The National Research Program of the U.S. Geological Survey (USGS)

The National Research Program (NRP) encompasses a broad spectrum of scientific investigations and focuses on long-term studies that integrate hydrological, geological, chemical, climatological, and biological information related to water resources and environmental problems. Using shared facilities, personnel, and equipment, the Program provides an infrastructure within which the USGS can develop new information, theories, and techniques to understand, anticipate, and solve water-resource problems facing the Nation. The NRP's staff of about 260 permanent and 120 non-permanent individuals is located principally at USGS centers in Reston, Virginia; Denver, Colorado; and Menlo Park, California.

Research Fills Many Needs

Researchers in the National Research Program focus both on (1) the study and application of hydrologic principles to particular geographic settings or water-resources problems, and (2) on fundamental research addressing hydrologic processes and principles that are related to broad geographic areas or problems. The combination of approaches is essential to the development of scientific understanding and the application of results to problems related to the use and preservation of the Nation's water resources, both of which help the USGS and the U.S. Department of the Interior perform their public missions.

Results of hydrologic research by scientists in this program have provided much of the scientific basis that has enabled the USGS to tackle and resolve complex hydrologic problems. The new information, theories, techniques, and tools developed within the program are used not only by USGS scientists and managers, but also by the members of the hydrologic community outside the USGS, both nationally and internationally, and by the public. The NRP makes a deliberate effort to anticipate research needs that will be pertinent to hydrologic science issues of the future. Thus, the emphasis of NRP research activities changes through time, reflecting the emergence of needed new areas of inquiry and the demand for new tools and techniques with which to address water-resources issues and problems. The direct linkage of the program with other programs of the USGS, such as the Water, Energy, Biogeochemical Budgets Program (WEBB), Toxic Substances Hydrology Program, National Water Quality Assessment (NAWQA) Program, Place-Based Studies Program, Volcano Hazards Program, and other Bureau initiatives, ensures that the research remains relevant to current water-resources needs.

This publication is intended to convey general information about the NRP and highlight a few research activities to demonstrate the scope of research problems undertaken in addressing important scientific questions.

Research projects in the NRP and recent publications are on the Internet at **http://water.usgs.gov/nrp/**

Hydrologic Research

Hydrologic Research within the USGS has three components:

1. A centrally coordinated program: the National Research Program
2. Distributed research investigations:
   - District Offices in the States
   - National Water Quality Laboratory Methods Group
   - National Water Quality Assessment Program
   - Yucca Mountain Project
   - Cascades Volcano Observatory
3. An external program: State Water Resources Research Institutes

Research Disciplines and Topics

For purposes of technical oversight and review, research in the NRP is subdivided into six disciplines. Each discipline is represented by research scientists who serve as a technical advisors to NRP managers and as a peer resource for research scientists. Chiefs of the Branches of Regional Research are located in the Eastern, Central, and Western Regions. The three Chiefs, together with the Assistant Chief Hydrologist for Research at the national level, oversee the entire program. Below is a brief description of the disciplines and a list of current research topics.

Research Disciplines	General Research Topics
GROUND-WATER CHEMISTRY Investigate inorganic, organic, and biochemical reactions that affect water quality in relation to mineralogic, geochemical, and hydrologic conditions in the ground-water environment.	▪ Sedimentary climate records ▪ Isotopic investigations ▪ Geochemical evolution of ground water ▪ Reactions in contaminated aquifers ▪ Water-rock interactions in sedimentary basins ▪ Geochemistry of thermal systems ▪ Mineral-water interactions ▪ Reaction-transport modeling ▪ Age-dating of ground water ▪ Fate and transport of gases in the subsurface
SURFACE-WATER CHEMISTRY Assess natural and contaminant chemicals in water and sediment, and study fundamental chemical and biochemical processes that affect the movement of organic and inorganic solutes and gases through primarily surface-water systems.	▪ Radioisotopes in water, sediment, and wastes ▪ Trace-element partitioning ▪ Partitioning of organic and inorganic solutes ▪ Biogeochemical cycling ▪ Chemistry of small watersheds ▪ Natural organic material in water ▪ Chemistry of river systems ▪ Lake ecosystems ▪ Ultra-trace metals in water
GROUND-WATER HYDROLOGY Understand and develop tools to analyze processes that control movement and availability of subsurface water, its transport of dissolved substances, microbes, particulates and other fluid phases, and its interactions with the geological environment.	▪ Unsaturated-zone hydrology ▪ Ground-water flow and solute transport ▪ Numerical model simulations ▪ Physics and flow of immiscible contaminants ▪ Hydrology of fractured rocks ▪ Hydrology of thermal systems ▪ Hydraulic properties of aquifers ▪ Flow in low-permeability systems ▪ Borehole geophysics ▪ Monitoring network design

SURFACE-WATER HYDROLOGY

Quantify, understand, and model the physical processes that control the distribution and quality of the Nation's surface-water resources.

- Surface-water modeling
- Surface-water flow and transport
- Estuarine hydrodynamics
- Surface water-ground water interactions
- Geochemical interactions in catchments
- Paleoflood hydrology
- Climate variability and surface-water hydrology
- Watershed modeling
- Statistical hydrology

GEOMORPHOLOGY AND SEDIMENT TRANSPORT

Understand stream-channel morphology and erosional processes that govern the source, mobility, and deposition of sediment.

- Sediment transport dynamics
- Sediment transport from disturbed lands
- Climate implications from fluvial systems
- Channel morphology and sediment transport
- Flow and sediment mechanics

ECOLOGY

Investigate biological and microbiological processes that affect and are affected by the quality of water and evaluate environmental factors that determine the ecology and biogeochemistry of surface-water and ground-water resources.

- Responses to climate variability
- Aquatic vegetation in rivers and wetlands
- Riparian vegetation and geomorphology
- Dynamics of plankton and benthic organisms
- Transport of solutes in estuarine systems
- Toxic substances and effects on biota
- Microbial biogeochemistry
- Microbial activity and transport in ground water
- Carbon fluxes across interfaces