board process. This process consists of field managers reporting conditions of facilities and whether they are adequate to meet the needs of the required functions of the field unit. Local managers submit their proposals to the Regional Directors, who in turn review them and rank them in a priority order respective to their Region and submit decisions to

Headquarters. In Headquarters, facilities staff rank all of the projects according to accepted procedure and prepare them for Board consideration. Managers/Regions make presentations to the Board on the projects selected for funding and action. The USGS IRB then discusses all projects in an Executive Session and recommends a ranked list to the Director for decision. Projects are then included in the Bureau budget request to the Department, concomitant to funding targets. This process was modeled on the DOI IRB model. The USGS follows the procedures in the Department’s Capital Planning and Investment Control Guide to review, select and manage the business cases (OMB Exhibit 300) for construction projects greater than \$2 million.

Characteristics (Types of Financial Awards)

Type of Award	# of projects	\$ value of projects	Type of recipient	Award Selection Criteria (high-level bullets)
Contracts	3	\$17,791,000	small and large business	Vendors will be selected based on meeting statement of work requirements; performance record; evaluation of competitive costs and performance record.
Grants				NONE CONTEMPLATED
Cooperative Agreements				NONE CONTEMPLATED

Performance Measures

Performance Measure # 1***

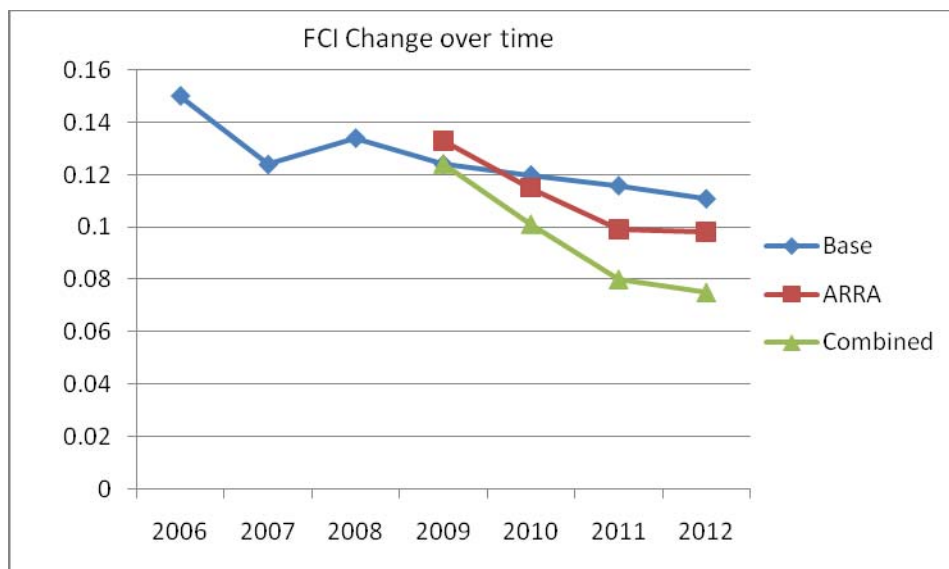
Description of Measure	Improvement in Bureau Facilities Condition Index (FCI)*
Length of Period between Measurement	Reported Quarterly
Measurement Methodology	Annual Federal Real Property Profile (FRPP) FCI will be compared against baseline FY08 FRPP FCI (facility condition improves as FCI gets smaller)
How Results Will be Made Available to the Public	Results will be provided on DOI’s Recovery Act web site.
2008 Actual Performance	0.134 base
2009 Performance Target	0.133 ARRA; .124 base; .124 combined**
2010 Performance Target	0.115 ARRA; .12 base; .101 combined**
2011 Performance Target	0.099 ARRA; .116 base; 0.08 combined**
2012 Performance Target	0.098 ARRA; .111 base; 0.075 combined**

*FCI is determined by combining funding for Deferred Maintenance – Facilities (\$29.4M) and Construction (\$18.3M).

**The combined impact of using base funding and ARRA funding on the FCI is greater than the sum of the two.

***The ARRA “subset” of projects are those requiring immediate attention from a health and safety standpoint

American Recovery and Reinvestment Act



A declining FCI signals improved condition of facilities. The infusion of ARRA funds will accelerate USGS ability to improve the condition of its facilities.

Project Milestones and Completion

Types of Projects

Type	Description	# of Projects	\$ Value of Projects
Greater than \$2M	Construction Projects	3	\$17,791,000

Greater than \$2.0M

Construction Project List

Project Name	Description
Patuxent Wildlife Refuge Center (MD) Phase 3	Phase 3 of Construction of New Facility and Disposal of Assets would provide for design and engineering of new buildings; archaeological, historical, and cultural assessment and mitigation; and animal research facility upgrades; work will include disposal of up to 10 assets
Upper Midwest Environmental Sciences Center (WI) Building Addition Segment "D"	Building Addition Segment "D" will be a wing on the main office/laboratory building and will alleviate severely overcrowded conditions resulting from vacating 25,000 square feet of leased space in nearby Onalaska to consolidate science operations
Columbia Environmental Research Center (MO) Office/Laboratory Consolidation New Building Construction	Office/Laboratory Consolidation, Demolition and New Building Construction includes constructing an office/laboratory building which would replace nine agricultural and modular structures that have exceeded their useful life cycles, have safety and structural deficiencies, and no longer meet accessibility and electrical code standards

Timeline

Project Information		Duration of Activities (in months)					Months to Complete
Name of Project	\$ Value	Planning	Permitting/ Pre-Contract Award	Design	Construction	Close-Out	
Patuxent	\$8.5M	1	2	12	12	3	30
UMESC	\$3.09M	1	2	3	21	3	30
CERC	\$6.2M	1	2	3	21	3	30

*Administrative cost for construction projects is \$534K

Mission/Savings/Costs Implications

Expected cost implications are described for each of USGS' three ARRA projects:

Patuxent Wildlife Refuge Center, MD (home to approximately 140 Federal employees): The Patuxent Wildlife Refuge Research Center is a national treasure: America's first wildlife experiment station and research refuge unit in the system, it was the research home to Rachel Carson who paved the way for the important ecological studies continuing there today. The ARRA funds will allow for the immediate implementation of the architecture and engineering-designed plans that have been under development to rehabilitate this historical facility for over a decade. USGS plans a new facility that is expected to have a minimal annual operational cost differential.

Upper Midwest Environmental Sciences Center (UMESC), WI, Segment D (home to approximately 180 Federal employees): UMESC was established in 1959, in La Crosse, WI in an old fish hatchery. It was designed to investigate and develop chemical agents for controlling undesirable freshwater fish, in efforts to assist the Great Lakes fishing industry with the best known methods at the time. Its mission expanded tens years later to include research into control of sea lamprey in the Great Lakes and develop chemicals for public use in aquaculture. Most on-site current structures date to late 1960's; they are in need of repair. Specifically, new labs are required for research to support the \$7.5 billion fishing industry in the Great Lakes. This building expansion project is estimated to increase square foot occupancy by 21,500 for the 180 staff housed there. Increases in operational costs of approximately \$291,486 for this expansion will be covered through combined funding from an allocation from the Rent and Operations and Maintenance appropriation, facilities costs in reimbursable agreements, and program funding.

Columbia Environmental Research Center (CERC), MO (home to approximately 100 Federal employees): CERC was also established in 1959 at the US Fish and Wildlife Service's Denver Wildlife Research Center as its Fish Pesticide Research Lab (FPRL). In 1966, the University of Missouri demonstrated its dependence on the work of the facility in both educational and adaptive application and deeded 33 acres to move the lab to its present location. The partnership initiated between the University and (the now) UMESC remains strong through cooperative research. This project would include demolition of nine buildings to be replaced by one. The new office/laboratory consolidation building construction project at CERC is estimated to reduce annual operations and maintenance costs by \$33,066. A decrease in utility costs and unscheduled maintenance is expected with this Leadership in Energy and Environmental Design (LEED) certified building that will replace nine assets.

Performance Measures¹

	2010	2011	2012	2013	2014
Patuxent - Construct New Facility					
% Change (positive or negative)	0%	0%	0%	0%	0%
UMESC - Building Addition Segment "D"					
Projected Operational Costs	\$537,403	\$537,403	\$828,889	\$828,889	\$828,889
% Change (positive or negative)	0%	0%	54.2%	0%	0%
CERC - Office/Laboratory Consolidation New Building Construction					
Current Operational Costs	\$217,138.00	\$217,138.00	\$184,072	\$184,072	\$184,072
% Change (positive or negative)	0%	0%	-15%	0%	0%

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- ¹ Calculations are based on 2008 dollars; O&M model used, applied \$13.13/gsf to additional 22,200gsf.
- ² This phase does not result in changes to operational costs.

Part V: Deferred Maintenance – Streamgages, Cableways, and Wells

Program	Funding Amount	# of Projects
Remediation of discontinued streamgages, cableways, and ground-water wells	\$14,625,000	183*

**Each project in the project list may include multiple sites for each project type, priority, and State. There are a total of 1289 individual sites included in the projects on the project list.*

Program Manager

Steve Blanchard; sfb Blanch@usgs.gov; 703-648-5629

Objectives

The USGS installs and manages ground-water wells, streamgages, and cableways to measure the water quality and quantity of the Nation's rivers and aquifers. The USGS' intent is to operate these monitoring stations indefinitely; however, the USGS has to discontinue use of a monitoring station if funding to operate the site is no longer available from a cooperating organization such as Federal, State, local, and Tribal governments. When funding from a cooperating organization is no longer provided, the monitoring station is discontinued. When discontinued, the station immediately presents a facilities management issue with potential health and safety concerns.

Discontinued cableways are large structures that seem to draw people to climb on them and present a fall hazard; discontinued streamgages often have shafts within them that present a fall hazard; and ground-water wells can potentially serve as conduits for contamination of aquifers. These discontinued monitoring sites are entered into the deferred maintenance-capital improvements (DM) database.

A priority objective of the ARRA DM funding is to remediate all the discontinued sites as previously identified by the USGS Water Science Centers (WSCs) as priority 1 or 2 in the DM database as of the end of fiscal year 2008 (145 of the 183 projects are priority 1 or 2). After priority 1 and 2 sites are addressed, remaining sites will be remediated in priority order and if additional funding is available, all sites needing remediation will be completed along with repairs and stabilization to existing streamgages and cableways.

National Environmental Policy Act (NEPA) and USGS Environmental Liability

In accordance with NEPA and the legal environmental requirements, each site in the DM must be verified as being in compliance with NEPA and not an environmental liability to the USGS before and after the rehabilitation of the project. This process has been simplified into a field form that will be filled out by an appropriate USGS field person to ensure the bureau's potential safety and environmental liabilities have been met in the mitigation of the project.

Activities

USGS will remediate 1,289 discontinued streamgages, cableways, and ground-water wells contained within the USGS DM database. This activity will be done principally through contracts. WSCs will inspect each site before and after the mitigation.

Selection Criteria

The plan for allocating the ARRA DM funding is to retire all the discontinued sites as previously identified by the WSCs as priority 1 through 4 and many of the priority 5 projects in the DM database as of the end of Fiscal Year 2008. The sites are ranked from 1 to 5 with 1 highest priority for remediation and 5 representing the lowest priority for remediation. Remediating these sites accounts for about \$12 million of the \$15 million of expected ARRA funds. All the project costs in the DM database are estimates, so after much of the work for priority 1 and 2 projects has been contracted and firmer costs have been established, work will begin on priority 3 and higher projects contained in the DM database. The database has documentation about the locations of all the sites, the infrastructure needing removal, and the history of the stations (Figure. 1).

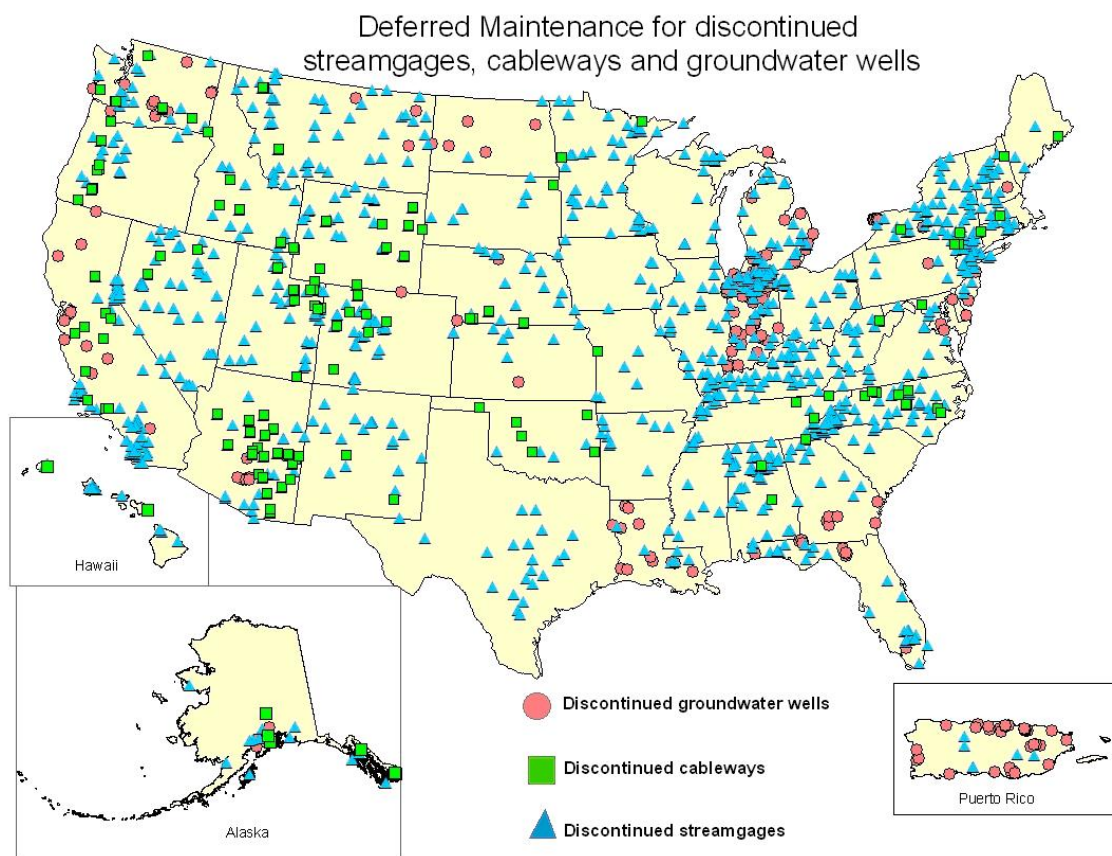


Figure 1.—Map of discontinued streamgages, cableways, and streamgages in the USGS.

Characteristics (Types of Financial Awards to be Used)

Type of Award	# of projects	\$ Value	Type of recipient	Award Selection Criteria
Temporary Term Appointments	183	1,000,000	USGS Hydrographers	Quality assurance visits to discontinued sites to ensure remediation is completed properly and to complete NEPA documentation.
Contracts	183	\$13,625,000	Private Contractors	Methods available: open market competition; orders using Indefinite Delivery/Indefinite Quantity (ID/IQ); GSA schedule orders; and open market non-competitive for small transactions (less than \$3,000).

Performance Measures

Performance Measure # 1

Description of Measure	Remediation of discontinued streamgages, cableways, and ground-water well.
Length of Period between Measurement	Quarterly
Measurement Methodology	Remediation project completions will be tracked in the DM-CI database
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	No discontinued sites were remediated in 2008
2009 Performance Target	Remediate 140 discontinued sites (ARRA only)
2010 Performance Target	Remediate 750 discontinued sites (ARRA only)
2011 Performance Target	Remediate 399 remaining discontinued sites (ARRA only)
2012 Performance Target	Projects completed in 2011

Project Milestones and Completion

Types of Projects

Type	Description of Project Type	# of Projects	\$ Value of Projects
Wells	Remediation of discontinued ground-water wells according to State regulations	42 (222 sites)	\$6,893,000
Cableways	Removing cableway structures at discontinued cableway sites	50 (145 sites)	\$1,285,000
Streamgages	Removal of streamgage structures at discontinued streamgage sites	91 (922 sites)	\$6,447,000

Completion Rate

Quarter	# of Sites Completed (Category X-wells)	# of Sites Completed (Category Y – cableways)	# of Sites Completed (Category Z - streamgages)	Total # Completed per Quarter	Cumulative % Completed
FY 2009 Q4	30	17	100	147	11 %
FY 2010 Q1	30	20	115	165	24 %
FY 2010 Q2	30	25	135	190	39 %
FY 2010 Q3	30	25	150	205	55 %
FY 2010 Q4	31	20	135	186	69 %
FY 2011 Q1	23	13	100	136	80%
FY 2011 Q2	16	13	85	114	89 %
FY 2011 Q3	16	7	57	80	95 %
FY 2011 Q4	16	5	45	66	100%

Mission/Savings/Costs Implications

The \$14.6 million in ARRA funding is expected to remediate approximately 1,289 discontinued monitoring sites nationwide that currently present ongoing challenges to management including public safety and health problems. Once this work is completed, there will be no future operating costs associated with these sites. This work will reduce the USGS liability for discontinued monitoring sites by millions of dollars.

Part VI: Upgrades to Streamgages

Program	Funding Amount	# of Projects
Upgrades to Streamgages	\$14,625,000	52*

*Each project shown in the project list includes two components (radios and streamflow technology) for each State, Puerto Rico, and headquarters.

Program Manager

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Objectives

The USGS national streamgage network (7,500 sites) is dependent on the NOAA-operated Geostationary Operational Environmental Satellites (GOES) for transmission of real-time streamflow data. In order for the USGS to make streamflow information available and continue to use the NOAA satellite, it is necessary for USGS to convert their streamgages to the new high-data rate radio (HDR) technology by the end of 2013.

Each USGS WSC will acquire equipment to upgrade to HDR technology. In addition to HDR upgrades, WSCs will use funds to upgrade streamgages with new streamflow measuring technologies including (hydroacoustic flow measuring devices, side looking hydroacoustic sensors and non-contact radar units). The new technology stream measurement equipment will allow the USGS to more efficiently monitor streamflow and provide higher quality data. Solar powered technologies will be utilized to the greatest extent possible.

USGS will purchase approximately 2,000 of the needed 3,000 HDR for total of 6,500 of 7,500 or 87% of the national network sites (approximately 4,500 streamgages already have HDR technology). The remaining 1,000 streamgages to be upgraded would be completed through the current plan of upgrading 400 streamgages per year with annual appropriations. With ARRA funding combined with annual funding, the conversion would be completed well before 2013.

It is anticipated that private vendors and manufacturers of equipment would need to increase production to meet demand. Streamgage equipment would be installed during regular periodic servicing visits by USGS hydrologic technicians. It is expected that equipment installation generally will be accomplished in less than one hour at each site.

Activities

Examples of ARRA projects:

- Purchase High Data Rate (HDR) satellite telemetry radios and install them on approximately 2,000 USGS streamgages nationwide. The new HDR radios will allow for hourly transmission of streamflow data instead of transmissions once every 4 hours.
- Purchase new technology streamflow measuring equipment, such as hydroacoustic flow measuring devices, side looking hydroacoustic sensors, non-contact radar units, etc. to improve the efficiency and safety of streamflow monitoring by the USGS and to provide higher quality data to the public.

Selection Criteria

To meet the HDR upgrade requirement and improve USGS streamgage technology, USGS will allocate funding for streamgage upgrades to each USGS Water Science Center (WSC) based on the size of their streamgage network in relation to size of national network. If the California Water Science Center streamgage network is 4% of the national network, they will receive 4% of the funding for the equipment upgrades. USGS would spend approximately \$10 million on HDR and \$5 million on other equipment and technologies to modernize the streamgage network.

Characteristics (Types of Financial Awards)

Type of Award	# of projects	\$ Value of projects	Type of recipients	Award Selection Criteria
Contracts	52	\$14.625M	Private Instrument Vendors	Criteria based on statement of work, successful record of past performance and adherence to cost schedule

Performance Measures

Performance Measure # 1

Description of Measure	# of streamgages upgraded with high data rate radios to increase frequency of radio transmission
Length of Period between Measurement	Reported Quarterly
Measurement Methodology	Count of # of streamgages with high data rate radios
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	4,500 streamgages upgraded with high data rate radios to increase frequency of radio transmission
2009 Performance Target	5,300 (+ 400 base; + 400 ARRA; +800 combined)
2010 Performance Target	6,900 (+ 400 base; + 1,200 ARRA; +1,600 combined)
2011 Performance Target	7,500 (+ 200 base; + 400 ARRA; +600 combined)
2012 Performance Target	N/A

Performance Measure # 2

Description of Measure	% of discharge measurements made with hydroacoustic instruments
Length of Period between Measurement	Reported Quarterly
Measurement Methodology	# of streamflow measurements made with hydroacoustic equipment out of the total # of measurements made during the quarter
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	35 % streamflow measurements are made with hydroacoustic instruments
2009 Performance Target	45 % (+5% base; +5% ARRA; +10% combined)
2010 Performance Target	55 % (+5% base; +5% ARRA; +10% combined)
2011 Performance Target	60 % (+5% base; +0% ARRA; +5% combined)
2012 Performance Target	65 % (+5% base; +0% ARRA; +5% combined)
	Long-term goal 75 %

Project Milestones and Completion

Types of Projects*

Type	Description of Project Types	# of Projects	\$ Value of Projects
Radios	Purchase and installation of high data rate satellite telemetry radios	52	\$9,750,000

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Type	Description of Project Types	# of Projects	\$ Value of Projects
Streamflow equipment	Purchase new technology streamflow measuring equipment	52	\$4,875,000

*Each of the 52 projects has two components—radios and streamflow equipment.

Completion Rate

Quarter	# of Projects Completed (Radios)	# of Projects Completed (Streamflow Equipment)	Total # of Projects Completed per Quarter	Cumulative % of Projects Completed
FY 2009 Q4	0	5	5	5%
FY 2010 Q1	5	5	10	14%
FY 2010 Q2	5	7	12	26%
FY 2010 Q3	7	10	17	42%
FY 2010 Q4	10	10	20	62%
FY 2011 Q1	10	9	19	80%
FY 2011 Q2	7	6	13	92%
FY 2011 Q3	5	0	5	97%

Purchase of HDRs – Key Milestones

Milestones	Avg. Completion
Equipment funding assignments for Water Science Centers determined	1 week
HIF HDR ordering web page developed and operation	2 weeks
Water Science Centers place orders	3 weeks
HIF places orders with Vendors for HDRs	3 weeks
Vendors fabricate and deliver HDRs	2 years
HDRs are installed at streamgages	30 weeks

Purchase new steamflow measuring equipment -- Key Milestones

Milestones	Average Length of Completion
Equipment funding assignments for Water Science Centers determined	1 week
HIF HDR ordering web page developed and operation	2 weeks
Water Science Centers place orders	3 weeks
HIF places orders with Vendors for HDRs	3 weeks
Vendors fabricate and deliver HDRs	2 years
Streamflow measuring equipment is put into operation	24 weeks

Mission/Savings/Costs Implications

Streamflow data is critical to the health, safety and welfare of the United States, providing key information on the quality and quantity of the Nation's water supply. Streamflow measuring equipment will allow for more measurements to be made for the same operational costs and provide a safer and more efficient means to measure streamflow.

The HDR radios will not decrease operational costs but will provide improved data quality to data users through more timely data transmissions (1 transmission every hour instead of 1 transmission every 4 hours.) This is particularly important during periods of flooding when emergency and water managers critically need timely information.

Hydroacoustic equipment and other new technologies will provide a safer and more resilient way to measure streamflow during major flooding events. This could save millions in annual equipment replacement costs.

Part VII: Earthquake Monitoring

Program	Funding Amount	# of Projects
Earthquake Monitoring Network Upgrades	\$29,445,000	3

Program Manager

David Applegate, Ph.D; applegate@usgs.gov; 703-648-6714

Objectives

Earthquakes are one of the most costly natural hazards faced by the Nation, posing a significant threat to 75 million Americans in 39 states. The timely delivery of earthquake information requires modern seismic networks and data processing centers – critical infrastructure that provides the situational awareness required for effective emergency response, saving lives and reducing economic losses. Funding in the stimulus proposal will further improve timely delivery of earthquake information.

In areas of the U.S. at risk for destructive earthquakes, some of the current monitoring system is 40-year-old technology; even previously-upgraded systems now have outdated technology. Stimulus funding would replace old instruments with state-of-the-art, robust systems across the highest earthquake hazard areas in California, the Pacific Northwest, Alaska, the Intermountain West, and the Central and Eastern U.S. The modernization of our earthquake networks will deliver more reliable, robust information, helping to save lives in the wake of natural disasters that can strike the Nation at any time. The planned upgrades will also allow for "earthquake early warning" – a technology in operation in Japan, Taiwan and Mexico that uses sensor detections at the earthquake epicenter to broadcast warnings to nearby areas about-to-be-shaken.

The proposed investments in earthquake monitoring meet the stated Recovery Act criteria for spending that will flow directly into the Nation's economy. These investments will provide jobs for U.S. equipment manufacturers; geophysical contractors to do installations, and the colleges and universities that run regional earthquake networks and partner with USGS. Because the investments will modernize aging equipment at existing stations, they do not represent out-year commitments and the new equipment should lower future maintenance costs. Solar powered technologies will be utilized to the greatest extent possible.

Activities

Examples of areas that ARRA funds will address:

- Replacement of existing urban strong motion instrumentation (modernization as part of the development of the Advanced National Seismic System, ANSS)
- Replacement/upgrade of existing seismograph stations & processing centers (modernization as part of the development of the Advanced National Seismic System and the Global Seismographic Network (GSN))
- Replacement/upgrade/reconfiguration of Existing Deformation Monitoring Equipment (integration as part of the development of the Advanced National Seismic System)

When supplemented with base program funds over 3 years, ARRA funds will double the number of ANSS stations, completing the initial stations called for in the ANSS plan, and will allow the

completion of planned “next-generation” system upgrades to the USGS-operated portion of the GSN.

Selection Criteria

Priorities were set through the long-standing and multi-year planning process for the Advanced National Seismic System (ANSS) and Global Seismographic Network (GSN). Priorities address upgrading equipment in areas most vulnerable to seismic activity and subsequent potential natural disasters related to it. Committees comprising USGS and partner scientists identified priority needs, which are included in the Department’s and USGS planning processes for major IT capital investments. Priorities also reflect guidance from the following external (FACA) advisory committees: ANSS National Steering Committee, GSN Standing Committee, and the congressionally-established Scientific Earthquake Studies Advisory Committee. These documents are available at: <http://earthquake.usgs.gov/research/monitoring/anss/>.

Characteristics (Types of Financial Awards to be Used)

Type of Award	# of projects	\$ Value of projects	Type of recipient	Award Selection Criteria
Contracts**	3	\$19,450	equipment manufacturers and software developers	Criteria based on statement of work, successful record of past performance and adherence to cost schedule

**Each project will utilize a combination of contracts and cooperative agreements in completing the work.

Performance Measures

Performance Measure # 1

Description of Measure	Number of ANSS earthquake monitoring stations*
Length of Period between Measurement	Quarterly
Measurement Methodology	Direct count by field teams
How Results Will be Made Available to the Public	Results will be provided on DOI’s Recovery Act web site.
2008 Actual Performance	805 ANSS earthquake monitoring stations
2009 Performance Target	849 (+17 base; +27 ARRA; +44 combined)
2010 Performance Target	1,292 (+12 base; +431ARRA; +443 combined)
2011 Performance Target	1,642 (+0 base; +350 ARRA; +350 combined)
2012 Performance Target	N/A

* Determined as equivalent stations to encompass various types and stages of development, the exact number of stations to be installed will depend on the results of competition, both for purchase of equipment (including volume discounts) and its installation.

Performance Measure # 2

Description of Measure	Number of GSN next-generation systems deployed (of 87 needed)*
Length of Period between Measurement	Quarterly
Measurement Methodology	Direct count by field teams
How Results Will be Made Available to the Public	Results will be provided on DOI’s Recovery Act web site.
2008 Actual Performance	1 GSN next-generation system deployed
2009 Performance Target	22 (+8 base; +13 ARRA; +21 combined)
2010 Performance Target	40 (+0 base; +18ARRA; +18 combined)
2011 Performance Target	54 (+0 base; +14 ARRA; +14 combined)
2012 Performance Target	87 (+0 base; +33 ARRA; +33 combined) These 33 installations will be funded with base program funds

*The exact number of upgrades to be installed will depend on the results of competition, both for purchase of equipment (including volume discounts) and its installation.

Project Milestones and Completion

Types of Projects

Type	Project Type	# Projects	Value Projects
Seismic	Upgrades to seismic stations	1	\$6,825,000
Center	Upgrades to processing centers & communications	1	\$16,478,000
Deformation	Upgrades to deformation monitoring systems & communications	1	\$6,142,000

Completion Rate

Quarter	% of Project Completed* (Seismic)	% of Project Completed (Center)	% of Project Completed (Deformation)	% of Projects Completed per Quarter	Cumulative % of Projects Completed
FY 2009 Q2					
FY 2009 Q3	33%	75%	20%	42%	42%
FY 2009 Q4	33%	0%	20%	17%	59%
FY 2010 Q1	0%	0%	20%	7%	66%
FY 2010 Q2	0%	0%	20%	7%	73%
FY 2010 Q3	0%	0%	0%	0%	73%
FY 2010 Q4	17%	25%	20%	21%	94%
FY 2011 Q1	0%	0%	0%	0%	94%
FY 2011 Q2	17%	0%	0%	6%	100%
FY 2011 Q3	Equipment purchases complete				
FY 2011 Q4					

*Percent of projects completed was used since each project type has only one project.

Upgrades to seismic stations -- Key Milestones

Milestones	Target Time to Completion
Equipment orders placed (1 st set)	1 month
Temporary hires, students in place (USGS)	3 months
Installation contracts/coops funded	5 months
Equipment delivery	6 months
Installations completed - USGS	18 months
Installations completed - University	22 months

Upgrades to processing centers and communications -- Key Milestones

Milestones	Target Time to Completion
Equipment orders placed	1 month
Development and installations contracts funded	2 months
New contracts funded (e.g., communications upgrades)	3 months
Upgrades completed	18 months

Upgrades to deformation monitoring systems

Key Milestones

Milestones	Target Time to Completion
Project plan completed	1 month
RFP for site restoration	4 months
New coop. agreement(s) for demonstration projects	7 months
Equipment purchases – USGS	10 months
Upgrades completed	18 months

Savings/Costs Implications

There will be no net change to operational costs as a result of these projects. Operational costs are expected to decrease on the modernized stations where older technology will be replaced with cost efficient and solar powered equipment. Some operational costs may increase with

additional equipment required to upgrade the data centers and improve communications. These changes are expected to offset each other and result in no net change to the operational costs.

Part VIII: Volcano Monitoring

Program	Funding Amount	# of Projects
Volcano Hazards Program Research And Monitoring	\$15,210,000	6

Program Manager

David Applegate, Ph.D; applegate@usgs.gov; 703-648-6714

Objectives

The U.S. and its territories contain 169 potentially active volcanoes. Hazards from volcanic eruptions and resultant ash and lahars are dangerous to human health and welfare and to the Nation's economy. They are mitigated by a system of five volcano observatories maintained by the USGS and its partners. Deployment of networks of geophysical instruments on high threat volcanoes, together with regular satellite surveillance, permits unrest, which is a prelude to eruption, to be detected early enough for communities, business, and emergency response agencies to take protective measures. Coupled studies of eruption history and community vulnerabilities permit wise monitoring investment priorities to be established and likely eruption scenarios predicted. The result is that losses to life and property are minimized.

While all these volcanic systems are monitored, there is a serious need to bring the equipment and systems up to state-of-the-art standards outlined by the National Volcano Early Warning System (NVEWS) report framework. This is the planned use of Recovery Act funds. In particular, antiquated analog seismic systems need to be upgraded to digital systems, and newly developed instruments, such as continuously recording Global Positioning Systems (GPS) and gas sensors need to be added to monitoring stations. Networks of seismic instruments deployed on volcanoes are the first line of the defense in "hearing" magma (molten rock) moving, and GPS – by measuring swelling of the volcano – can tell how much magma is moving and how close it is to the surface. Improvements need to be made to the telemetry systems that bring this data from highly remote mountain locations to the observatories for analysis. Other new tools need to be brought to bear on the volcano hazards problem. Airborne Light Detection and Ranging (LiDAR), essentially precision mapping by laser from an airplane, can reveal new information about volcanic structures and provide a baseline against which to measure the results of volcanic eruptions. Geologic investigations of recent eruptions, new computational fluid dynamic models for mudflows, and new Geographic Information System (GIS) approaches to assembling data make possible much better assessment of the hazards posed by eruption and so inform preventative measures. Computer upgrades are needed to fully benefit from the increasing amount of satellite data that can detect heat, gas, and ash coming from volcanoes. All of these upgrades will enhance public safety by providing volcano monitoring data that is both timely and accurate. These improvements will also support a wide array of jobs in the private sector as well as with academic and state partners.

Activities

Examples of areas that ARRA funds will address:

- Installation of geophysical and telemetry equipment at remote sites in Alaska (AK), the Cascade Range (WA, OR, CA), Yellowstone National Park (WY, ID, MT), Long Valley

Caldera (Mammoth Lakes, CA), Island of Hawaii (HI), and Commonwealth of the Northern Mariana Islands (CNMI)

- Aviation services at above locations
- LiDAR surveys (airborne precision laser mapping)
- Geologic mapping
- GIS-based hazard assessments
- Data network design
- Software development for data visualization, analysis, and archiving
- Geophysical data analysis
- Supply of geophysical and geochemical sensors and other electronic devices

Selection Criteria

Establishing priorities for which geographic areas needed to be addressed were based on needs identified to enable the implementation of the National Volcano Early Warning System (NVEWS). NVEWS focuses on areas deemed to be at risk for high-activity volcanoes and was endorsed by AAAS in a 2007 program review. Priorities areas for NVEWS are enhancing Alaska volcano monitoring; modernizing volcano monitoring in Hawaii, improving the telemetry backbone in the Cascades to close a monitoring gap, and replacing analog monitoring with digital monitoring and continuous GPS sensors.

Selected projects were vetted to and approved by the Volcano Hazards Program Council and were determined to be projects which would support NVEWS. Information on NVEWS can be found at <http://pubs.usgs.gov/fs/2006/3142/2006-3142.pdf> and <http://pubs.usgs.gov/of/2005/1164/>.

Characteristics (Types of Financial Awards to be Used)

Type of award	# of projects	\$ value	Types of recipient	Award Selection Criteria (high-level bullets)
Contracts	40-60	\$8,460	Equipment manufacturers, aviation services, software developers, state agencies	Criteria based on statement of work, successful record of past performance and adherence to cost schedule
Cooperative Agreements	7	\$6,750	Universities, state or territory agencies	Consistent with the ARRA requirements.

Performance Measures

Performance Measure # 1

Description of Measure	# of monitoring and telemetry nodes upgraded (e.g., analog to digital conversion, added sensors, improved power systems, upgraded radio transmitters and receivers)
Length of Period between Measurement	Quarterly
Measurement Methodology	Direct count by observatories
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	12 monitoring and telemetry nodes upgraded from base funding
2009 Performance Target	134 (13 base; 121 ARRA) Not a cumulative measure
2010 Performance Target	178 (12 base; 166 ARRA) Not a cumulative measure
2011 Performance Target	40 (11 base; 29 ARRA) Not a cumulative measure
2012 Performance Target	10 (10 base; 0 ARRA) Not a cumulative measure

Performance Measure # 2

Description of Measure	% of very high threat volcanoes with at optimal level monitoring (X number of 18)
Length of Period between Measurement	Quarterly
Measurement Methodology	Direct count by observatories
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	22.2% (4/18) from base funding
2009 Performance Target	27.7% (5/18) (ARRA only)
2010 Performance Target	33.3% (6/18) (ARRA only)
2011 Performance Target	38.9% (7/18) (ARRA only)
2012 Performance Target	38.9% (7/18)

Project Milestones and Completion

Types of Projects

Type	Project Type	# Projects	\$ Value Projects
Observatory	Improvements to observatory systems	6	\$15,210,000

Project List

Project Name	Description
Alaska	Alaska Volcano Observatory and NVEWS upgrades
Hawaii	Hawaii Volcano Observatory and NVEWS upgrades
Cascades	Cascades Volcano Observatory and NVEWS upgrades
Yellowstone	Yellowstone Volcano Observatory and NVEWS upgrades
Marianna Islands	Mariana Islands Volcano monitoring and NVEWS upgrades
Long Valley CA	Long Valley Volcano Observatory and NVEWS upgrades

Completion Rate

Quarter	% of Project Completed* (Observatories)	% of Projects Completed per quarter	Cumulative % of Projects Completed
FY 2010 Q2	1	17%	17%
FY 2010 Q3	2	33%	50%
FY 2010 Q4	3	50%	100%

Improvements to observatory systems -- Key Milestones

Milestones	Average Length of Completion
Cooperative agreements completed	3 months
Contracts for equipment and services placed	6 months
Observatory data facility upgrades completed	12 months
Observatory monitoring site upgrades completed; contract design and assessment projects completed	18 months

Savings/Costs Implications

With improved instrumentation, USGS will be able to monitor volcanic activity of the highest-risk volcanoes in the United States. This monitoring will allow for advanced warning of potential eruptions, thereby avoiding loss of human life and economic resources. There will be no net change in operational costs as a result of these upgrades to the volcano observatory systems. However, the rate at which data are available and the accuracy and frequency of measurements will improve considerably, strengthening program effectiveness.

Part IX: Imagery and Elevation Maps

Program	Funding Amount	# of Projects
National Map	\$14,625,000*	2

Program Manager

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Objectives

The National Map’s activities supported by the American Recovery and Reinvestment Act of 2009 (ARRA) will expand employment and business opportunities within a key sector of the geospatial industry with the acquisition of data to be used for myriad mapping applications including flood mapping, elevation, land cover and other topographical issues that are important to the safety and commerce of the American public. The acquisition of Light Detection and Ranging (LiDAR) data will substantially improve the resolution of the National Elevation Dataset (NED) over coastal areas of the U.S. most likely to be susceptible to storm and hurricane flooding, earthquake damage, and coastal erosion due to storms and sea level rise. The full LiDAR data set will be collected and made available for use in other national applications (data layers) such as infrastructure development, resource assessment and scientific studies. Funds will also be available for the acquisition of high resolution orthoimagery.

In concert with Federal and State programs and other partners, ARRA funding will complete LiDAR elevation and high resolution orthoimagery acquisitions in selected areas. The strategy would be to use the funding to leverage other Federal and State funding through the USGS Geospatial Liaison Network Partnership and existing Federal affiliations and State programs to: 1) augment the coastline elevation and near-shore bathymetric data currently being collected by Federal and State agencies, and 2) augment existing and new partnerships for leaf-off, high-resolution orthoimagery. These data help local land managers in the decisions they make to protect the environment and the American people.

Activities

Examples of ARRA projects:

- Elevation data collection from high resolution source (LiDAR)
- High resolution, leaf-off orthoimagery collection

Selection Criteria

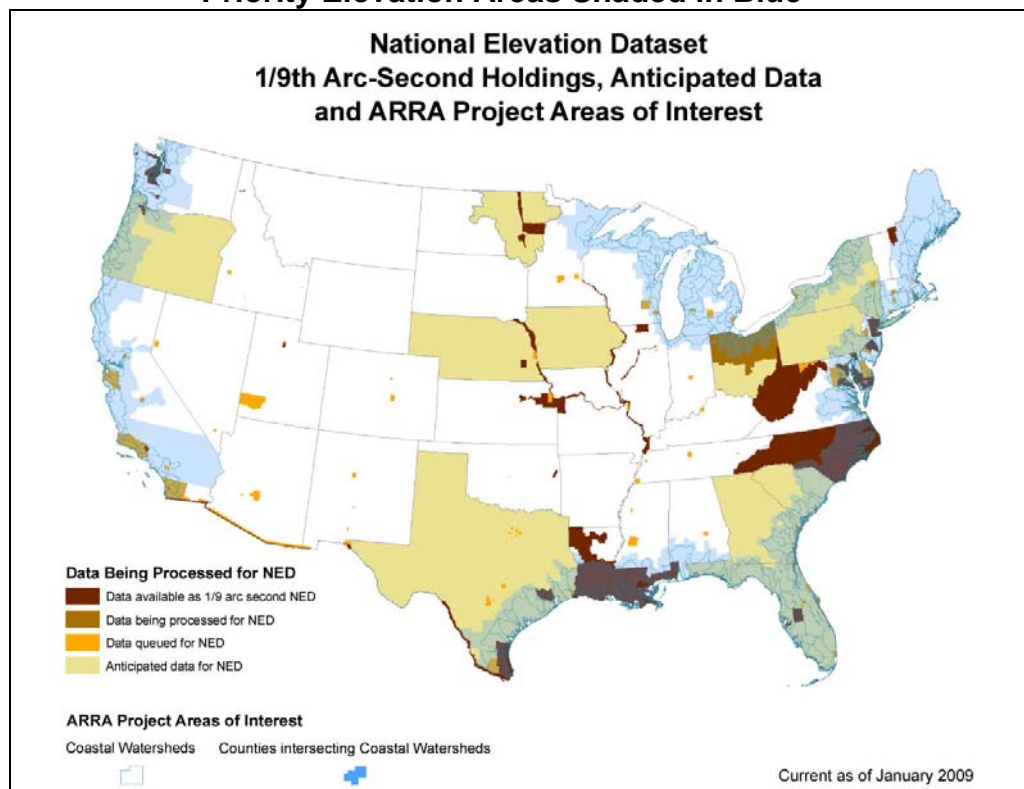
Specific sites to be targeted for data acquisition have yet to be selected. However, projects will be selected based on the following criteria:

- Technical soundness/completeness of proposal
- Geographic Area Priority: coastal and flood areas
- Large Geographic Area of Coverage (areal extent)
- Improvement of Data Currentness
- Improvement of Data Accuracy
- Partner/USGS Funding Ratio
- Number of partners/collaborators
- Relevance to with USGS missions and needs including science

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- Factors related to economic situation of partners, such as impact to local economy, jobs retained or created

Priority Elevation Areas Shaded in Blue



Characteristics (Types of Financial Awards to be Used)

Type of Award	# of projects**	\$ value	Types of recipient	Award Selection Criteria
Contracts	2	5,850,000	Private Firms	Criteria based on statement of work, successful record of past performance and adherence to cost schedule
Cooperative Agreements*	2	8,775,000	Federal, State, & Local Government	Methodology of peer-reviewed competitive with selection criteria: technical excellence, project effectiveness, leveraging existing cooperator capability

* Includes Interagency Agreements with other Federal agencies. Any funds, outgoing or incoming, will meet ARRA reporting requirements as identified by OMB.

**To complete each project, a combination of contracts and cooperative agreements may be used.

Performance Measures

Performance Measure # 1 - Elevation

Description of Measure	Square miles of high resolution elevation data collected in Priority Areas and added to the 1/9 arc-second (3-meter) National Elevation Dataset (NED).
Length of Period between Measurement	Quarterly
Measurement Methodology	Square miles are calculated when entered into the National Elevation Dataset (NED).
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	93,153 square miles of the US with updated high resolution elevation data, with base funding
2009 Performance Target	79,000 (58,000 base; 21,000 ARRA) Not a cumulative measure
2010 Performance Target	93,000 (58,000 base; 35,000 ARRA) Not a cumulative measure

2011 Performance Target	35,000 (50,000 base; 35,000 ARRA) Not a cumulative measure
2012 Performance Target	50,000 base Not a cumulative measure

Performance Measure # 2 - Orthoimagery

Description of Measure	Square miles of the US with high resolution, leaf off, <1m imagery data
Length of Period between Measurement	Quarterly
Measurement Methodology	Square miles are calculated when entered into the National Orthoimagery Dataset
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	79,751.35 square miles of the US with high resolution, leaf off, <1m imagery data, with base funding.
2009 Performance Target	75,000 (75,000 base; 0 ARRA) Not a cumulative measure
2010 Performance Target	250,000 (200,000 base; 50,000 ARRA) Not a cumulative measure
2011 Performance Target	175,000 (75,000 base; 100,000 ARRA) Not a cumulative measure
2012 Performance Target	75,000 base Not a cumulative measure

Project Milestones and Completion

Types of Projects

Type	Description	# of Projects	\$ Value of Projects
Elevation	Collection of elevation data	1	\$11,700,000
Orthoimagery	Collection of orthoimagery data	1	\$2,925,000

Completion Rate

Quarter	% Completed (Elevation)	# Completed (Orthoimagery)	% Completed per Quarter	Cumulative % Completed
FY 2009 Q4	25%*	0	13%	13%
FY 2010 Q1	25%	0	13%	13%
FY 2010 Q2	35%	10%	25%	25%
FY 2010 Q3	35%	10%	25%	25%
FY 2010 Q4	60%	40%	50%	50%
FY 2011 Q1	80%	60%	70%	70%
FY 2011 Q2	100%	100%	100%	100%

*Percent of the project completed was used since each category has one project. The number of individual tasks in each project has not been determined.

Elevation -- Key Milestones

Milestones	Average Length of Completion
Contract/Agreement Award	6 months
Planning/Collection of elevation data	3 months
Processing of elevation data	6 months
Quality Assurance	1 month
Archive/Dissemination of elevation data	2 months

Orthoimagery -- Key Milestones

Milestones	Average Length of Completion
Contract/Agreement Award	6 months
Planning/Collection of orthoimagery data	3 months
Processing of orthoimagery data	6 months
Quality Assurance	1 month
Archive/Dissemination of orthoimagery data	2 months

Savings/Costs Implications

There will be no operational costs changes in the completion of these projects, which will provide the Nation an enhanced set of important digital data for use in local and National decision making.

Part X: Data Preservation

Program	Funding Amount	# of Projects
USGS Patuxent Wildlife Research Center Bird Banding Laboratory	\$488,000	1

Program Manager

Bruce Peterjohn; bpeterjohn@usgs.gov; (301) 497-5646

Objectives

The USGS Bird Banding Laboratory (BBL) at Patuxent Wildlife Research Center manages all marking and recovery information for migratory birds for the United States, Canada and Mexico. Since 1908, more than 66 million birds have been banded and 4.1 million have been recovered. Recovery Act funding will make it possible to digitize and make available to the public via the Internet, the historical banding recovery and bird banding records. Bird banding data have a wide variety of uses including applications for disease research. Sampling wild birds for serious disease helps determine the prevalence of the disease in the population and any of these birds with bands can be traced back to when and where the bird was banded.

The BBL has approximately 533,000 recovery records on paper dating from 1985 to present and 1,221 microfilm reels with recovery data from 1908-1984. These records serve as the original recovery data for banded birds and include information that is not currently part of the electronic database. The BBL has all banding records from 1960 stored in a relational database, but the paper schedules remain and serve as the original data source to address problems identified in these data. Digitizing these records would allow the BBL to eliminate the need for off-site record storage and the associated storage costs. Recovery Act funding will save resources by allowing more work to be accomplished in a shorter amount of time, and improve access to this information which is widely used by bird management and conservation programs.

PWRC is incurring costs for the off-site storage of these data; converting records would eliminate the storage need. The records have scientific usefulness beyond the record management benefit to the BBL for investigations of topics such as bird phenology and changes to the status and distribution of birds in response to global climate change.

Banding records from 1955-1959 are available in a summarized format although individual banding records are not digitized. Banding data collected before 1955 are available only on paper schedules. After the conversion of the paper records, any funds remaining would be used to computerize the pre-1960 banding records. The benefits of this project would be the same as for the conversion of the paper and microfilm records recovery records.

Activities

Examples of ARRA projects:

- Preparation for scanning and conversion to electronic files of paper recovery files, paper banding schedules, and microfilm data reels.
- Quality control of electronic files of recovery records and banding schedules to ensure legibility.
- Computerization of pre-1960 bird banding data from paper schedules.

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- Conduct edit checks of computerized records of pre-1960 banding data and correction of data entry errors.

Selection Criteria

USGS has a program underway to convert paper records to electronic files and this project was determined to be the highest priority for ARRA funding, given the risk of loss due to potential damage and limited access by others. This project is a high priority because of the importance of access to the information by the USGS, States, Universities, and others. The initial phase will be the conversion of the paper and microfilm recovery records to electronic files. These records represent the complete set of available information for all reports of banded birds recovered in the wild, representing a unique data set of significant importance for the management of game bird populations and defining the movement of migratory birds.

The second phase is the conversion of post-1960 paper banding schedules to electronic files. These schedules are the original record for the computerized banding data. Availability in electronic format will facilitate the correction of errors in the existing dataset and provide a more accurate dataset for use by scientists and managers.

The third phase is the entry of the pre-1960 banding data from the paper schedules. The data from 1955-1959 are available in a summarized format but the individual banding records have not been entered. Entry of the 1955-1959 data would occur first to complete the banding dataset through 1955.

If funds are available, data will be entered back in time from 1954. This process would work towards completing the computerization of all banding records from the U.S. and Canada, a dataset of considerable value for bird conservation and management.

Characteristics (Types of Financial Awards)

Type of Award	# of projects	\$ value	Types of recipient	Award Selection Criteria
Contracts	1	\$488,000	Small businesses Large businesses	Criteria based on statement of work, successful record of past performance and adherence to cost schedule

Performance Measures

Performance Measure # 1

Description of Measure	% of complete historical bird banding records available electronically
Length of Period between Measurement	Quarterly
Measurement Methodology	The number of complete records that have been converted to electronic files, proofed, and added to the BBL database.*
How Results Will be Made Available to the Public	Results will be provided on DOI's Recovery Act web site.
2008 Actual Performance	0%
2009 Performance Target	10% (ARRA only)
2010 Performance Target	50% (ARRA only)
2011 Performance Target	55% (ARRA only)
2012 Performance Target	N/A

*If additional funds are available, more records will be converted.

Project Milestones and Completion

Types of Projects

Type	Description	# of Projects	\$ Value
Records	Computerization of historic bird banding	1	\$500,000

Type	Description	# of Projects	\$ Value
	records		

Completion Rate

Quarter	Total # of Projects Completed	Cumulative % of Projects Completed
FY 2009 Q3		5
FY 2009 Q4		15
FY 2010 Q1		35
FY 2010 Q2		60
FY 2010 Q3		85
FY 2010 Q4	1	100

Records -- Key Milestones

Milestones	Average Length of Completion
Document preparation for scanning	4 months
Records scanned and electronic files prepared	1 year
Quality control for electronic files	2 months

Mission/Savings/Costs Implications

Digitization of data and making it available to the public via the Internet has a wide variety of uses including applications for disease research. Sampling wild birds for serious disease helps determine the prevalence of disease in the population and the birds with bands can be traced back to when and where the bird was banded. This project will provide considerable savings with respect to the efficiency of operations at the BBL. On average, locating individual recovery or banding data records takes 10-15 minutes per record, so that only 4-6 records per hour can be located when necessary. This process will reduce that time to seconds per record. The net result will be a noticeable increase in the efficiency of the BBL operations when dealing with questions that require personnel to access these records, and a noticeable improvement to the quality of data in the BBL database because of the improved access to this information.

Part XI: Recovery Act Funds' Impact on Existing USGS Programs

Construction

USGS Portion of ARRA Construction Projects Selected from Current Program

Recovery Act Projects Construction			
# of Recovery Act Projects Not on 5-Year Plan	\$ Value of Projects Not on 5-Year Plan	# of Recovery Act Projects that meets criteria for inclusion on 5-Year Plan	\$ Value of Projects
3	\$18,325	3	\$18,325

Construction projects were identified for inclusion in the Recovery Act using the existing USGS Investment Review Board process. The USGS follows the procedures in the Department's Capital Planning and Investment Control Guide to review, select and manage the business cases for construction projects greater than \$2.0 million. Seven projects on the 5-year plan are being addressed by ARRA construction projects.

Deferred Maintenance

USGS Portion of ARRA Deferred Maintenance Projects Selected from 5-Year Priority Lists*

Current 5-Year Plan		5-Year Plan Projects funded by Recovery Act Funds		Recovery Act Projects Not on 5-Year Plan			
# of projects on 5-Year Plan	\$ value of projects on 5-Year Plan	# of ARRA projects selected from 5-year plan	\$ Value of ARRA projects selected from 5-year plan	# of ARRA projects not on 5-Year Plan	\$ Value of projects not on 5-Year Plan	# of ARRA projects meeting criteria for inclusion on 5-Yr Plan	\$ Value of Projects
86	\$31,044,000	63	\$22,351,000	4	\$7,052,000	4	\$7,052,000

*This information is based on the 5 Year DM Plan (2010-2014).

USGS' Recovery Program funds 73% of the projects on the 5-year plan, or 72% of the dollar value. The projects funded by the Recovery Act that are not on the 2010 -2014 5-year DM Plan include the replacement of two research vessels on the Great Lakes which will remove several DM projects associated with these facilities. Two projects (Priority 15 and 17) were on past 5-year plans and were not funded in the 2010-2014 5-year plan because additional requirements for these two projects were identified and the total was in excess of available funding in the year planned. All USGS DM projects are ranked using the DOI scoring and weighting process as outlined earlier in this document.

Cross-Cutting Initiatives

Use of Renewable and Efficient Energy Technologies

USGS recently implemented the USGS Sustainable Buildings Implementation Plan (SBIP). The SBIP will be followed for all ARRA projects. The SBIP incorporates the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. The Guiding Principles employ integrated design principles, optimize energy performance and renewable energy, protect and conserve water, enhance indoor air quality, and reduce environmental impact of materials. Regardless of size, all construction and building renovation projects shall be as sustainable and energy efficient as possible. As outlined in Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, USGS will implement renewable energy generation technology when life cycle costs determine that it is cost effective.

In addition to renewable and energy efficient technology for facilities, streamgages and seismic monitoring equipment for earthquakes and volcanoes will utilize solar energy technology and the newer technologies in the sensors will also provide more efficient and timely transfer rates and better accuracy in measurements.

Types of USGS Renewable and Efficient Energy Technology Projects	# of Projects	% of Projects*
Projects with Renewable technology	68	21%
Energy Efficiency Projects	131	41%
Total	199	

* Deferred Maintenance of streamgages, cableways, and wells total 183 projects. Without including these projects, the percent of renewable technology is 51% (68/134) and the percent of energy efficient projects is 98% (131/134).

Engage America’s Youth

Youth will be involved in implementing many of the USGS projects executed with ARRA funding. Specific projects where youth will be directly involved will be the data preservation to digitize bird banding data at Patuxent Wildlife Research Center and the implementation of upgrading seismic monitoring.

Types of USGS Youth Outreach Projects	# of Projects	% of Projects
Data preservation and Seismic Monitoring	10	3%
TOTAL	10	3%

Governance in USGS at the Bureau Level

USGS has established a bureau Recovery Act Oversight Board (RAOB). The RAOB will ensure that the bureau’s project plans are executed in accordance with the Act’s specific requirements. Projects will come from those previously reviewed and approved by the bureau’s Investment Review Board. The RAOB will monitor projects against schedule and cost. Associate Directors, in consultation with Regional Directors, will continue to exercise direct oversight and leadership in their respective areas of responsibility and will provide to the RAOB reports as defined for purposes of RAOB oversight roles and responsibilities. Instructional memoranda are being written to provide guidance on recording and tracking obligations, expenditures and performance in accordance with OMB and Departmental guidance.

RAOB members are the Bureau's Executive, senior and program leadership. The Director of the Office of Budget and Performance and the Associate Director for Administrative Policy and Services/Chief Financial Officer serve as co-chairs.

Contracting Methodology:

Contracting will be used to acquire the goods and services required to implement the projects proposed. Current contracting methodologies will be used. Open competition using firm, fixed price contracts will be used to the maximum extent possible. Selection criteria include technical excellence, project effectiveness, support for cross-cutting initiatives, and lowest price. The USGS will adhere to the following contracting methodologies:

- open market competitive solicitations;
- task orders awarded using fair opportunity (i.e. multiple award) under Indefinite Delivery/Indefinite Quantity (ID/IQ) contracts awarded using competitive procedures;
- task orders awarded to an established source (i.e. single award) under ID/IQ contracts awarded using competitive procedures;
- GSA schedule orders using fair opportunity; and
- Availability of product or service applies to open market non-competitive transactions less than \$3,000.

USGS implemented an environmental purchasing policy by considering the environmental consequences of procurement choices. Areas considered are

- relative energy consumption of competing alternatives;
- avoiding hazardous materials when there is a safer alternative;
- avoiding ozone-depleting substances;
- selecting items with recycled content or bio-based product alternatives; and
- eventual disposal costs of alternative products.

Facility deferred maintenance and construction will follow guidelines set forth in the USGS Sustainable Buildings Implementation Plan.

Administrative Costs

The report covering the Recovery Act legislation allows the Department to retain up to 5% of each appropriated account to cover administrative costs. A total of \$3.8 million will be retained to cover bureau and Department level administration costs associated with implementing ARRA projects. Examples of administrative costs will be used include: the hiring term appointment contracting officers and project managers. USGS proposes to retain 3% of the total amount available for deferred maintenance – facilities and construction projects and 2.5% of the total amount available for other project categories. In addition, the programs will have up to another 2% for deferred maintenance – facilities and construction and 2.5% for other project categories within their program areas for administrative costs to implement work specific to a project. The Bureau funding will be monitored and tracked separately. Project level administrative costs will be included in the overall project cost. Bureau funding will be used to obtain additional resources in the form of Contracting Officers and Contracting Officer Representatives. As a cost control measure, the RAOB has the responsibility to approve and monitor all ARRA related staffing plans and associated administrative cost expenditures.