Argonne NATIONAL LABORATORY

Ten-Year Site Plan

FY 2009–FY 2018

July 2007

ANL/FMS/TYSP-2007

About Argonne National Laboratory
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UChicago ▶ Argonne LLC

Office of Science
U.S. DEPARTMENT OF ENERGY

A U.S. Department of Energy laboratory managed by UChicago Argonne, LLC

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Notation

AEBL	Advanced Exotic Beamline Laboratory
ACI	asset condition index; ACI = 1 – (DM/RPV)
ACRF	Atmospheric Radiation Measurement Program (ARM) Climate Research Facility (DOE)
AGHCF	Alpha-Gamma Hot Cell Facility
APCF	Advanced Protein Crystallization Facility
APS	Advanced Photon Source
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ATLAS	Argonne Tandem-Linac Accelerator System
AUI	asset utilization index
CAMP	Capital Asset Management Process (DOE)
CARIBU	Californium Rare Ion Beam Upgrade (to ATLAS)
CAS	Condition Assessment Survey
CECo	Commonwealth Edison Company
CERN	European Center for Nuclear Research
CHP	central heating plant
CNM	Center for Nanoscale Materials
COE	U.S. Army Corps of Engineers
CP-5	Chicago Pile 5 Reactor
D&D	decontamination and decommissioning
DM	deferred maintenance
DMR	deferred maintenance reduction
DOE-EM	U.S. Department of Energy, Office of Environmental Management
DOE-OECM	U.S. Department of Energy, Office of Engineering and Construction Management
DOE-SC	U.S. Department of Energy, Office of Science
DOE-SSA	U.S. Department of Energy, Office of Security and Safety Performance Assurance
E.O.	Executive Order
EFD	Excess Facilities Disposition (program; DOE-SC)
EMC	Electron Microscopy Center
EPAct	Energy Policy Act of 1992
ERL-FEL	Energy Recovery Linac–Free-Electron Laser
ESH&I	environment, safety, health, and infrastructure
ESPC	Energy Savings Performance Contract
FCI	facility condition index; FCI = DM/RPV
FIMS	Facility Information Management System (DOE)
FIS	Financial Information System (Argonne)
FRPC	Federal Real Property Council
FTE	full-time equivalent
GPP	General Plant Projects
GSF	gross square foot (feet)
HMFB	High-Magnetic-Field Beamline
IGPP	Institutional General Plant Projects

ILC	International Linear Collider
IP	Internet protocol
IPNS	Intense Pulsed Neutron Source
ISC	Illinois Science Center
ISNSE	International School of Nuclear Science and Engineering
LHC	Large Hadron Collider
LOM	laboratory-office module (at APS)
LWTP	laboratory wastewater treatment plant
M&O	Management and Operations
MII	maintenance investment index
MRR	Major Repairs (program)
NBL	New Brunswick Laboratory
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
ORNL	Oak Ridge National Laboratory
PBX	private branch exchange
PEMP	Performance Evaluation and Management Plan
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RIC	rehabilitation and improvement cost
RICI	rehabilitation and improvement cost index; RICI = RIC/RPV
ROI	return on investment
RPAM	Real Property Asset Management
RPV	replacement plant value
RWSF	Radioactive Waste Storage Facility
SAMM	Sub-Angstrom Microscopy and Microanalysis (Facility)
SBF	Systems Biology Facility
SCADA	supervisory control and data acquisition
SCI	summary condition index; SCI = TRIC/RPV = (FCI + RICI)/RPV
SLI	Science Laboratories Infrastructure (Program)
SSC	Systems Simulation Center
SWTP	sanitary wastewater treatment plant
TAA	turnaround arc
TCS	Theory and Computing Sciences (Facility)
TDM	time division multiplexing
TEC	total estimated cost
TRIC	total rehabilitation and improvement cost; TRIC = FCI + RICI
VOIP	voice over Internet protocol
VVF	Validation and Verification Facility
XII	X-ray Imaging Institute
ZGS	Zero Gradient Synchrotron

A Executive Summary

The Argonne FY 2007 *Ten-Year Site Plan* is a comprehensive sitewide plan for the management of Argonne's real property assets in support of the DOE strategic plan and the Secretary of Energy's five-year planning guidance. This *Plan* documents the Laboratory's vision for its scientific missions and for reconfiguring its multiprogram and research support facilities to achieve needed mission capabilities. The *Plan* also establishes goals and strategies and estimates the resources needed to achieve those goals through selective modernization, recapitalization, replacement, and increased sustainment of its facilities. In keeping with annual program direction and guidance from the DOE Office of Science (DOE-SC), Argonne's annual submittal of its land use plan for DOE review and approval is contained in Section E.1 (Appendix: Land Use Plan).

The Argonne physical site has few constraints to expanding the Laboratory's role in 21st century research. Sufficient land is readily available to support mission adaptation and developmental change. Rather, the challenges for Argonne are to revitalize and reshape the existing facility infrastructure to meet the current and emerging needs of scientific missions, including compliance with standards of environmental performance and safety and elimination of legacy waste and substandard facilities, while optimizing operation and maintenance costs.

Argonne is demonstrating an enviable record of mission achievement through innovation and adoption of alternative means of implementing the necessary physical resources to achieve significant strides forward in new, state-of-the-art facilities.

Implementation of this *Plan*, which is a major step toward achieving the Laboratory's vision for the 21st century, requires investment of approximately $927 million in FY 2009–FY 2018. This level of funding would enable the Laboratory to achieve the major infrastructure performance goals and objectives identified in this *Plan*. Of this needed investment, $508 million will be funded internally, in keeping with Argonne's continued commitment to meet the current DOE-SC maintenance investment index goal of 2%, to meet deferred maintenance reduction goals, and to provide for Institutional General Plan Projects (IGPP) needs, in the absence of the directly funded General Plant Projects (GPP) program.

Another $419 million in direct funding is expected from the Science Laboratories Infrastructure (SLI) modernization initiative for six line-item projects to selectively replace and modernize substandard facilities and infrastructure. The funding requirements underlying this *Plan — especially for the SLI modernization initiative* — are critical success factors for the Laboratory in reducing its operating costs, improving scientific productivity, and realizing a state-of-the-art infrastructure that is reliable, efficient, safe, secure, and environmentally sound. The savings achieved through implementation of the SLI modernization initiative are necessary to support Argonne's commitment to significant increases in IGPP expenditures. The stated funding needs exclude funding from other sources, such as third-party financing for the construction of new facilities and energy-related infrastructure improvement and funding expected from a program of the DOE Office of Environmental Management (DOE-EM) type for the disposal of legacy waste and demolition activities.

An internal assessment and evaluation of Argonne missions and capabilities has articulated a preferred direction for nuclear facilities at Argonne. Ultimately, the goal is to consolidate the nuclear facilities and reduce the inventory of radiological material, preserving the capability to perform mission-important experiments and to receive, store, disposition, and transfer nuclear materials. An identification of funding sources such as DOE-EM within DOE is required for expeditious cleanup, materials disposition, and waste disposition from the facilities formerly dedicated to nuclear programmatic missions, as well as the ultimate decontamination, decommissioning, and demolition of these facilities. Order-of-magnitude estimates suggest a need for $400 million (current dollars) for this effort. The accelerated removal of the facilities and wastes will significantly support Argonne's necessary transition from past nuclear roles and missions to achievement of important evolving missions in the 21st century.

B Overview of Site Facilities and Infrastructure

Argonne had its inception in a World War II research activity under the leadership of Enrico Fermi at the University of Chicago, code named the "Metallurgical Laboratory." After the war, the U.S. government continued nuclear research, development, and production activities. The Argonne Division of the Metallurgical Laboratory became Argonne National Laboratory on July 1, 1946. The Atomic Energy Act of 1946 established a civilian agency, the Atomic Energy Commission, to manage and control the atomic energy program. The Commission assumed control of the program and broadly defined basic research as a major element of the Argonne mission, a principle that carried over to other multiprogram national laboratories as they evolved or were created. At its inception, the Argonne site was located at the suburban fringe in a rural setting removed from the center of population, yet still accessible to the research staff and faculty of the University of Chicago. The intervening 60 years of growth in the metropolitan Chicago region have fundamentally altered Argonne's setting, though the Waterfall Glen Forest Preserve surrounding the Laboratory somewhat obscures the extent of this change.

B.1 Summary Overview of Argonne Facilities and Infrastructure

B.1.1 Physical Description

Argonne conducts basic and technology-directed research on a 1,500-acre site owned by DOE in DuPage County, Illinois, about 25 miles southwest of Chicago (Figure B.1). The site is surrounded by Waterfall Glen Forest Preserve, a 2,470-acre greenbelt.

Today the Argonne site is ideally situated for its purpose as a 21st century multiprogram research laboratory. Its ready access to businesses, industries, and universities and its location on one of DuPage County's growth corridors ensure that the Laboratory will maintain its competitive position in attracting and retaining highly skilled, educated personnel and in fostering business links to other high-technology enterprises in the area.

Activities at Argonne support the full range of missions described in Chapter C. Major facilities at the site include the Advanced Photon Source (APS), the Laboratory's newest and largest user facility; the Intense Pulsed Neutron Source (IPNS); the Argonne Tandem-Linac Accelerator System (ATLAS); and the Electron Microscopy Center (EMC). Researchers from outside Argonne use all these facilities heavily. Argonne also houses a full spectrum of administrative and technical support organizations, as well as DOE's Chicago Operations Office and the New Brunswick Laboratory, both of which use facilities operated and maintained by Argonne.

The site currently accommodates approximately 4,800 persons (including DOE employees, contractors, and guests). Throughout the year, over 2,000 other researchers use the Laboratory's scientific facilities as visitors or collaborators. The Argonne site includes 99 buildings (98 record entries in the Facility Information Management System [FIMS]) having 4.6 million total square feet of floor space. An additional 110,000 square feet of space is provided by various other structures and facilities throughout the site. Building 900, with 73,229 square feet of ingrant leased space, is off-site to the southwest, approximately 3.5 miles from the center of the site. In addition to the space in Building 900 leased to alleviate a space shortage near the Argonne site, an additional 22,000 square feet is leased, primarily for offices in the Washington, D.C., area and in Colorado. Occupancy of off-site space has remained generally stable for several years.

Argonne facilities are nearly 97% occupied, as measured by the Argonne space management system. The asset utilization index (AUI), which is related to overall facility utilization, measures 0.965 ("good"; see also Section D.1.4.4); the use-specific measures exceed the goals of the DOE Office of Engineering and Construction Management (DOE-OECM) for each of the four applicable use types. The replacement value of all existing facilities and other structures at Argonne is estimated to exceed $1.6 billion (Section B.1.3), and the asset condition index (ACI) is also "good"

FIGURE B.1 Aerial Image of the Argonne Site

at 0.961. The maintenance investment index (MII; see also Sections D.1.4.1 and D.8) has been achieved at the specified rate of 2% of replacement plant value (RPV). By Argonne policy, MII will continue to be met at that guidance funding level. The summary indices established by DOE and reported through FIMS indicate that the Laboratory is effectively utilized and maintained overall, although it contains significantly aged facilities.

Research programs supported by DOE-SC account for more than half of the space usage at Argonne. Figures B.2 and B.3 summarize the distribution of building space at Argonne by General Services Administration use code (Administrative, R&D, Housing, and so on) and by building age.

Adequate land is available to accommodate Argonne's plans for expanded programs in basic research and other areas. The site road and utilities infrastructure generally can accommodate modest growth. Facilities are now almost fully occupied, so additional construction will be required to satisfy the needs of growing programs.

Existing physical, site, and regional location factors present no constraints to planned accommodations. The planned Laboratory growth will not encroach on neighboring areas, because the site is separated from them by the greenbelt forest. The exceptional road connections to major expressways and the local arterial network can accommodate the increased traffic that will accompany such growth.

Argonne's total operating budget was $473 million in FY 2006 and is estimated at $500 million for FY 2007. The budget is expected to grow to approximately $550 million in FY 2008 and to approach $1 billion by the close of the planning horizon in FY 2018. Funding of Laboratory missions is projected to be in keeping with the American Competitiveness Initiatives, at approximately 6% annually. Although these more distant financial data are being reviewed in consultation with Laboratory management and

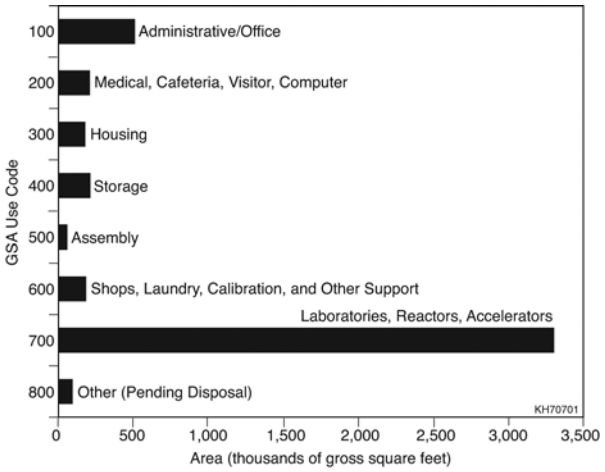

FIGURE B.2 Distribution of DOE-SC Space at Argonne

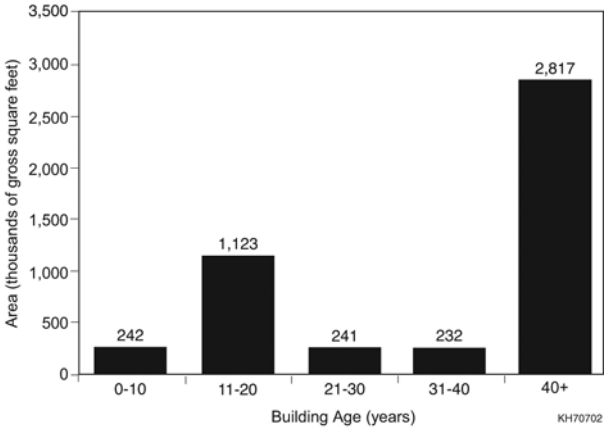

FIGURE B.3 Age of DOE-SC Buildings at Argonne (The average is 37.3 years.)

DOE funding sponsors, they are sufficiently developed to quantify meaningful mission needs for infrastructure improvements.

Argonne is managed for the U.S. Department of Energy by UChicago Argonne, LLC, as a government-owned, contractor-operated research facility, under an operating contract awarded for 5 years at the beginning of FY 2007. The contract includes an option for noncompetitive renewal, given satisfactory performance, for a total contract period of 20 years.

B.1.2 Characterization of Site and Facilities

Development of permanent facilities has largely followed the initial architectural site development planning of the late 1940s and early 1950s. The Inner Circle Drive and the Outer Circle Drive established a pattern that has been sustained in most subsequent development. The first research buildings were constructed between the two roads. Early special-purpose nuclear facilities were located south of the circles to provide a meteorological advantage in the event of accidental releases. This precedent was followed in later development.

Most facilities are clustered within one of the following ten distinct areas: east, 100, 200, 300, 360, 400, 500, 600, 800, and Argonne Park (Figure B.4). Detailed descriptions of these areas and the special concerns and opportunities associated with them are in Section E2. Discussions of general sitewide infrastructure or civil improvements (roads and bridges, parking, and pedestrian circulation and walks), security-related assets (guard posts and fencing), and several large utility facilities that are separate from these areas of clustered development are described similarly in Section E3.

Most of Argonne's basic research activities are conducted in the permanent buildings of the 200 area, within the Outer Circle Drive, or housed in the 400 area, in the collaborative access laboratories related to the APS. The 300 area to the south comprises current and former special-purpose nuclear facilities, largely permanent structures. The 800 area, west of the Outer Circle Drive, was erected by the initial site development contractor for storage and shop support and formerly consisted of a group of temporary buildings. This area is now cleared, pending assignment to a future mission requiring significant acreage in a brownfield setting. The east area, a second group of temporary buildings, was erected around 1950 near the eastern boundary of the present site to house support, administration, and some technical functions; it is now also almost completely cleared and available for reassignment for suitable missions or initiatives.

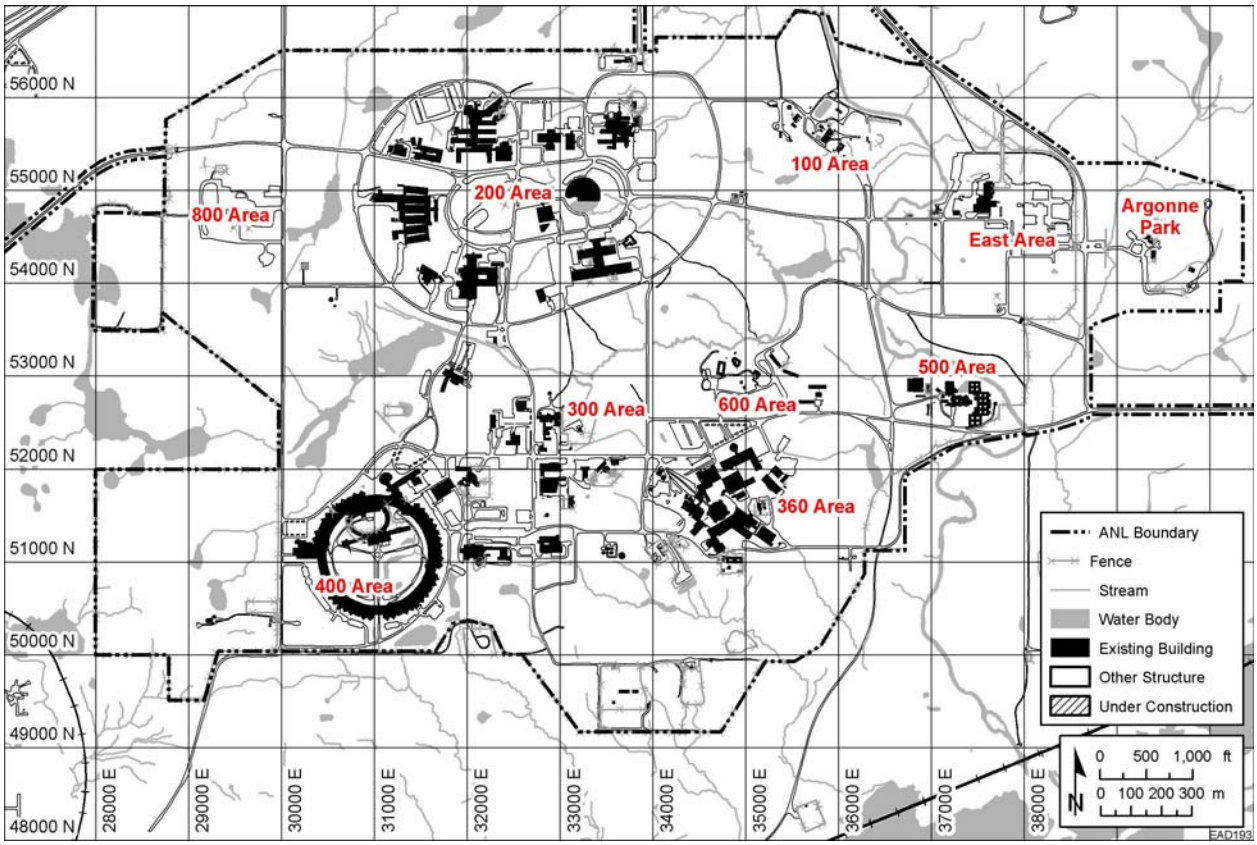

FIGURE B.4 Developed Areas of the Argonne Site

Construction of the Zero Gradient Synchrotron (ZGS) in the early 1960s required bedrock support for the accelerator ring. The construction cost was minimized by choosing a location southeast of the Outer Circle Drive. Consequently, the ZGS complex of R&D facilities was located in the 360 area. After ZGS operation ended in 1979, the facilities of the complex were used by a variety of programmatic groups, most notably the IPNS user facility and the Center for Transportation Research (for testing of drive trains and engines).

The meteorology experiment area in the southwest corner of the site encompasses large open spaces and is used for a variety of ecological and air pollution research projects. This area is discussed in Section E2.7, in conjunction with the 400 area (APS, the newest research complex on the site) and the developmental land reserves associated with former ecology plots.

The 600 area consists of lodging facilities. Freund Lodge, the original guest house, was acquired with the site to accommodate visitors to the then-remote site in the early 1950s. Other facilities were added in the late 1950s and mid 1960s to meet housing needs for students and visiting research associates.

Topography and soil conditions across most of the site are suitable for construction. The clustering of facilities for program effectiveness has resulted in substantial open spaces or green belts between major facilities. Naturally wooded plots have been preserved, and considerable reforestation has taken place. These environmental features integrate the site into a natural setting and differentiate the various developed areas. Grounds maintenance outside the developed areas of the site is limited to that required for traffic safety. Maintenance includes mowing most of the 200, 300, 400, 600, and Argonne Park areas, as well as the areas around the entrance gates and building perimeters. Decorative landscaping is restricted to building entrances and courtyards. Maintenance

mowing is performed in other areas as required for access and growth retardation.

B.1.3 Condition Overview

Because most building and facility infrastructure systems have a useful-life expectancy of 25–35 years, many Argonne facilities constructed in the 1950s and 1960s now require upgrading or replacement. The aging of facilities has caused the accumulation of a large inventory of needed revitalization. Figure B.3 summarizes the ages of Argonne facilities.

Principal challenges being addressed by Argonne are (1) the normal aging of buildings and infrastructure and (2) the need to provide sufficient continuing maintenance and selective replacement and upgrades to facilities to meet 21st century requirements.

As indicated in Figure B.3, over 60% of Argonne facilities are more than 40 years old. In recent years, Argonne has successfully reduced substandard space by replacing or rehabilitating older facilities and by adding new programmatic facilities.

Table B.1 summarizes statistics used by DOE-SC to evaluate the condition of various types of facilities at its laboratories. The rehabilitation and improvement cost index (RICI) reflects the increasingly urgent need for increased capital funding to maintain reliability and support replacement/modernization as Argonne facilities continue to age. The overriding need is for facilities categorized as "Laboratories, Reactors, Accelerators," especially for rehabilitation/improvement and selective replacement beyond current deferred maintenance. The continued improvement and selective replacement of these facilities are the focus of mission reconfiguration and the plans for infrastructure revitalization presented in Chapter D.

Section E2 contains more detailed information on the range of facility conditions for each developed area of the site. Section E3 provides descriptions of sitewide infrastructure systems and utilities.

B.2 Summary of DOE-SC Facilities

The statistical summary of the DOE-SC facilities in Table B.1 includes selected sitewide indications reflecting general site conditions. More detailed facility condition descriptions are in Section E2. Supporting infrastructure systems are characterized similarly in Section E3. The data in these sections have been developed with reference to the FY 2006 Condition Assessment Survey (CAS) inspection cycle and include all changes from the FY 2006 *Ten-Year Site Plan* submission that are now in the FIMS database. To preserve comparability with the requirements of the FIMS database, the values in Table B.1 have not been escalated. The results of the current (FY 2007) cycle of inspections will not be available until late in the fiscal year. The conditions reported in Table B.1 were determined by using the CAS process described in Section D.2.

B.3 Laboratory Space Distribution and Age Profile

Figures B.2 and B.3 summarize aggregate data regarding the space distribution and age profile of Argonne DOE-SC facilities. These data reflect current (FY 2007) ages and usage characteristics.

B.4 Former Non-SC Facilities

One former non-DOE-SC facility at Argonne, the New Brunswick Laboratory (NBL), occupies an 85,372-square-foot building, with an average long-term occupancy of about 40 personnel. In February 2007, ownership of the NBL facility was transferred from the DOE Office of Security and Safety Performance Assurance to DOE-SC. The existing Memoranda of Understanding govern the working relationships between this facility and the ongoing landlord functions at Argonne. Data reflecting the current DOE-SC landlord responsibilities have been incorporated into all documentation throughout this *Plan*. The NBL is an integral part of DOE's central authority for nuclear materials measurements and measurement evaluation and is the federal government's certifying authority for nuclear reference materials.

TABLE B.1 Facility Condition Statistics at Argonne by Secretarial Office and Asset Type

Asset Type	No.	RPV[a] ($ million)	Gross Floor Area (thousand square feet)	Deferred Maintenance			Rehabilitation and Improvement Cost Index		Total Facility Needs ($ millions)
				Cost ($ millions)	ACI[b]	Rating[c]	Cost ($ million)[d]	RICI[e]	
Buildings									
Administrative/Office Use	9	92.3	493.5	4.3	0.954	Good	31.8	0.344	36.1
Medical, Cafeteria, Visitor, Computer	11	41.0	197.0	1.4	0.966	Good	10.7	0.260	12.1
Housing	9	31.5	170.9	3.5	0.887	Fair	2.9	0.091	6.4
Storage	13	113.5	209.3	3.6	0.969	Good	11.9	0.105	15.4
Assembly	2	5.0	42.6	0.5	0.909	Adequate	1.5	0.306	2.0
Shops, Laundry, Calibration, Other Support	9	54.1	169.4	0.4	0.992	Excellent	4.1	0.076	4.5
Laboratories, Reactors, Accelerators[f]	44	914.8	3,289.4	41.6	0.955	Good	164.6	0.180	206.2
Other (Pending Disposal)	2	43.2	82.6	0.2	0.995	Excellent	23.5	0.544	23.7
Buildings, Totals[g]	99	1,295.7	4,654.6	55.4	0.957	Good	251.0	0.194	306.5
Other Structures and Facilities		317.4		8.2	0.974	Good	16.8	0.053	25.0
Facilities, Totals		1,613.1		63.4	0.961	Good	267.8	0.166	331.4

[a] Excludes reactors, accelerators, scientific equipment.

[b] Asset condition index. ACI = 1 – (DM/RPV), where DM is deferred maintenance and RPV is replacement plant value.

[c] Rating scale:

ACI Range	ACI Rating
1.00 ≥ 0.98	Excellent
0.98 ≥ 0.95	Good
0.95 ≥ 0.90	Adequate
0.90 ≥ 0.75	Fair
0.75 ≥	Poor

[d] Includes disposal costs for Buildings 040, 301, and 330

[e] Rehabilitation and improvement cost index. RICI = RIC/RPV, where RIC is rehabilitation and improvement cost and RPV is replacement plant value.

[f] Includes NBL, as follows:

RPV	$24.7 million
Gross Floor Area	85.4 thousand GSF
DM Cost	$0.9 million
ACI	0.963 (Good)
RICI Cost	$12.3 million
RICI	0.496
Total Facility Needs	$13.2 million

[g] Buildings 331 and 331A are counted as one FIMS building entry.

Building 350, which houses the NBL, is one of the older buildings on the site. It was initially used for fuel development and as a balance facility during the era of reactor R&D and was enlarged to nearly twice its original size to accommodate the transfer of NBL staff and missions in the late 1970s. The older portion of the building retains original features, largely unmodified. As reported through FIMS, the NBL facility requires substantial rehabilitation. Summary statistics for the NBL are included in Table B.1 (footnote “f”).

The NBL receives all utility services through Argonne’s distribution and collection systems. Memoranda of Understanding define the procedural, service, and financial arrangements between the organizations. In addition to providing all operating utilities, the Laboratory provides other facility-related services, such as custodial services and building maintenance; responds to utility service breakdowns or calls; and provides for waste management as it does for Argonne programs. Under the Memoranda of

Understanding, operations for site safety, security, environmental controls, waste handling, and emergency preparedness are conducted under DOE procedures that are consistent with Argonne policies, though DOE retains lead responsibility for assurance and compliance. The NBL is a separate nuclear materials accountability entity; it is excluded from oversight, reporting, and control or security of nuclear materials, by or through Argonne.

DOE-SC, the DOE Chicago Office's Integrated Support Center, and the NBL are discussing the relationships among the organizations with regard to stewardship, property management, and recapitalization for the NBL facility. The allocation of funding responsibility is a significant area for resolution in terms of coordination of roles and obligations, as discussed in Chapter D.

C Current and Future Missions

Founded in 1946, Argonne traces its scientific legacy directly to nuclear physics research teams led by Nobel laureate Enrico Fermi. In its early days, the Laboratory was largely responsible for the science supporting emergence of the U.S. nuclear power industry. Today, Argonne is a multipurpose laboratory with a mission focus and deep capabilities in basic and applied materials, chemical science, energy technologies and analysis, high-performance computation, physics, and biosciences. We also lead research in other scientific areas of importance to DOE, such as environmental science and national security, and we pioneer new concepts in the design, construction, and management of major scientific facilities.

As a DOE steward of critical national research infrastructure, the Laboratory offers access to university, industry, and government researchers. Our research facilities include the APS, which generates x-ray beams for research ranging from materials science to structural biology; the IPNS, which has achieved many "firsts" in the field of neutron scattering; the EMC, which is bringing next-generation aberration-corrected electron microscopy online as a leader in DOE's TEAM project; the Center for Nanoscale Materials (CNM), which focuses on exploration of the nanoscale physics and chemistry of nontraditional electronic materials; and ATLAS, a superconducting linear accelerator for heavy atoms. The Argonne user community now includes more than 3,500 scientists and engineers.

C.1 Laboratory Focus and Vision

Six core competencies underpin activities at Argonne:

1. Materials science, nanoscience, chemistry, and structural biology

2. Synchrotron radiation science and technology for the study of materials of all kinds

3. Energy-related research, including transportation science and engineering, as well as nuclear fuel cycle and reactor design

4. Integration of modeling and fundamental science with engineering and economic expertise to address energy and environmental issues

5. Advanced software tools, massively parallel computer architectures, and large-scale computational science capabilities

6. Fundamental nuclear physics tied to cosmology and the origins of the elements

These six competencies enable Argonne to deliver its mission and customer focus, to perform a complementary role in the DOE laboratory system, and to pursue its vision for scientific excellence and preeminence in the following areas:

- Pursuit of the limits of high spatial and temporal resolution for materials research at the nanoscale; associated initiatives include the CNM and the Sub-Angstrom Microscopy and Microanalysis (SAMM) Facility.

- Production of x-rays of increased brightness and coherence (by two or more orders of magnitude) through an upgrade to the APS, the Western Hemisphere's preeminent synchrotron radiation source; these initiatives will include the Energy Recovery Linac–Free-Electron Laser (ERL-FEL) upgrade, the X-ray Imaging Institute (XII), and the High-Magnetic-Field Beamline (HMFB).

- Capture of the frontiers of low-energy nuclear physics, particularly for the study of rare and unstable isotopes. Associated initiatives include the Californium Rare Ion Breeder Upgrade (CARIBU) to ATLAS, other planned improvements to the ATLAS accelerator system, and ultimately the successful attainment of the Advanced Exotic Beamline Laboratory (AEBL) project.

- Integration of materials science, computational science, and other sciences to create a sustainable and secure energy future.
- Creation of the world's leading core accelerator technology development capability. Associated initiatives include the ERL-FEL upgrade to the APS and participation on the America's Regional Team, which is helping to develop the technology needed for the International Linear Collider (ILC).
- Advancement of computational science — both architectures and applications — to tackle national R&D challenges requiring petascale capabilities; the associated keystone initiative is the Theory and Computing Sciences (TCS) Facility.
- Development of nanobioscience capabilities to improve chemical energy conversion dramatically.

C.2 Business Lines

The following capabilities, aligned by business lines, distinguish Argonne and provide a basis for effective teaming and partnering with other DOE laboratories, universities, and private-sector partners in pursuit of the Laboratory mission. The primary business lines and the distinguishing capabilities outlined below provide an additional window on the mission focus and unique contributions and strengths of Argonne and its role in the DOE-SC laboratory complex.

C.2.1 Primary Business Lines

Materials Science. Argonne's mission capabilities distinguish it as an international leader in materials science, as recognized through authorship of many of the most highly cited papers in the field. The Laboratory offers an unrivaled co-location of photon-, neutron-, electron-, and ion-based materials analysis facilities. The high caliber of the staff is indicated by the award of the 2003 Nobel Prize in Physics to Alexei Abrikosov. Argonne is distinguished in its performance in research areas including correlated electron materials, catalysis, biological and inorganic materials synthesis and characterization, and hard-x-ray nanoscale science. Key research facilities in the materials science core area include the APS, the CNM, the EMC, and the IPNS. These facilities are instrumental in contributing to the understanding of materials structure for energy, information technology, health, and national security applications.

Mathematics and Computer Sciences. Argonne's mission capabilities in mathematics and computer sciences distinguish it as a leader in the development of fundamental architectures for massively parallel computer systems. The Laboratory's leadership in large-scale massively parallel optimization is recognized among DOE's top ten scientific achievements, and Argonne is a partner with Oak Ridge National Laboratory (ORNL) in establishing leadership-class computing for open scientific research. The Laboratory is distinguished in its performance in advanced architecture research, applied modeling and simulation, and computational mathematics. The key research initiative supporting this business line, the TCS Facility, will facilitate the continued provision of computational tools to advance the forefront of science within Argonne's multidisciplinary setting.

Advanced Biosciences. The Laboratory's mission capabilities in advanced biosciences distinguish it as among the top three worldwide producers and characterizers of protein structures. Our unique capabilities are based on the APS, the IPNS, and our protein crystallization center. Our performance along this business line is distinguished through achievements in imaging, structural biology and genomics, biomolecular structure determination, and bioinformatics. Key research facilities in this business line include the existing Structural Biology Center and the Advanced Protein Crystallization Facility (APCF) and Protein Production Facility initiatives. This business line mission is particularly relevant for its potential to increase biodefense capabilities, develop new energy sources and environmental technologies, and advance medical sciences.

Fundamental Physics. Argonne's mission capabilities distinguish it as a world leader in the area of experimental and theoretical nuclear physics. Our staff members authored the most highly cited nuclear theory paper of the past decade, and we have demonstrated worldwide roles in experiments involving the Collider

Detector at Fermilab and ATLAS. Our research in nuclear structure and astrophysics relies on stable beams; laser trapping of individual atoms, and high-energy physics experiments and theory. Key research facilities in this business line include ATLAS, the CARIBU upgrade, and the planned AEBL project. This business line mission is particularly relevant for its potential to extend the understanding of fundamental matter and forces and to master connections between high-energy and nuclear physics, astrophysics, and cosmology.

Energy and Environmental Science and Technology. The Laboratory's mission capabilities in energy and environmental science and technology are providing international leadership in fuel cycle and reactor technologies, as evidenced by our partnership with French and Japanese nuclear agencies. Our world leadership in vehicle testing, confirmed by major automakers, has developed the world's most widely used greenhouse gas and total fuel cycle model (GREET). Recognized for its shared leadership with ORNL and Pacific Northwest National Laboratory of the DOE Atmospheric Radiation Measurement Program Climate Research Facility (ACRF), Argonne also has internationally recognized expertise in environmental assessment, as evidenced by our authorship of the *Trans-Alaska Pipeline System Renewal Environmental Impact Statement*. Unique facilities associated with this business line include the ACRF, our engine research facility for diesel engines, our Advanced Powertrain Test Facility for hybrid vehicles, and our Electrochemical Analysis and Diagnostics Laboratory. This business line mission is particularly relevant for its potential to support next-generation nuclear reactor design efforts; advance integrated approaches to energy and environmental challenges; and extend the frontiers in applying large-scale, systems-level modeling and simulations to energy and environmental technologies.

C.2.2 Secondary Business Lines

Several emerging Argonne capabilities carry substantial potential for continued mission growth because of their strengths and interrelationships with our primary business lines. These secondary business lines are insufficiently mature to be characterized by dedicated facilities or initiatives with discreet, self-standing additions with specific locations in the site infrastructure.

Accelerator Design. Argonne has distinguished itself through the implementation of the world's first superconducting ion accelerator and has pioneered new classes and performance standards for radio frequency cavities. Most recently, the APS achieved world-leading development of synchrotron operations. Significant accelerator design capabilities include accelerator R&D for low-velocity beams, superconducting radio frequency design, and synchrotron radiation sources. Our role in this business line is to maintain DOE's lead in accelerator design, construction, and operation.

National Security. Argonne has distinguished itself as a national leader in energy infrastructure risk mitigation, in detection and deterrence of radioactive threats, and in microbioarrays for agent detection. Our significant capabilities include infrastructure assurance, nuclear risk mitigation, and bioagent detection. We are playing an expanding national role in the reduction of homeland security threats.

C.3 Overview of Mission Change

Argonne has achieved a demonstrated record of mission stability over long periods of time. With its inception and dedication to the peaceful use of atomic energy and the realization of nuclear power as an ongoing energy source for the nation, in addition to its initial leadership in interdisciplinary multiprogram research in chemistry, materials science, biology, physics, chemical engineering, and engineering research and applications, Argonne's missions have evolved with the national understanding of the frontiers of science and the challenges of world political, economic, and environmental conditions. These processes of change will continue, guided most strongly by Argonne's dominant business lines and their needs for preserving existing capabilities and reequipping the existing physical infrastructure to address the emerging technological requirements of specifically tailored state-of-the-art facilities, largely funded by scientific program initiatives and supplemented by innovative and possibly unconventional funding sources. Retention of more general baseline capabilities for continued

scientific advancement will occur through renovation, modernization, and replacement of selected facilities, as well as through reconfiguration or conversion of other research platforms to achieve additional capabilities.

C.3.1 Continuing and Evolving Missions in Current Facilities

Reinvestment in the existing physical framework of the Laboratory and support buildings is the primary infrastructure imperative. However, when achieving the needed functionality and reliability through reinvestment is not cost-effective in terms of life cycle, replacement with state-of-the-art facilities is the course of action proposed in this *Plan*.

C.3.2 Conversion of Facilities

Conversion of facilities from their original missions to a redirected mission is a second avenue of mission change. At Argonne, conversion has historically been reflected in the transition of formerly mission-specific facilities to a secondary or supporting role, particularly when such roles require less stringent performance and operational characteristics and can be achieved without the extensive retrofitting necessary to increase operational performance. Many emerging business lines are housed in such facilities, as are developing technologies that do not yet warrant specifically dedicated facilities containing narrowly focused technological settings. The emergence of the transportation research area at Argonne illustrates a mission whose growth has recently crossed over the conversion boundary; creation of special-purpose facilities uniquely responsive to critical factors affect the Laboratory's ability to effectively pursue technological innovation. This area of controlled facility evolution is seen as a secondary but essential strategy.

C.3 3 Addition of Unavailable Capabilities

Argonne has experienced several generational waves of development and redevelopment as its mission focus had broadened and evolved over the decades. These changes are exhibited in part by the addition of facilities in the developed areas of the site and in part by the opening of new areas of the site to accommodate large, expanded mission areas, such as for the ZGS in the 1960s and the APS project in the 1990s. This process is being carried out under the *Ten-Year Site Plan* as a part of the overall strategy of plant and facility revitalization, as described further in Section D.1.4 and — with respect to mission-related initiatives — in Section C.8.

C.3.4 Curtailment of Continuing Work Missions

Throughout its years of operations, Argonne has distinguished itself through the timely removal and disposal of more than 0.75 million square feet of obsolete, unneeded space, primarily original "temporary" metal buildings and Army surplus Quonset huts dating back to the 1940s. Efficient and safe operation of highly technical, complex facilities requires reliable facility maintenance to avoid curtailed or downgraded usage. At the site scale, the evolution and ultimate removal of structures in the old "east" area and "west" area (now referred the 800 area) have returned the land to a state of readiness for mission assignment as "brownfield" locations (Sections D.3 and E1). The removal of existing excess facilities (Sections D.4, D.6, and D.8) reflects mission changes affecting the continued operations of Argonne's current nuclear facilities.

C.3.5 Infrastructure Reliability and Continuity of Operations

The decade of the 1990s witnessed significant upgrades and overhauling of much of Argonne's supporting infrastructure: sewer and waste treatment systems; water systems; electrical distribution reliability and service capacity; infrastructure capacity in many buildings; distribution, management, and reporting systems; and sitewide communications and safety systems. Our telecommunications, data-handling, and data-processing systems are among the infrastructure systems experiencing the most rapid rates of innovation, change, and obsolescence. Consequently, the basic capabilities for these systems require constant change and upgrading. This situation is reflected at the highest level by the Laboratory's mission focus on the development of petascale computing

capabilities and the growth of on-site applications for creation and evaluating nanomaterials, modeling to serve bioengineering and synthetic biology applications, and fission and fusion reactor modeling. Achievement of the TCS Facility initiative will develop a test bed for the next generation of machine development and the application-based capabilities that exemplify Argonne's unique role in the support of collaboration and visualization processes now central to scientific research.

Argonne's strategy is to continue a broad upgrading process in the mission-driven areas through scientific investments in equipment and operating technologies, while maintaining the traditional infrastructure in a state of efficiency and readiness largely through increased maintenance and timely replacements as system components begin to deteriorate. More detailed descriptions and evaluations of current and projected operating conditions for utility and support systems are in Section E3. Conditions within the end-use buildings and throughout the site's developed areas are described in Section E2. Section E1 assesses the overall land planning and development framework of the site, which is operationally capable of sustaining up to two or three times the current levels of development.

C.4 Major Activities — Plans for Business-Line-Related Facilities

Building on its core strengths and capabilities, Argonne pursues seven major activities in support of its recognized DOE missions. These seven activities are at different stages of development; some are currently under way, while others are being conceptualized. For activities still in the conceptual phase, Argonne is considered to have a current supporting research and mission focus to pursue each activity. The strong commitment of DOE-SC to a fair and competitive funding process, coupled with budgetary factors and technical advice from major scientific advisory committees to DOE-SC, will ultimately contribute to decisions about which activities can be pursued, and at which sites. The DOE five-year plans provide greater insights into these activities in terms of various five-year budget scenarios.

Argonne's major activities, ranging from immediate extensions of current research to proposed new future complexes, include the following:

- APS Optimization and Upgrade
- Petascale Computing
- Integrated Energy, Environment, and Economic Research
- A Next-Generation Facility for Nuclear Structure and Astrophysics

C.4.1 APS Optimization and Upgrade

Through major upgrades to the APS accelerator, Argonne is striving to create a capability to see nanostructures in real time and in real environments and to deliver unprecedented x-ray pulses having one-picosecond time resolution. The expectation is that the unique characteristics of an optimized APS will open new frontiers of scientific discovery and investigation and will enable exploration of complex chemical and biological reactions in real time. This achievement will offer order-of-magnitude improvements in capacities for materials studies and *in situ* studies of self-assembling nanoscale semiconducting materials. The benefits are potentially transformational.

The APS has delivered a return on DOE's investment during its past 12 years of operation, serving approximately 3,000 users per year. These users conduct leading-edge experiments that have made lasting contributions to the U.S. economy and social well-being. Ensuring that the APS remains at the forefront of scientific discovery over the next two decades will draw on Argonne's competencies in synchrotron radiation sources and will build on the capabilities of the new CNM, which uses the APS x-ray source as a primary tool. Over the past 12 years, the APS beam emittance, a primary measure of beam quality, has been improved from 8 nm to 3.1 nm, which is close to the practical minimum. Recently, the APS undertook an intensive exploration of potential upgrades, including options for a replacement storage ring or ERL injector. The conclusion, supported by the Machine Advisory Committee, was that only the ERL would provide a revolutionary new capability. In particular, the

ERL promises improvement by two or more orders of magnitude in x-ray brightness and coherence. Also demonstrated was that building an ERL as an upgrade to the APS will not significantly affect the potential performance of the ERL. These two outcomes make a compelling case for an ERL upgrade as the future of the APS.

The ultimate configuration envisioned, shown in Figure C.1, involves a single-pass, 7-GeV superconducting linac pointed away from the APS, as well as a large loop structure (the turnaround arc [TAA]) to change the direction of the beam and bring it into the APS. This configuration has two significant advantages. First, the linac, coupled with a separate high-brightness, high-intensity injector, can simultaneously supply beam to a straight-ahead user facility (shown at the right of Figure C.1 as a rectangle) dedicated to research using ultra-short x-ray pulses. Such a facility could be based on an FEL, spontaneous radiation, or a mixture. A repetition rate of approximately 100 kHz should be possible without affecting the ERL, providing a high pulse rate that can be fanned out to multiple users. The second major advantage of this configuration is that the TAA provides space for as many as 48 additional user straight sections. These straight sections would accept 8-m-long undulators for delivery of the ultimate brightness, and they would also support use of multiple complementary devices, polarization switching, and other advanced concepts. Both of these capabilities can be implemented as follow-on upgrades some years after initial operation of the ERL begins. Thus, this geometry prepares the APS to occupy a leading position in x-ray science for the foreseeable future.

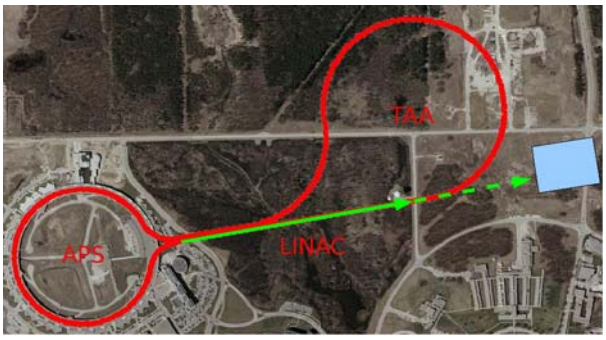

FIGURE C.1 The Proposed APS Energy Recovery Linac

Considerable R&D will be needed in accelerator simulation, x-ray beamline optics, and accelerator technology. The performance of the injector is critical, as it is the primary determinant of the beam brightness; improvements of one to two orders of magnitude in injector emittance are needed. Proper design of linac components is also vital if the facility is to be affordable and reliable in operation.

C.4.2 Petascale Computing

Argonne's focus on advanced architecture deployment and integration at the petascale to support DOE's missions will include activities in nanoscale materials research, reactor simulation, systems biology, accelerator design, and the modeling of complex energy and environment systems. Development of petascale computing capabilities will support creation of "designer" nanomaterials for industrial, medical, and other applications; modeling of whole microbial cells for bioengineering and synthetic biology applications in support of energy and environmental research; and fission and fusion reactor modeling that will significantly help reduce design margins and shorten development schedules by streamlining experimental and licensing requirements.

Argonne is a partner with ORNL in development of leadership-class computing capabilities to support forefront science. While the work supports broad classes of advanced architectures, it focuses on architectures with substantial promise to reach petascale levels of computing capability within the next five years. This activity builds on Argonne's strengths in high-performance computing software, advanced hardware architectures, and application expertise; it enables forefront research, engineering, and facilities. The proposed TCS Facility would provide the needed space and facilities support. The TCS Facility also leverages Argonne's plans to co-locate the High Energy Physics Division with the Nuclear Physics Division.

Major technical hurdles in petascale computing involve the development of a computer architecture that achieves high application performance with reasonable cost and power consumption. Argonne is working with IBM and other vendors to achieve this goal, in collaboration

with researchers at other DOE laboratories and at universities. Argonne also must ensure that applications software with appropriate scientific content, efficiency, and reliability are available to meet the community's needs. In addition to hiring new staff, Argonne will collaborate with other DOE laboratories (especially ORNL and Lawrence Berkeley National Laboratory), the University of Chicago, Northwestern University, the University of Illinois, and other universities to build strong software development teams.

C.4.3 Integrated Energy, Environment, and Economic Research

We are combining our expertise in decision science and in computational, fundamental, and applied research with social and economic science capabilities to develop a suite of products and tools that advance DOE's mission to provide a more diverse, sustainable, and secure energy future for the nation, while mitigating environmental impacts. These mission extensions are expected to establish an integrated analytical energy-environment-economic modeling framework to provide DOE with a new capability for informing policy and investment decisions, leading to a more diverse, sustainable, and secure energy future. This work will develop new technology options, primarily in the transportation, transmission, and nuclear generation sectors, and will integrate R&D programs from basic and applied research to deployment.

Currently, DOE lacks an integrated approach to analyzing the impacts of technology options on energy use and production, the economy, and the environment. Our ability to draw on our systems and decision modeling expertise, Argonne's basic and applied scientific talent, and the social and economic sciences capabilities of the University of Chicago (together with its partner institutions Northwestern University and the University of Illinois) presents an opportunity to achieve analytical capabilities never before available to DOE.

Our investment in integrated energy, environmental, and economic research exploits our capabilities in materials characterization and synthesis; nuclear fuel cycle and reactor design; transportation science and engineering; computational sciences; and integration of computing, science, engineering, and large-project delivery. We expect this investment to have broad impact and significant returns, in the form of a reduction in petroleum use to save $4.5 billion/year in trade balance and $6 billion/year in consumer costs. Diesel engine work at Argonne currently targets a 30-40% reduction in fuel use of the average diesel vehicle. This target also reduces emissions of greenhouse gases by 30-40%.

C.4.4 Next-Generation Facility in Nuclear Structure and Astrophysics

A next-generation facility in nuclear structure and astrophysics — a powerful research tool dedicated to producing and exploring new rare isotopes that are not naturally found on Earth — will help answer long-standing questions of nuclear physics and astrophysics. This area of research is viewed as the top priority of the nuclear physics community. Research conducted at a facility with exotic beam capabilities will have far-reaching results, including uncovering the origins of heavy elements in the periodic table; determining how galaxies, stars, and planets form and evolve; and producing isotopes for biomedical applications.

Argonne will leverage existing capabilities in nuclear physics, including scientific talent and the ATLAS facility, to develop the world's leading exotic beam facility. This activity draws on our experience with accelerator research and technology, especially our long history in building and operating ATLAS. The work will involve development of specific technologies for rare isotope beam capabilities; fundamental physical, materials, and computational sciences; and large-project management. Given the complexity of this undertaking, Argonne intends to partner with other DOE laboratories and with the nation's leading universities and industry. Included will be joint efforts with the University of Chicago and the National Science Foundation Physics Frontier Center, focusing on nuclear astrophysics.

A facility with exotic beam capabilities will provide the means for the next generation of researchers in the nuclear physics and laboratory astrophysics communities to answer some of the most important and fundamental questions of our

time, as well as to train the next generation of nuclear physicists. Fundamental physics research in the United States will increase in preeminence, and U.S. leadership in low-energy nuclear physics will not be lost to Europe and Japan. Important applications in stockpile stewardship and nuclear medicine will be addressed. The proposed Illinois Accelerator Institute will bring together the needed partners and capabilities.

C.4.5 X-ray Imaging Institute

Argonne has proposed a comprehensive XII as part of the future APS upgrade, to promote and support (1) the development of state-of-the-art experimental and computational capabilities, incorporating multiple modalities and imaging on multiple length scales for biological and materials sciences, and (2) R&D efforts and user activities needed to develop next-generation, cutting-edge imaging tools. Funding has been requested through the state of Illinois for a new building adjacent to APS Building 400, with an estimated area of approximately 50,000 square feet, to house the proposed XII and position Argonne to take advantage of the upgraded APS facility. It is in the area of x-ray imaging that the most dramatic impact of the new upgraded APS will be felt; this area has a wide range of applications, supporting both practical and basic R&D. The XII will attract leading experts in x-ray image formation, detection, image reconstruction and analysis, and theoretical modeling and image interpretation, and it will provide a suite of advanced imaging tools complementary to x-rays. Argonne is working closely with medical schools at Northwestern University, the University of Chicago, and other universities to build collaborative activities in the XII that will have major impact on the local biomedical environment. The XII will house laboratories for imaging sample preparation and characterization, as well as for the development, management, and support of nanometer x-ray imaging optics and high-end imaging detectors and electronics. The new XII building will include the end station of a 200-m-long synchrotron beamline dedicated to advanced imaging applications.

The total estimated cost for the construction of the new XII building is $35 million, to be funded through the state of Illinois. In the first year (as early as FY 2008), building and infrastructure design work would be followed by bidding for construction. The facility would be built in the subsequent two years. The cost of the new long beamline, estimated at $12 million, will come from DOE as part of the near-term plan to build out the remaining sectors at the APS. One possible location for this new building adjoins Building 438, where the imaging beamline 32-ID is positioned. This and other proposed locations for the XII building entail no known significant impacts to the site or surroundings. Together with the APS upgrade, the proposed XII and the long imaging beamline will position Argonne as a world leader in advanced x-ray imaging research and applications.

C.4.6 High-Magnetic-Field Beamline

An HMFB for x-ray research, extending outside the present limits of the APS facility, is part of the near-term plan to build out the remaining sectors at the APS. X-ray scattering in a high magnetic field will enable investigation of previously inaccessible parameters of magnetic materials, such as novel vortex states, metamagnetic structures, multipolar ordering in 4f and 5f compounds, fractional quantum Hall effects in two-dimensional electron gases, quantum phase transitions of electronic matter, and Bose-Einstein condensation. The plan is that, in collaboration with the National High-Magnetic-Field Laboratory, this beamline will combine the brilliant hard x-ray beam of the APS with a high magnetic field (30-40 tesla) to establish world-leading facilities for magnetism research.

The APS is the ideal location for an HMFB for the following reasons:

- The straight sections can easily be extended to 8.5 m for optimized insertion devices, further increasing the x-ray beam brilliance.
- The insertion devices operate with a 7-GeV electron beam, allowing continuous coverage of the entire spectral region.
- The APS beam has the outstanding stability necessary for long data acquisition times.
- Polarization control and switching are efficiently implemented at the APS.

- Novel focusing optics deliver a small beam spot to the sample.

Construction of the HMFB would require an extension to one of the buildings in the current APS facility. The beamline end station building would house the HMFB experimental station and the high-field magnet itself, as well as support facilities for beamline staff and users. The utilities for the HMFB would be extended from the APS facility, but operation of the high-field magnet would require considerable additional power. To achieve field strength in the range of 30-40 tesla, 10 MW of additional electrical power will be required. Chilled water and liquid helium will also be needed to operate the magnet. Funding for the beamline and construction of the building would come from DOE-SC. Possible locations for the building adjoin the laboratory-office modules (Buildings 431-438) of the APS complex. The building and beamline extension will have no significant impact to the Argonne site or surroundings. As part of the proposed APS facility upgrade, the HMFB will position Argonne as a world leader in magnetic materials research.

C.4.7 International Linear Collider

In the past century, physicists exploring on ever smaller scales have sought to catalog and understand the fundamental components of the universe, to explain the origin of mass, and to probe the theory of extra dimensions. In recent years, experiments and observations have suggested that we can account for only a surprising 5% of the universe. Physicists need more powerful accelerators to explore these fundamental issues. A proposed electron-positron collider, the ILC will complement the Large Hadron Collider (LHC), a proton-proton collider at the European Center for Nuclear Research (CERN) in Geneva, Switzerland, in unlocking some of the deepest mysteries in the universe. With LHC discoveries pointing the way, the ILC — truly a precision machine — will provide the missing pieces of the puzzle.

Consisting of two linear accelerators that face each other, the ILC will hurl some 10 billion electrons and their anti-particles, positrons, toward each other at nearly the speed of light. Superconducting accelerator cavities operating at temperatures near absolute zero will increase the particles' energy until they smash in a cross-fire at the center of the machine. The beams, approximately 35 km long, will collide 14,000 times every second at extremely high energies — 500 GeV. Each collision will create an array of new particles that will answer enduring fundamental questions. The current baseline design allows for an upgrade to a 50-km, 1-TeV machine during the second stage of the project.

Argonne is a member of the America's Regional Team that is working on developing the technology needed for this machine. Using existing expertise in superconducting radio frequency, control systems, positron sources, and damping rings, Argonne has already contributed significantly to R&D efforts for the ILC. These contributions will continue and expand in the future. We also expect to become involved in the significant nascent area of ILC detector development.

C.5 Financial Outlook

Detailed information regarding Argonne's financial outlook is subject to (1) competition and merit review for federal funds among other research institutions and DOE facilities, (2) the availability of appropriated funds, and (3) programmatic decisions.

C.5.1 DOE-Funded Work

For DOE-funded work, the results of competition and merit review and the availability of funds cannot be predicted or estimated in advance. DOE's programmatic decisions are developed in accordance with the planning targets reflected in programmatic five-year plans, companion documents to strategic laboratory business plans. In addition, the commitment of DOE-SC to competition and merit review often results in a time lag between programmatic decisions and the determination of which research provider can deliver the greatest value. Thus, the way programmatic decisions will unfold for particular laboratories is not always apparent. Likewise, the preferred facility setting is not always reliably apparent from the conceptual framework that establishes the need for a DOE project.

Nevertheless, some decisions, such as the plans for large scientific user facilities, show clear paths to individual laboratories and therefore inform the laboratories' business plans.

C.5.2 Non-DOE-Funded Work

Support for non-DOE-funded work is a vital role of the national laboratories that contributes to national security, energy security, environmental stewardship, scientific discovery, and — more fundamentally — to the competitiveness of the U.S. economy. For Argonne, this is no exception. Our non-DOE-funded work engages both the federal and private sectors and represents approximately 25% of our total budget.

Our major non-DOE federally funded activities are supported primarily by the Department of Homeland Security, focusing on infrastructure assurance; the National Institutes of Health, emphasizing but not limited to protein characterization; the Department of Defense, covering a broad range of specialized technical (and often classified) assistance, infrastructure assurance, environmental assessments, and nuclear-related issues; the Department of Agriculture, for hazardous waste assessments; the Department of State, in support of International Atomic Energy Agency; and the Nuclear Regulatory Commission, providing a technical basis for regulatory decisions. Each of these areas is expected to continue to grow. We also anticipate that the intelligence community will become a key sponsor over the next five years.

Our work for the private sector is varied and typically involves much smaller effort per project and shorter duration than work for the non-DOE federal sector. Typical current work for the private sector includes locomotive engine combustion studies for Electro-Motive Diesel, Inc., and extreme ultraviolet lithography support for Intel Corp.

C.6 Uncertainties and Risk Management

Over the next several years, Argonne will face a number of concerns driven by external forces. A primary concern is the stability of funding for new facilities required for core scientific programs. Argonne's future is directly coupled with federal support for a broad science and technology program.

Beyond the initial mission horizon that is keyed to DOE programmatic plans, Argonne anticipates continued expansion of research and outreach of its capabilities along the business lines identified in Section C.4, approaching an operating budget of $1 billion (in today's dollars) by FY 2018. Though linkage of this growth with the initiatives outlined for the initial planning period is subject to considerable uncertainty, present projections (Table C.1) retain a growth rate in keeping with the American Competitiveness Initiatives and the President's commitment to double the federal investment in the most critical basic research programs in the physical sciences over the next ten years. Consistent with DOE guidance, Argonne's planning for facilities and infrastructure supports these key multi-programmatic mission capabilities.

C.7 Mission Funding and Staffing Projections

Our ability to recruit and retain scientific staff and maintain relationships with external partners (universities, other laboratories, private industry) is vital to our ability to maintain core science and technology programs. Our workforce must perceive Argonne as a suitable employer with potential to support individual achievement. In addition, the workplace itself presents unique challenges and opportunities for success. The physical setting and conditions and the capabilities of the Laboratory's infrastructure are key determinants of Argonne's and DOE's ability to achieve their missions and realize their vision for scientific advancement in the 21st century.

C.8 Research-Program-Funded Infrastructure Projects

Argonne's projected facilities funding stream includes large initiatives requiring new facilities to provide the infrastructure supporting significant new areas of research that would be largely unattainable through reassignment or upgrading of existing operational facilities. Examples of these

TABLE C.1 Argonne Operations Funding Summary

	Funding in Fiscal Year ($ million BA)												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
DOE-SC Funding													
Basic Energy Sciences	146.7	163.8	172.1	188.0	199.3	211.2	223.9	237.3	251.6	266.7	282.7	299.6	317.6
Safeguards and Security	8.2	8.0	9.0	10.3	10.9	11.6	12.3	13.0	13.8	14.6	15.5	16.4	17.4
High Energy Physics	10.0	12.0	21.3	22.0	23.3	24.7	26.2	27.8	29.4	31.2	33.1	35.1	37.2
Nuclear Physics	19.5	22.6	24.2	27.8	29.5	31.2	33.1	35.1	37.2	39.4	41.8	44.3	47.0
Computational and Technology Research	13.7	29.8	41.5	44.0	46.6	49.4	52.4	55.5	58.9	62.4	66.2	70.1	74.3
Biological and Environmental Research	26.3	25.3	27.6	28.0	29.7	31.5	33.3	35.3	37.5	39.7	42.1	44.6	47.3
Fusion Energy	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Excess Facilities Disposition Program	0.8	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8
Workforce Development	1.3	1.2	1.7	1.7	1.8	1.9	2.0	2.1	2.3	2.4	2.6	2.7	2.9
Total DOE-SC Funding	**227.5**	**264.2**	**298.9**	**323.4**	**342.8**	**363.4**	**385.2**	**408.3**	**432.8**	**458.7**	**486.3**	**515.5**	**546.4**
Percent of Laboratory Total	*48.1*	*52.9*	*54.4*	*56.7*	*56.7*	*56.7*	*56.7*	*56.7*	*56.7*	*56.7*	*56.7*	*56.7*	*56.7*
Non-SC DOE Funding													
Nuclear Energy, Science, and Technology	19.7	26.7	55.0	55.0	58.3	61.8	65.5	69.4	73.6	78.0	82.7	87.7	92.9
Energy Efficiency and Renewable Energy	37.1	39.3	44.4	43.2	45.8	48.5	51.5	54.5	57.8	61.3	65.0	68.9	73.0
National Nuclear Security Administration	24.5	23.5	24.6	25.6	27.1	28.8	30.5	32.3	34.3	36.3	38.5	40.8	43.3
Other DOE Programs	55.2	50.6	38.0	37.2	39.4	41.8	44.3	47.0	49.8	52.8	55.9	59.3	62.8
Total Other DOE	**136.5**	**140.1**	**162.0**	**161.0**	**170.7**	**180.9**	**191.8**	**203.3**	**215.5**	**228.4**	**242.1**	**256.6**	**272.0**
Total DOE Funding	**364.0**	**404.3**	**460.9**	**484.4**	**513.5**	**544.3**	**576.9**	**611.5**	**648.2**	**687.1**	**728.4**	**772.1**	**818.4**
Percent of Laboratory Total	*77.0*	*80.9*	*83.9*	*85.0*	*85.0*	*85.0*	*85.0*	*85.0*	*85.0*	*85.0*	*85.0*	*85.0*	*85.0*
Work for Others Funding													
Department of Homeland Security	25.6	18.2	15.3	14.9	15.8	16.7	17.7	18.8	19.9	21.1	22.4	23.7	25.2
Department of Defense	19.7	17.4	18.6	18.4	19.5	20.7	21.9	23.2	24.6	26.1	27.7	29.3	31.1
Nuclear Regulatory Commission	11.4	7.3	6.6	6.7	7.1	7.5	8.0	8.5	9.0	9.5	10.1	10.7	11.3
Other Federal Agencies	23.9	20.8	21.1	20.2	21.4	22.7	24.1	25.5	27.0	28.7	30.4	32.2	34.1
Non-Federal Organizations	28.1	31.5	26.7	25.3	26.8	28.4	30.1	31.9	33.9	35.9	38.0	40.3	42.7
Total Work for Others Funding	**108.7**	**95.2**	**88.3**	**85.5**	**90.6**	**96.1**	**101.8**	**107.9**	**114.4**	**121.3**	**128.6**	**136.3**	**144.5**
Percent of Laboratory Total	*23.0*	*19.1*	*16.1*	*15.0*	*15.0*	*15.0*	*15.0*	*15.0*	*15.0*	*15.0*	*15.0*	*15.0*	*15.0*
Laboratory Total Funding	**472.7**	**499.5**	**549.2**	**569.9**	**604.1**	**640.3**	**678.8**	**719.5**	**762.7**	**808.4**	**856.9**	**908.3**	**962.8**
Laboratory Personnel (FTE)	***3,009***	***2,969***	***3,081***	***3,098***	***3,181***	***3,268***	***3,356***	***3,447***	***3,541***	***3,637***	***3,735***	***3,836***	***3,940***

initiatives include the APS complex, the CNM, the APCF, and the TCS Facility. These initiatives are discussed below. Significantly, the three initiatives pursued most recently rely on non-conventional funding sources. Figure C.2 indicates the locations of these initiatives.

C.8.1 Center for Nanoscale Materials

The CNM is a joint DOE-state of Illinois partnership located at the northwest sector of the APS. Prior facility use planning identified two research beamlines to be dedicated to nanoscale research; the CNM is co-located to take advantage of this technology. The CNM is a two-story structure similar to the APS in construction materials. It includes clean rooms, laboratories for chemical and physical measurements, computational laboratories, offices, and conference rooms. The total cost of the project, $72 million, is split equally between DOE and state funding. The $36 million conventional facility is provided by the Illinois Department of Commerce and Community Affairs. The balance of the $36 million Major Item of Equipment project for the primary instruments and beamline construction is funded by DOE. Facility construction began in FY 2004. Completion for the conventional non-laboratory portion of the facility occurred in FY 2006; occupancy and build-out of the clean rooms will follow.

The CNM is funded by the state of Illinois, and thus the construction does not apply to space banking requirements. The facility will be capitalized in the current fiscal year; its contributions to RPV and MII are included in this plan (Sections D.6, D.7, and D.10). Proximity to an existing wetland, the primary expressed concern for site impacts, has been identified and tracked throughout construction.

C.8.2 Theory and Computing Sciences Facility

The TCS Facility will provide a world-class research center supporting large-scale computation; high-end visualization; and the integration of computers, people, data, and instruments over high-speed networks. The facility, to be adjacent to Argonne's Northgate Road entrance from Cass Avenue, is programmed to occupy approximately 200,000 gross square feet and accommodate a minimum of 500 occupants. The design will incorporate offices and laboratories, areas for collaboration and advanced digital conferencing, supercomputer support, and ancillary facilities. Innovative financing mechanisms are being finalized to develop the facility for leasing by a third party, requiring a flexible approach to final space determination. DOE accepted the mission need for this facility (Critical Decision 1), and the necessary approvals for implementation of this design-build, third-party-financed project are in place.

The TCS Facility is being funded by state of Illinois revenue bonds and does not apply to space banking requirements. Sections D.6 and D.10 reference the projected occurrence of beneficial occupancy, but no impacts are associated with RPV and MII because of the lease. No impacts are identified through the process required under the National Environmental Policy Act. The location of the site is well coordinated with other related expansions of missions conceptualized for the 200 area, and the location beneficially supports a larger concept for renewal of the main area of the site around a revitalized entry and redevelopment corridor.

C.8.3 Advanced Protein Crystallization Facility

The APCF will be a state-of-the-art resource for identifying, crystallizing, and characterizing proteins. The facility will house the instruments and staff of the Midwest Center for Structural Genomics and will support the bioscience-related collaborative access teams at the APS. The APCF building will be funded by grants from the Illinois Department of Commerce and Economic Opportunity, totaling $33.5 million. Preconceptual design of the facility has begun, subsequent to receipt of the first grant in FY 2007. The Argonne Directorate has approved a site for the APCF in the 400 area, near and attached to an APS laboratory-office module, Building 435. As a result, the APCF will be near the laboratories and offices of the Structural Biology Center and its x-ray beamline at APS Sector 19. Beneficial occupancy is projected for FY 2011.

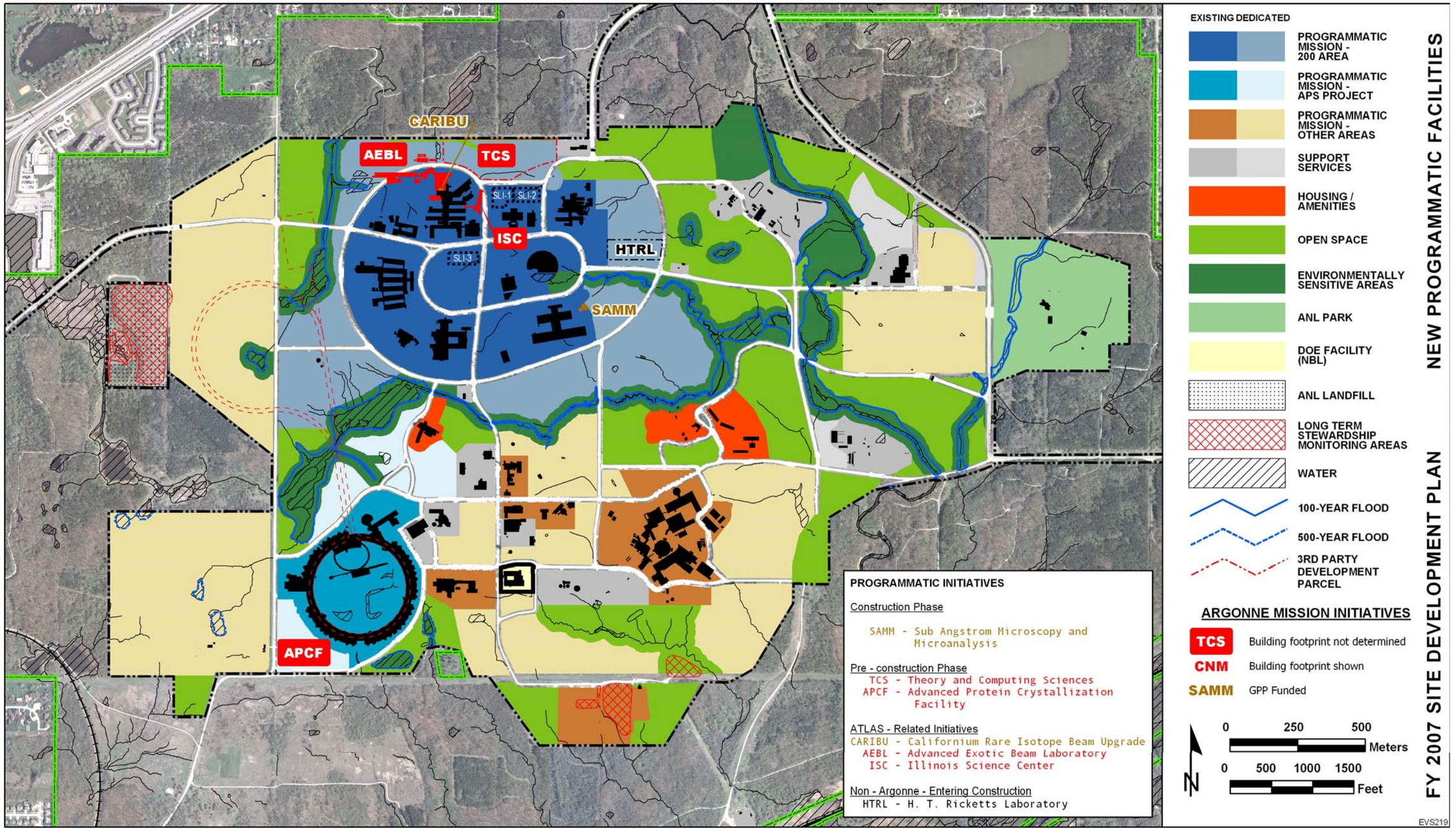

FIGURE C.2 Locations of Programmatic Facility Initiatives

The APCF will be funded by the state of Illinois, and thus the construction does not apply to space banking requirements. The facility is currently projected to be capitalized in FY 2011 at $33.5 million. Its contributions to RPV and MII are included in this plan (Sections D.6, D.7, and D.10). The proposed location entails no known significant impacts to the site or surroundings.

C.8.4 Advanced Exotic Beamline Laboratory

Argonne is one of several sites competing for a national mission to provide intense, high-quality beams of short-lived nuclear species for basic research in nuclear physics. The AEBL is a logical outgrowth of the investments in and evolution of the accelerator capabilities at ATLAS. The Argonne site master planning currently retains the facility's location in the northwest quadrant of the 200 area, northwest of Building 203 and north of Buildings 208 and 206. Building components of this complex would most likely include an accelerator operations building, a driver linac, cryogenic facilities, a high-energy experimental area, a production target area, a low-energy experimental area, and a new experimental area dedicated to nuclear astrophysics.

Embarking on the AEBL research agenda depends on funding from the state of Illinois, and thus the construction does not apply to space banking requirements. Its contributions to RPV and MII are included in this plan (Sections D.6, D.7, and D.10). The proposed location involves no known significant impacts to the site or surroundings. Validation of this location or reassessment of the siting decision will involve evaluation of location criteria and any associated impacts that might emerge from a more detailed understanding and design response to the operational building program, when it enters the design phase.

C.8.5 Illinois Science Center

The Illinois Science Center function was initially proposed as the first portion of the Rare Isotope Accelerator complex master plan to be built following a favorable mission determination. The design concept has a continuing role and will remain valid in a new mission start-up for the large-scale expansion of the ATLAS complex, as envisioned in the AEBL project, as well as in subsequently accommodating and serving outside users and researchers and related educational programs during beam operations. The atrium building design currently contains approximately 71,500 gross square feet, including offices, laboratories, conference rooms, classrooms, an auditorium, and associated ancillary support spaces. The construction of the building was proposed for a $15 million state of Illinois grant, covering hard construction costs out to five feet from the building boundary. Costs for site utilities, paving and landscaping, parking, and work within existing connected buildings is to be funded from other sources. This project has proceeded through final design under state funding, and its location in relationship to the ATLAS complex, the TCS Facility and the hub of the 200 area suggest the viability of the design in support of the next-generation accelerator capability that is being actively pursued as a key Laboratory mission area.

C.9 Infrastructure Projects Funded as General Plant Projects

In past years, small-scale new Argonne capabilities associated with program funding could be achieved by the limited means of using GPP funding to establish the conventional portion of the programmatic construction and relying on program funding for the technical equipment and possibly final build-out.

These GPP-based initiatives result in upgrades that are already integrated into the development fabric of the site. They involve little aggregate change in development intensity, energy requirements, etc., particularly in view of their significant contributions to mission capabilities, which would be impossible without the growth increments. Starting FY 2009, the directly funded GPP program will be eliminated as part of the DOE-SC modernization initiative. The GPP program will be replaced by the internally funded IGPP program, which will provide for the same needs as the GPP program.

D Facilities and Infrastructure

The Argonne FY 2007 *Ten-Year Site Plan* is a single comprehensive plan addressing the ways Argonne's real property assets will support the DOE strategic plan, the Secretary of Energy's five-year planning guidance, and DOE-SC annual program direction and guidance. This *Plan* provides a road map for sustaining excellence in operation, maintenance, and renewal and for modernization of the Laboratory's facility and infrastructure portfolio to accomplish its mission.

D.1 Vision, Goals, and Strategy

Argonne's vision is to reconfigure its facilities and infrastructure to capitalize on its national core competencies and achieve mission outcomes commensurate with its primary business lines: materials science, mathematics and computer sciences, advanced biosciences, fundamental physics, and energy and environmental science and technology. Argonne also has two rapidly emerging secondary business lines: accelerator design and national security. The needed expansions and adjustments to physical infrastructure will address long-term operational costs and return on investment; will sustain excellence in the operation, maintenance, and revitalization of Argonne's facilities; and will support infrastructure required to achieve national energy and research goals.

D.1.1 Vision

Argonne will retool its physical setting to achieve a 21st century infrastructure having appropriately configured mission-responsive research facilities that provide reliable, safe, efficient, attractive working environments suitable for world-class science, engineering, and technical services.

D.1.2 Strategic Goals

The following three major goals of this *Ten-Year Site Plan* support Argonne's vision:

- *Goal 1. Maintain Excellence in Environment, Safety, Security, and Health*

Argonne is fully committed to maintaining continued excellence in environment, safety, security, and health performance, both in existing operations and in the design, siting, construction, and operation of future facilities. This commitment includes compliance with applicable state and county regulations when they are not in conflict with DOE's policies and standards. Argonne actively complies with federal regulations in conducting project design, review, and construction, as well as in ongoing scientific and facilities operations. Complying with environment, safety, security, and health standards and increasing operational safety, security, and reliability are goals in rehabilitating and upgrading existing facilities. Argonne is committed to providing a safe, secure environment for all of its employees, visitors, and neighbors. In addition, facilities, equipment, and information must be protected from theft, disruption, or misuse.

- *Goal 2. Improve Cost-Effectiveness in Use of Existing Facilities and Systems*

Argonne will continue to manage existing facilities and infrastructure to maximize the efficiency of mission research and to support effort at the lowest effective facilities cost. Facilities that cannot be maintained cost-effectively to meet functional needs will be replaced to reduce overall maintenance and operating costs and to decrease liability in the areas of environment, safety, and health. Research and support space will be maintained to meet all functional, safety, and security requirements. As research requirements change, facilities and systems will be refurbished or upgraded, modernized accordingly, or assigned a new functional use. New missions will be accommodated by adapting or upgrading existing general purpose facilities to meet mission needs, wherever feasible.

- *Goal 3. Maintain and Enhance a World-Class Setting*

  World-class research is enhanced by world-class work settings, both within the actual workplace itself and in the natural surroundings of the facilities in a campus setting. New facilities will be located in a way that creates interconnected, integrated neighborhoods and enhances the collaborative environment for the scientific community. Modern, flexibly appointed research and support facilities will benefit from the latest construction technologies consistent with their research missions, as well as from flexibility, versatility, and longevity in design. Rehabilitation and construction will incorporate state-of-the-art sustainable-design principles regarding selection of building materials and furnishings, construction techniques, energy and water conservation, and habitability features, to the extent that such practices are economically feasible.

  Natural areas will be maintained as a buffer and to provide expansion space. Standards for building intensity, coverage, and open space — comparable to existing conditions — will apply to all areas of the site. The existing site enhancement program will move forward in concert with the development standards.

D.1.3 Planning Assumptions

Achievement of Argonne's infrastructure goals depends on the following operational and mission-related assumptions for the ten-year planning horizon:

1. Overall site population is assumed to grow to previous (FY 1994–FY 1996) levels consistent with the expansion and realization of mission initiatives identified in the core areas of competence. Collaborating researchers from outside organizations will increase in numbers as the use of Argonne user facilities increases.

2. Research will continue to be diversified, in keeping with the role of a multiprogram laboratory. The types of research programs conducted at Argonne will continue to match the projected Laboratory missions for the planning period.

3. The way fundamental research activities are carried out at Argonne is changing. Integration between experiments and simulations will increase, as will collaboration by remote access.

4. Major new scientific programs are expected to fund the construction of facilities needed to support their research missions, either through conventional or innovative funding arrangements.

5. Infrastructure changes in existing facilities required to meet changing research needs will be accommodated by the laboratory space rehabilitation, upgrades, and replacements set forth in this plan; via selective use of IGPP funding for small-scale initiatives; and through use of line-item funding in keeping with DOE guidance.

6. Major new programmatic facilities are expected to fund all increases in capacity and demand required of the existing infrastructure. However, the existing infrastructure must deliver a fully functional interface point that minimizes the cost of construction.

7. All facilities, except those currently slated for demolition (as recorded in FIMS), are needed to support mission research activities.

8. All construction and refurbishment will incorporate state-of-the-art sustainable design principles (e.g., regarding selection of building materials and furnishings, construction techniques, energy and water conservation, habitability features), to the extent that such practices are economically feasible.

9. Research will be accommodated, to the extent practical, on the Argonne property, minimizing the need for off-site leased space.

10. The configuration of refurbished or new laboratory space will meet the standards and needs of 21st century research, providing space that allows co-location of research, increased communications capability, higher-capacity utility services, and improved temperature and humidity controls. Modern laboratory needs such as fume hoods,

laboratory benches, and high bay capability will be provided for multipurpose use.

11. The use of third-party financing partnerships for the development of new facilities will continue to be a priority, such as for the TCS Facility and the APCF.

12. The Laboratory will continue to be a good neighbor to surrounding community stakeholders and will minimize the impact of construction and operations. Environmental compliance, with involvement of all stakeholders, will remain a priority. DuPage County's planned unit development standards that are applicable to office or research areas and light industrial areas will be a basis for future development.

D.1.4 Planning Strategy and Objectives

A growing concern is the ongoing deterioration, despite adequate maintenance, of facilities and infrastructure due to aging, plus the resulting effect on reliability, operational effectiveness, and ability to fully accommodate functional needs. In recent years, the focus has been on the long-range goal of defining changes in baseline capabilities necessary to achieve modernization of facilities that have infrastructure technology several decades old. The focus on this aspect of scientific mission needs is necessary to accommodate new mission capabilities and to support the collaborative, data- and communications-intensive, flexible patterns of conducting interdisciplinary research that are now characteristic of most cutting-edge approaches.

In keeping with its vision and goals, the Laboratory's strategic approach to management of facilities and infrastructure involves multiple implementation paths. Argonne's ability to conduct and extend its current and emerging missions depends on its ability to add selectively to the inventory of facilities in the most essential areas where existing facilities are either completely dedicated to the pursuit of existing missions or they are fundamentally at a disadvantage in attaining key capabilities necessary to achieve the missions. The disadvantages might be due to either (1) changes in technology, such as the requisite conditions for nanoscience, clean rooms, and electron microscopy and microanalysis research or (2) obsolescing facility systems incapable of providing adequate support effectively and efficiently. Realization of the new capabilities will extend the Laboratory's scientific reach in support of its missions, but the new capabilities will not replace our focus on the effective and efficient use of the existing infrastructure.

More detail is provided throughout this chapter on key aspects of the Argonne strategy. In implementing this strategy, the Laboratory expects to achieve targeted benefits including reductions of (1) approximately 30% in gross square footage with more efficient replacement facilities, (2) 15-30% in operating and maintenance costs, and (3) 25-35% in building energy use. Chapter B includes a description of current baseline conditions.

Argonne's priority is to assure adequate maintenance and improve the condition of existing facilities. In doing so, Argonne's *first facilities objective* is the continued achievement of the DOE-SC goal of an MII of 2% of RPV (Section D.1.4.1). The *second facilities objective* is to attain ACI goals. The ACI measures the status of deferred maintenance (DM) levels of 0.98, 0.95, and 0.85 for Mission Critical, Mission Dependent, and Not Mission Dependent facilities, respectively (Section D.1.4.2).

Another priority is to assure effective revitalization and mission growth, through the addition of key infrastructure assets and the removal of obsolete ones. Doing so will improve a third measure of Argonne's effectiveness — the summary condition index (SCI). The RICI (Section D.1.4.3) is a measure of the degree of facility revitalization, improvement, or modernization required throughout the existing facility base. The SCI, which combines RICI with ACI to portray overall infrastructure modernization, performance, and capability more completely than either index alone, has been Argonne's preferred single measure of facilities.

Argonne's *third facilities objective* is to reduce the current level of overall condition (SCI = 0.20, "minor rehabilitation required") to "adequate" (SCI < 0.10).

A final performance measure, the AUI (Section D.1.4.4) demonstrates the high level of use of Argonne facilities. Argonne's *fourth facilities objective* is to improve its current overall AUI rating of 96.53% ("good") to near 100% ("excellent").

In addition to the quantifiable objectives stated above, we strive to dispose of nuclear materials and waste and complete the remediation of contaminated space within active facilities, thus closing and removing inactive facilities. Most of the funding for this effort is expected to come from a DOE-EM-type program.

D.1.4.1 Maintenance Investment Index

The MII is the DOE measure of funding performance with regard to resources provided by Laboratory operations for maintenance expenditures. Argonne has consistently met required performance goals for MII and is committed to continued investment of internally generated maintenance funding at 2% (or more) of RPV.

D.1.4.2 Asset Condition Index

The ACI is the primary DOE performance measure of facilities conditions. The performance target for DOE-SC sites is to achieve an ACI value of 0.98, 0.95 and 0.85 for Mission Critical, Mission Dependent, and Not Mission Dependent facilities, respectively. The ACI is based on the ratio of DM costs to RPV. A related measure, the facility condition index (FCI), is the direct ratio DM/RPV. The ACI measure is the complement to FCI (1 – DM/RPV); the ideal score is expressed as a "perfect" ratio of 100%. Argonne's overall ACI as currently recorded in FIMS is 0.96, or "good."

A more detailed treatment of this subject is in Section D.8. Projections of ACI indicate that with the projected funding commitment, the Laboratory will attain an overall ACI of ≥ 0.98. An exclusive focus on reduction of residual DM, often of significantly lower priority in the DOE Capital Asset Management Process (CAMP) than competing needs for mission-related improvements, carries the risk of preempting some potentially available funding from alternative uses. For facilities that are candidates for replacement or modernization under the modernization initiative over the planning horizon, the deferred maintenance reduction (DMR) investment will be made on the basis of risk priority.

D.1.4.3 Rehabilitation and Improvement Condition Index

Use of RICI provides a standardized measure of the level of reinvestment for recapitalization of building systems and assemblies that have or will exceed their normal operating life expectancies, for improvements, and for substantial modernization necessary to achieve operating characteristics and capabilities unattainable in the present facilities configuration. These needs are identified through the CAS process, as described in Section D.2 and as documented throughout the facility and infrastructure profiles in Sections E2 and E3.

All identified facility needs are classified as capital or maintenance related, then further classified regarding their severity (by using the CAMP prioritization process) and their required timing for implementation (year needed). All such needs (i.e., observed and predicted deficiencies related to the condition of existing facilities) are therefore either current needs or are estimated to be required in a specific future year, and they are either maintenance or capital related. Deferred maintenance (Section D.8) is the portion of these needs that were maintenance related and remained unmet at the close of the fiscal year. All other identified deficiencies are included in the estimates of RICI. As described in Chapter B, Table B.1, sitewide DM totals $63.4 million, and rehabilitation and improvement costs (unescalated) total $267.8 million. Overall, the RICI for Argonne is 16.6%, a change of +0.3% from the comparable statistic in the FY 2006 *Ten-Year Site Plan.*

D.1.4.4 Asset Utilization Index

The AUI is DOE's corporate performance measure for the use of facilities and land holdings. The AUI reflects the outcome from real property acquisition and disposal policy, planning, and resource decisions. As reported in FIMS, Argonne is rated "good," at AUI = 96.5%.

The DOE-SC goal is to achieve a ratio of 1:1 for utilization-justified assets and thus meet or exceed DOE-OECM guidelines (Table D.1), which are based in part on use-specific ranges of utilization established by the Federal Real Property Council (FRPC). The index is the ratio of the area of all utilization-justified space in operating facilities or land holdings (numerator) to all operational and excess facilities or land holdings without a disposition baseline or funding (denominator). Ratings are assigned to AUI range measures. The AUI decreases as the excess and underutilized facilities at a site increase; it increases as excess facilities are eliminated and when consolidation increases the utilization rate of remaining facilities. As implemented in FIMS, the index captures only assets classified as buildings. This classification includes the vast majority of Laboratory-occupied space, though not all.

The current sitewide AUI measure reflects, to a large degree, the need for disposal of two surplus facilities (Building 301 and Building 330; see Section D.4), funding for which has been largely external to direct Argonne control. Disposal of these two facilities would change Argonne's AUI from the current value of 0.9653 to nearly 1.000.

Table D.1 Asset Utilization Index by FRPC Category

Measure	AUI	Guidelines (%) FRPC	Guidelines (%) OECM	No. of Bldgs.	Operating Space (1,000 GSF)
Office	98.52	70-95	95	8	489.2
Laboratory	97.43	60-85	90	44[a]	3,289.3
Warehouse	94.02	50-85	89	14	209.3
Housing	100.00	85-100	99	9	170.9
All Other	88.98	NA	NA	23	413.3
Sitewide	96.53			98[a]	4,572.0

[a] Buildings 331 and 331A are counted as one FIMS building entry.

D.1.5 Road Map of Activities and Resources

This section describes the activities and the resource projections identified for the sustainment, revitalization, and modernization of the facilities and infrastructure required to support Laboratory and DOE missions. Replacing facilities that cannot meet functional needs cost-effectively and maintaining and upgrading only sound but depreciated facilities is central to Argonne's operating strategy for existing general purpose facilities. Disposal of surplus facilities, continued environmental stewardship, and construction of new state-of-the-art programmatic research facilities complete the salient physical features of this road map. To this end, this *Ten-Year Site Plan* describes planned infrastructure changes in the following three key areas:

- Addressing the needs of existing facilities
- Management of the site
- Achieving scientific capabilities and initiatives through the addition of new facilities

Implementation of the activities described below to address these three areas will achieve a balanced approach to the sustainment, revitalization, and modernization of the Laboratory's assets.

D.1.5.1 Activities

Addressing the Needs of Existing Facilities. Argonne's plan focuses on (1) maintaining facilities that are safe, secure, and efficient; (2) upgrading facilities (when cost-effective on the basis of life cycle) or otherwise replacing them; and (3) improving utilities and transportation networks.

Upgrading and modernization of selected older multiprogram laboratory-office buildings in the 200 and 300 areas, along with replacement of ineffective buildings with state-of-the-art buildings, is the main focus.

The modernization of the existing buildings involves rehabilitation and upgrading of existing laboratory-office space to accommodate state-of-the-art research requirements and rectifying adverse functional, operational, environmental, safety, and security conditions. Activities and organizations will be co-located as needed, and facilities will be made readily adaptable to changing research requirements and technologies. This modernization will include reconfiguration of laboratory, office, and support space within buildings; enhancement of the functionality and appearance of the work environment;

incorporation of energy-efficient and sustainable design features; reconfiguration, rehabilitation and/or replacement of mechanical, electrical and control systems; and proper segregation of liquid waste streams to laboratory, sanitary, and storm sewers.

Replacement facilities will provide an effective, agile, and state-of-the-art research laboratory-office space that can be modified when scientific technology and missions change. The facilities will incorporate flexible design that is adaptable to changing needs; improves efficiency of work flow and space utilization; increases synergy through co-location of multiple programs; provides spaces for collaboration; and fosters productive informal interactions. The facility designs will be based on standardized use of materials and equipment. Designs will be sustainable and will incorporate energy-efficient systems to minimize operating and maintenance costs.

Facilities that are not candidates for replacement or "thorough modernization" will require selected rehabilitation and upgrading of roofs, electrical power and lighting systems, mechanical systems and controls, data communication systems, space partitioning, laboratory furnishings, architectural features, and other systems.

Management of the Site. The Argonne site can physically accommodate a significantly higher level of development. Land use planning is described in Section E1. Environmentally sensitive and interconnecting open-space areas that support the natural ecology and hydrologic drainage of the site are being retained in their natural condition. The density of planned development on the balance of the site — in terms of covered area, floor area ratio, and landscaping standards — will remain consistent with the character of areas already developed.

Site utilities and other support infrastructure will be upgraded to accommodate future expansion and improve reliability and cost-effectiveness. The utilities will be sized appropriately and reconfigured to improve their efficiency and environmental performance. The general site circulation infrastructure (roads, walks, lighting, parking, perimeter controls, entrances, inspection facilities, traffic safety systems) and site utility systems will be rehabilitated to achieve reliability and extend service life. The transportation infrastructure will be revamped to provide safe pathways for pedestrian traffic.

Environmental monitoring and surveillance, including stewardship actions, are essential parts of the modernization plan. Included are surveillance and maintenance responsibilities that revert to the landlord upon completion of remediation funded by DOE-EM. Several of these remediation activities have arrested immediate health and environmental concerns; however, continued surveillance and maintenance of the remediated areas are required in accordance with the Laboratory's Resource Conservation and Recovery Act (RCRA) Part B Permit (issued by the Illinois Environmental Protection Agency).

In addition, to reduce its environmental, safety, and health liability and to reduce operating costs, the Laboratory plans to continue with the off-site disposal of radioactive material and waste, decontamination of partially contaminated facilities for reuse, and decontamination and disposition of contaminated facilities that have already been excessed or will be excessed in the near future (Sections D.4 and D.5).

Achieving Scientific Capabilities and Initiatives through the Addition of New Facilities. Argonne's projected funding stream includes large initiatives requiring new facilities to provide infrastructure support for significant areas of new research that would be largely unattainable through reassignment or upgrading of existing operational facilities. The new facilities will be funded through the use of either programmatic funding or third-party financing. Examples of such initiatives are the APS complex, the CNM, the APCF, and the TCS Facility. These initiatives are described further in Chapter C.

New Argonne capabilities that can be achieved through upgrades to existing facilities or infrastructure will be achieved by the use of GPP-type or line-item funding to establish the conventional portion of the programmatic construction. This is the pattern the Laboratory is using for the expansion of the ATLAS beamline, electron microscopy improvements (the SAMM Facility), and construction of the final laboratory-office module near the APS storage ring (Building 437).

D.1.5.2 Resources

The resources needed to achieve Argonne's visions and goals over the ten-year planning horizon (FY 2009–FY 2018) will support the activities described in Section D.1.5.1. These resources, which will maintain/sustain, revitalize, and modernize Argonne's facilities and infrastructure, are consistent with DOE-SC guidance. The activities include routine maintenance (regularly scheduled periodic maintenance) and major repairs or replacement of components over the expected service life of the buildings. Improvements, revitalization, and modernization involve alterations, additions, and upgrades or replacement of facilities or system capabilities.

The basis for defining needed resources begins with the annual recurring maintenance requirement. In addition, some known deficiencies are associated with existing facility conditions, as documented through the CAS process and reported in FIMS under the rehabilitation and improvement cost (RIC), DM, and total rehabilitation and improvement cost (TRIC). These needs are part of both maintenance-sustainment and recapitalization-modernization. Beyond the known deficiencies, we must also provide for growth in deficiencies that are not identified under the current CAS inspections but will result from either degradation or age-related decline in performance beyond currently projected life cycle needs.

Modernization needs are also projected to add to total facility needs. These include increased emphasis on future issues such as flexibility and adaptability of general research space. Another component of existing needs is for cleanup of excess facilities. Such remediation activities will return contaminated space to future service or remove unneeded facilities from the inventory.

Table D.2 illustrates the Laboratory's facility funding needs of $927.3 million over the planning period, along with the proposed funding to meet these needs.

Acquisition costs for facilities expected to be funded by programs or through third-party financing are not included in this discussion. Also not included are the large-scale decontamination and decommissioning (D&D) and demolition of major facilities, disposal of radioactive materials and waste, and long-term stewardship costs needed from DOE-EM-type programs. An order-of-magnitude estimate of D&D costs is approximately $400 million.

Maintenance and Sustainment. The site maintenance needs and the approach to reduction of DM are addressed further in Sections D.7 and D.8.

Recapitalization and Modernization. The plans to address these needs are described in more detail in Section D.9.

TABLE D.2 Proposed Laboratory Funding to Meet Required Needs, by Source ($ million)

	Laboratory Operating Funds					Direct DOE Funding[a]		
Category	Routine Maintenance	Major Repairs	IGPP	DMR	Total Argonne	SLI Line Item	Total DOE	Total Argonne and DOE
Maintenance/ Sustainment	343.9	35.0	43.7	41.8	464.4	59.5	59.5	523.9
Recapitalization and Modernization	-	-	43.6	-	43.6	359.8	359.8	403.4
Total	343.9	35.0	87.3	41.8	508.0	419.3	419.3	927.3

[a] Figures exclude FY 2007 line-item funding for Building Electric Service Upgrade, Phase II, and funding required from a DOE-EM-type program for long-term stewardship and large-scale D&D projects.

Decontamination and Demolition of Facilities and Disposal of Waste. The plans to address these needs are discussed in Section D.4.

D.1.6 Key Facility and Infrastructure Issues

A critical factor for the successful implementation of Argonne's *Ten-Year Site Plan* is the timeliness and availability of funding. The presentation of issues below is meant to underscore the elements necessary for a successful outcome of the objectives laid out in this *Plan*. The second, third, and fourth facility and infrastructure issues require cross-program discussion and resolution. They are presented here to ensure that Argonne's key facility concerns are considered in their entirety and relative priorities.

1. In keeping with DOE-SC guidance, Argonne has developed a sound, structured modernization plan to meet the targeted goals of providing a productive, safe, secure, and environmentally sound physical setting to support its mission efficiently and effectively. The needs in the modernization plan were prioritized jointly by the Laboratory and the DOE Argonne Site Office. The funding profile for the SLI program was established in consultation with DOE-SC. The timing and sequencing of the modernization plan have been carefully developed to optimize the benefit to the Laboratory and leverage the limited resources available for execution. Faced with aging facilities and ever-increasing needs for fully functional modernized facilities, timely funding of this modernization initiative is a major concern for the successful implementation of the modernization plan.

2. A funding commitment for complete disposal and remediation of Building 330, the former CP-5 Reactor, is nearing resolution. A similar commitment for DOE-EM-program-type funding will be needed for the D&D and demolition of several substandard existing facilities that will become excess as the SLI modernization program is implemented. Current plans call for two candidate projects for DOE-EM-program-type funding, with total estimated cost (TEC) of $39 million and $36.5 million, planned to begin in FY 2016 and FY 2021, respectively. Identification of the source program for funding these projects will facilitate timely planning from the outset, so that the Laboratory does not carry unnecessary surveillance and maintenance costs or environmental, safety, and health liabilities for an indefinite period.

3. An internal assessment and evaluation of Argonne missions and capabilities has articulated a preferred direction for the nuclear facilities at Argonne. Ultimately, the goal is to consolidate the nuclear facilities and reduce the inventory of radiological materials, preserving the capability to perform mission-important experiments and to receive, store, disposition, and transfer nuclear materials. Nuclear facilities and activities will be sustained at a level needed to support the expected research in nuclear energy and security for DOE-SC; the DOE Office of Nuclear Energy, Science, and Technology; the DOE Office of Civilian Radioactive Waste Management; the National Nuclear Security Administration; and other government and national security agencies.

To meet these needs, Argonne envisions continuing research and experimental work in the Building 205 G- and K-Wing nuclear facilities.

Argonne will disposition materials off-site where possible. Materials that cannot be dispositioned and have no forward path for programmatic needs will be consolidated into a single storage and handling facility, the Building 200 MA/MB-Wing, which is planned to remain as a Hazard Category 2 nuclear facility.

The Radioactive Waste Storage Facility (RWSF) in Building 331, Building 315 Vault 40, the Alpha-Gamma Hot Cell Facility (AGHCF) in Building 212, and Building 306 will be downgraded to nuclear facilities at levels less than Hazard Category 3. Building 306 will remain as the primary waste-handling facility. The AGHCF and RWSF will be positioned for D&D.

To achieve this posture, sufficient funding will need to be made available. Projected end dates for transshipment currently lie beyond the time horizon of this *Plan*, primarily because of

funding uncertainties for the removal of the materials. This situation necessitates the provision of upgrades and other means of revitalizing the existing facilities, either to meet their redefined missions or to move in the direction of D&D. The schedule is currently outside the direct influence of the Laboratory because of funding constraints.

In the cases of the AGHCF, RWSF, and Building 315 Vault 40, the Laboratory will avoid continued operational and maintenance expenditures of undetermined (at this time) overall magnitude, to free these resources for other mission-related science activities and infrastructure support. Argonne therefore requests that a means be found to accelerate the transfer of radiological materials and waste now requiring processing and storage at Argonne, so that closure of past nuclear missions and their residuals can facilitate decommission and the beginning of the physical decontamination and disposal of the AGHCF in the 7- to 10-year planning horizon.

4. A less overarching area of infrastructure coordination pertains to the NBL, which is housed in Building 350 on the Argonne site. In February 2007, the ownership of the NBL facility was transferred from DOE-SSA to DOE-SC. With this transfer of ownership, the funding responsibility for the recapitalization and modernization of this facility (requiring GPP or line-item funding) needs to be clarified. Resources for such needs are not included in this *Plan*.

D.1.7 Role of Leasing to Meet Facility Needs

Argonne leases one significant nearby office facility, Building 900, approximately 1.5 miles from the site. This facility accommodates approximately 250-300 personnel, depending on the time of the year, and includes 78,250 gross square feet (GSF) (ingrant) at an annual base lease cost of approximately $750,450. Planned construction of the TCS Facility in the northern part of the 200 area is anticipated to free appropriately consolidated space to facilitate return of the Building 900 personnel to the site when construction is complete, currently projected for FY 2009. This schedule required an extension of the current lease, which would have expired in July 2007.

Five other minor leaseholds, totaling 25,098 GSF, support activities at scattered locations outside Illinois, the most significant being 14,735 GSF for the Washington, D.C., liaison office. Leased space is summarized in Table D.3.

TABLE D.3 Argonne Leased Facilities

Property Name	Area[a]	OCC[b]	Use	Leasing Plan
Catellus Development (Building 900) (ingrant)	78,250	258	Office	Relocation[c]
G.S. Investments LLC (Nebraska)	4,200	-	Storage	Continuing
Berndt and Sylvia Kornm (Germany)	947	2	Housing	Continuing
Potomac Creek (Washington, D.C.)	14,735	45	Office	Continuing
GDA Real Estate (Colorado)	2,466	7	Office	Continuing
Hallbeck Homes	2,750	9	Office	Continuing

[a] Area in gross square feet.

[b] Occupants.

[c] Occupants to be relocated on-site after construction of the Theory and Computing Sciences Facility.

At the conclusion of occupancy of Building 900, Argonne does not foresee the continued use of leased commercial office facilities near the campus, except possibly under a unique third-party partnership, such as the establishment of the TCS Facility being developed with the financial support of state of Illinois bonding authority and a third-party trust-developer joint venture. Temporary staff accommodations to facilitate build-outs or conversions, or to stage staffing increases for major programmatic growth, may be considered as a secondary consequence of the prioritization of infrastructure funding for maintenance-related investments necessitated by DOE guidelines and performance requirements. Such situations are neither expected nor desired in the framework of this *Plan*, but they cannot be ruled out.

D.1.8 Cross-Program Issues Needing Resolution in the Upcoming Year

Most of the key issues identified in Section D.1.6 that affect the strategic direction of the site are cross-program issues involving DOE-SC and other DOE offices. Issues 2 and 3 in Section D.1.6 specify corresponding needs for cross-program coordination and resolution.

D.2 Process for Identifying Needs and Developing Plans to Meet Vision, Goals, and Strategies

Argonne has a rigorous process for the identification of facility and infrastructure needs and the development of plans to meet the Laboratory's vision, goals, and strategies. The development process was built on relationships established for development of Argonne's *Business Plan* and the environment, safety, health, and infrastructure (ESH&I) prioritization and planning process. Mission needs identified through close programmatic collaboration with DOE Headquarters organizations and documented in the annual *Business Plan* form the basis and core assumptions for all of these efforts.

The Laboratory focus and vision, as described in the *Business Plan*, provide a strategic forward view from Argonne's programmatic managers. The programmatic missions and *Business Plan* form the basis for identification of the types of facilities that are required to provide a preferred working environment for the pursuit of programs.

The inventory of existing facilities undergoes ongoing evaluation to consider facility condition and utilization factors and ensure that the facilities provide the right size and quality of space and are adaptable to changing requirements and technologies. Each year, Argonne contracts with one or more outside firms to perform CAS inspections of its facilities, plant equipment, and site systems and utilities. The entire plant is surveyed objectively to measurable standards on a five-year cycle. The surveys use a life-cycle approach to produce detailed reports for each building, facility, or plant system. The condition and utilization factors, in turn, allow identification of facility rehabilitation and upgrade needs or construction of new facilities to meet the program needs. The quality and location of facilities are evaluated to ensure optimal configuration and condition to support programs, while providing a cost-effective, safe, healthy, and secure working environment.

Programmatic input is integrated into facilities and infrastructure planning through the ESH&I prioritization and planning process. The activities and resources needed to meet the targets established for the planning horizon and accomplish the facilities and infrastructure strategic goals are evaluated and categorized by the types of facilities and activities they affect (site area, existing facilities, new facilities, and maintenance and operations activities), the means of implementation (direct funding, indirect funding, third-party financing, etc.), and the time line required for accomplishment.

Projects included in the *Ten-Year Site Plan* are ranked and selected for appropriateness in several integrated processes. Most of the needs are evaluated on the basis of established CAMP criteria and the ESH&I risk assessment. The scheduling reflects a broad consensus of operational and programmatic management and an integration of what is required to achieve the vision and initiatives identified by senior Laboratory management with regard to missions and infrastructure capabilities

Argonne's management has approved this *Ten-Year Site Plan* to accomplish needed infrastructure investments in support of its research missions and scientific initiatives. This process has been coordinated closely with the DOE Argonne Site Office, whose staff has participated in the discussions and has provided input and feedback at the major junctures of the *Plan's* development.

D.3 Land Use Plans

Consistent with DOE-SC guidance, Argonne has combined the submittal of the land use and site development plans with its annual *Ten-Year Site Plan* update. This process was initially established in conjunction with the submittal of strategic facility plans (FY 2000, FY 2002), and it has gained additional formality under the published requirements for the *Ten-Year Site Plan* and its submittal in 2004, 2005, and 2006, per process

requirements contained in DOE Order 430.1B, Real Property Asset Management. Section E1 contains the most recent revision to the site development planning process and includes the FY 2007 land use plan. Approval of this *Ten-Year Site Plan* is intended to include concurrent approval of the land use plan and associated site planning information contained in Section E1, as well as descriptions of the site's development guidelines, existing and projected uses, and profiles of current conditions throughout the sub-areas of the site and various distributed infrastructure systems (described in Sections E2 and E3).

D.3.1 Latest Approved Plan

Pending review and approval of the site development and land use plan in Section E1, the most recent plan submitted for approval is in Chapter 3 of the FY 2006 *Ten-Year Site Plan*, submitted to DOE in June 2006.

D.3.2 FY 2007 Site Development and Land Use Plan

The FY 2007 site development and land use plan (see Section E1) is transmitted herewith for DOE review and approval for annual revision as required under DOE Order 430.1B, Real Property Asset Management. Pursuant to DOE Policy P430.1, Land and Facility Use Planning, there are no known impediments to the coordination and consistency of the Argonne FY 2007 *Ten-Year Site Plan* and the land use plan contained in Section E1. Existing physical, site, and regional location factors present no constraints to planned accommodations. Envisioned Laboratory growth would not encroach on neighboring areas, because the site is separated from them by the greenbelt forest. The exceptional road connections to major expressways and the local arterial network can accommodate the increased traffic that will accompany such growth.

In terms of land requirements, land suitable for development is not in short supply. Undeveloped areas available for functional uses equal the areas presently used. The capacity of areas dedicated for development should be sufficient to significantly increase current on-site developed space, at the current intensity. Including the reserve areas (those not immediately available for expansion) would permit significant additional expansion, if sufficient utility capacity and distribution systems were available.

D.4 Excess Real Property

Two facilities are identified in FIMS as planned for excess in their entirety. FIMS does not permit flagging of facilities that will experience a partial disposal action for a wing or ancillary facility associated with the main asset. Five of the planned disposals (Building 333A, in an ancillary entry contained within the Building 333 ledger entry) and Building 333 itself have no known radioactive involvement. These facilities are identified in Table D.4. Disposal of the fire station is predicated on the provision of replacement facilities to correct significant emergency shelter and age-related deficiencies. Disposal of the inactive facilities is based on availability of funds and a graded approach regarding the minimal health and safety issues these minor assets create on the site. Section E6 represents a prioritized list of partial or complete real property facilities currently planned for cleanup for reuse or disposal. Major determinants in the prioritization are regulatory compliance, the applicability of space banking, the need to reuse space, and the impact of the space on continued operating costs.

D.4.1 Dispositioning

Three facilities, all radiologically contaminated, are currently candidates for dispositioning: Buildings 301, 330, and 040. A fourth candidate, Building 202 is planned to become a candidate in conjunction with the modernization initiative line-item funding near the close of the planning horizon. The types of former activities in Buildings 040, 301, and 330 and the shielding, heavy masonry, and construction types of the buildings increase the technical difficulty, cost, and duration of their dispositioning. Dispositioning of these buildings is summarized in Table D.5. The three ancillary facilities and the single trailer asset associated with Building 306 will affect the space banking balance (Section D.10), but the facilities themselves are insignificant in terms of RPV.

TABLE D.4 Non-Contaminated Facilities

Bldg.	Name	Use	Year Built	Year FIMS Excess	Year Disposal	RPV ($1000, real)	FIMS Area (1000 GSF)
Active Facility							
333	Emergency Services Department	Fire Station	1977	2017	2017	1,569.6	11.395
333A	Emergency Generator Building			2017	2017		
Inactive Facilities							
300	Service Station	Vehicular Service	1969	2005	2009	480.2	2.403
603	Swimming Pool	Catchall	1933	2005	2009	141.5	
604	Bath House	Recreational Facility	1938	2005	2009	147.3	0.563
607	Pool Filter and Pump House	Other Service Structure	1994	2005	2009	56.5	0.240

TABLE D.5 Radiologically Contaminated Facilities

Bldg.	Name	Use	Year Built	Year FIMS Excess	Year Disposal	RPV ($1000)	FIMS Area (1000 GSF)
Active Facility							
040	INCAL Facility (Instrument Calibration)	Manufacturing/Production Related Laboratory	1949	2005	2008	1,790.5	4.896
202	Biosciences Division	Multiprogram Lab/Office	1952	tbd	2017	51.8	208.657
Inactive Facilities							
301	Hot Cell D&D Project	Physics Laboratory	1950	2001	2009	15,613.3	29.845
330	Former CP-5 Reactor	Office	1953	2001	2008	23,500.0	52.743
Partial/Ancillary Facilities							
306A	Waste Management Operations			2006	2007		
306B	EBR-II Storage			2006	2007		
306C	Flammable Materials Shack	General Storage		2006	2007		
306-TR05	Trailer Assay Facility		1994	2006	2007		

The D&D and subsequent dispositioning of Building 40 is planned for funding through the SLI Excess Facilities Disposition (EFD) program, beginning in FY 2006 and carrying through to FY 2008.

Building 301 is a remaining DOE-EM project. Disposal of the facility is funded through the DOE-EM program, as discussed below. Building 330 (CP-5 Reactor) was previously decontaminated by DOE-EM to a level consistent with restricted reuse and containing significant quantities of tritium contamination in foundations and soils under the existing concrete slabs. Argonne is seeking to have DOE, through the DOE-EM program, provide additional resources for dispositioning of this building as surplus and for the associated decontamination and removal of tritium in the underlying soils and possibly in the foundations themselves. The estimated cost for this project ranges from $18.3 million to $23.5 million. Funding commitment for this project is nearing resolution.

A similar commitment for DOE-EM program-type funding will be needed for the D&D and demolition of several substandard existing facilities that will become excess as the SLI modernization program is implemented. Current plans call for two candidate projects for DOE-EM-program-type funding, with TEC of $39 million and $36.5 million, planned to start in FY 2016 and FY 2021, respectively. Identification of the source program for funding these projects will facilitate timely planning from the outset, so that the Laboratory does not continue to carry the

unnecessary surveillance and maintenance costs and environment, safety, and health liabilities for an indefinite period.

Additional significant facilities that will ultimately require D&D and disposal beyond the horizon of this *Plan* include the following:

- AGHCF in Building 212
- RWSF in Building 331
- Building 315, Vault 40

Before Argonne can consider the most appropriate set of actions to consolidate the nuclear facilities, the site must complete the safe removal and final disposition of the radioactive materials and waste currently stored on-site. This consideration directly affects the continued usage the AGHCF, RWSF, and Building 315 Vault 40. Preliminary order-of-magnitude estimates for the D&D and disposal of these three facilities are $150 million, $50 million, and $15 million, respectively.

Argonne is currently supporting the DOE-EM effort to develop the DOE complex-wide RH-TRU Waste Characterization and Certification Program. The project is expected to be completed by the second quarter of FY 2009. Of the TEC of $7.8 million, DOE-EM has agreed to fund $5.7 million. This project will facilitate shipment of a substantial portion of Argonne's inventory of RH-TRU waste to the Waste Isolation Pilot Plant in Carlsbad, New Mexico.

Additional resources are needed for the safe disposition of excess radioactive materials and remaining waste. Preliminary order-of-magnitude estimates total $8 million for removal of the current materials inventory in Building 200 and $15 million for the AGHCF, $5 million for Building 315 Vault 40, $9 million for other legacy waste disposition, and $20 million for as-yet-undeclared waste dispositions in other facilities. Accelerated disposition of the materials and waste would also accelerate the timetable by which the AGHCF, RWSF, and Building 315 Vault 40 could be declared surplus. The expedited disposition of these facilities would significantly reduce the carrying costs for retaining the facilities in active service and would relieve the Laboratory of some environment, safety, and health liabilities. This situation is discussed further in Section D.1.8. A fully integrated business plan considering other programmatic activities at Argonne, along with budget and schedule to reduce the nuclear footprint, is under development and scheduled for completion by July 31, 2007.

D.4.2 DOE-EM Facilities

One facility on the Argonne site is currently considered to be managed by DOE-EM. This facility is the Building 301 Hot Cells. The D&D effort for Building 301 is underway. The D&D effort at the Building 315 Zero Power Reactor 6 facility was completed during calendar year 2006, and the space was returned to DOE-SC for reuse.

D.5 Long-Term Stewardship

The first component of long-term stewardship is the management of facilities after programmatic need for them ends, until their future use is eventually resolved. At Argonne, long-term stewardship involves initial characterization of a facility to identify hazards or remaining waste, then appropriate correction or remediation. Once the facility is in a stable, safe condition, a program of basic maintenance activities and inspections is established and conducted until final use or disposal of the facility is determined. Stewardship activities include maintenance of lighting, sprinkler systems, ventilation, and alarms, as well as regular walk-through inspections of systems. The principal purpose of the surveillance and maintenance program is to ensure that the real property asset, including its systems and stored hazardous materials and waste, remains in a stable and known condition and that adequate protection is given to workers, the public, and the environment, pending disposition.

The second component of long-term stewardship is activities required to maintain systems established for remediation of radiologically and chemically contaminated areas. Argonne completed its environmental remediation program on September 30, 2003, under the corrective actions portion of its RCRA Part B Permit. However, seven areas could not be cleaned up sufficiently to be classified as available for free release. These areas are part of an Argonne long-term stewardship program that maintains the

remediation systems and monitors groundwater to track residual contaminants. The scope of this activity is to provide ongoing monitoring, maintenance, inspections, and repairs to installed remediation systems. Included are the following:

- 317/319 area phytoremediation plantation
- 317/319 area groundwater extraction system
- 319 area landfill cap
- East-northeast landfill cap
- Groundwater management zone
- Monitoring of seeps south of the 317/319 area
- 800 area landfill cap

Because these activities are being conducted to demonstrate compliance with the RCRA Part B Permit conditions, including landfill closure, they are expected to continue for a minimum of 15 years. Annual operational funding of approximately $400,000 is provided by DOE-EM and is escalated at 3% (approximating the projected rate of inflation).

D.6 Replacement Plant Value Estimates

Argonne has historically derived RPV estimates from the procedures established at the outset of initial site development in the late 1940s. Argonne's reporting of RPV via FIMS has retained this reliance on the initially established valuation procedures.

More recently, DOE has increased its reliance on commercially based methods of cost estimation for construction projects. When they were initially developed, the models were evaluated against conditions at Argonne and found not to reflect the types of construction or the building geometries in place at the site. These two factors were believed detrimental to use of the model results for accurate estimation of levels of required maintenance associated with the continued operations of existing facilities.

Table D.6 summarizes the RPV levels currently retained at Argonne, as directed by DOE-SC guidance. This summary accounts for capital projects currently in construction and provides budget quality estimates for anticipated construction capitalization associated with programmatic missions supporting initiatives. All working figures are in current dollars.

Per DOE-SC guidance, estimates of RPV subsequent to FY 2007 have been escalated at the annual rate of 2.3% to account for inflation-induced growth to the base RPV being used to calculate MII goals (Section D.7).

D.7 Maintenance

Argonne's maintenance funding plan is based on meeting established DOE-SC goals for operating-funded physical plant maintenance investment as 2% of the total RPV. The annual funding levels shown in Table D.7 are based on the 2% of RPV estimates developed in Section D.6. These funding levels, coupled with the modernization initiatives and required DMR funding, will allow the Laboratory to achieve or exceed the overall ACI level of 0.98 by the end of the planning period.

Major repairs and "replacement in kind" projects (>$500,000) are shown in the FY 2008 Integrated Facilities and Infrastructure Budget Date Sheet in Section E4.

D.8 Deferred Maintenance Reduction

Since the initiation of DM reporting in 1998, total DM at the Laboratory has increased steadily. This is due primarily to flat budgets, coupled with an aging physical plant. Argonne has a current DM backlog of $63.4 million through the end of FY 2006. As reported in FIMS on the basis of the current RPV, the overall Argonne ACI of 0.96 exceeds the goal. Nevertheless, the Laboratory is committed to reducing the projected growth of DM, as well as to eventually significantly reducing DM to achieve an overall ACI value of 0.98, considered "excellent."

TABLE D.6 Replacement Plant Values ($ million)

		Additions			Removals				Value ($ million, escalated)	
Fiscal Year	RPV Start[a] ($ million, current)	RPV ($ million, current)	Facility	Financing Type[b]	RPV ($ million, current)	Facility	Net Change ($ million, current)	RPV End[c] ($ million, current)	Percent Value Factor (at 0.023)	RPV
2007	1,553.2	0.4	203 ATLAS Expansion	Conv	(0.1)	(306 ancillary)	9.3	1,562.5	1.023	1,598.4
		4.5	216 SAMM	Conv						
		4.5	LOM 437	Conv						
2008	1,562.5	3.0	203 build-out	Conv		(2.0)	2.0	1,564.4	1.047	1,637.2
		1.0	437 build-out							
2009	1,564.4		TCS[d]	Alt	(17.4)	(301)	(16.6)	1,547.8	1.071	1,657.0
		0.8	437 build-out	Conv						
2010	1,547.8	0.9	437 build-out	Conv			34.4	1,582.1	1.095	1,732.8
		33.5	APCF[e]	Alt						
2011	1,582.1	0.9	437 build-out	Conv	(0.1)	(605, 606, 607)	81.0	1,663.2	1.120	1,863.4
		80.3	Systems Biology Facility	Conv						
2012	1,663.2	27.0	Systems Simulation Center	Conv		(0.5)	26.5	1,689.6	1.146	1,936.6
2013	1,689.6	75.0	Project ANL-001 (lab-office Bldg.1)	Conv		(25.8)	60.2	1,749.8	1.173	2,051.7
		11.0	Validation and Verification Facility	Conv						
2014	1,749.8						0.0	1,749.8	1.200	2,098.9
2015	1,749.8	542.1	AEBL	Conv			542.1	2,291.9	1.227	2,812.4
2016	2,291.9	75.0	Project ANL-001 (lab-office Bldg. 2)	Conv			75.0	2,366.9	1.255	2,971.2
2017	2,366.9	51.8	221, 223 rehab	Conv		(48.7)	3.1	2,370.0	1.284	3,043.6
		TBD	ERL	Conv						
2018	2,370.0[f]						0.0	2,370.0	1.314	3,113.6[f]

[a] RPV at beginning of year.

[b] Financing is conventional (Conv) or alternative (Alt).

[c] RPV at end of year.

[d] The TCS Facility is financed through state of Illinois bonding authority and will be leased to Argonne, resulting in no capital addition during projected occupancy.

[e] The APCF is financed through state of Illinois. Beneficial occupancy will result in an estimated capital addition of $33.5 million (current dollars).

[f] Excludes ERL.

TABLE D.7 Site Maintenance Funding Plan

	Funding ($ million)					
Fiscal Year	RPV	DOE-SC Goal	Planned Site Maintenance (Direct)	Planned Site Maintenance (Indirect)	Total Planned Site Maintenance Funding	MII (% of RPV)
2007	1,297.2	28.3	-	30.1	30.1	2.3
2008	1,432.2	29.6	-	29.6	29.6	2.0
2009	1,553.2	31.1	-	31.1	31.1	2.0
2010	1,598.4	32.0	-	32.0	32.0	2.0
2011	1,637.2	32.7	-	32.7	32.7	2.0
2012	1,657.1	33.1	-	33.1	33.1	2.0
2013	1,732.9	34.7	-	34.7	34.7	2.0
2014	1,863.5	37.3	-	37.3	37.3	2.0
2015	1,936.7	38.7	-	38.7	38.7	2.0
2016	2,051.9	41.0	-	41.0	41.0	2.0
2017	2,099.1	42.0	-	42.0	42.0	2.0
2018	2,812.6	56.3	-	56.3	56.3	2.0

Table D.8 provides the Laboratory's annual funding plan for reducing DM. The plan is based on current DOE-SC funding guidance. Argonne's DMR plan consists of the following five funding components:

- Routine maintenance and the Major Repairs (MRR) program
- IGPP
- DMR
- DOE GPP (through FY 2008)
- SLI line items

Three of these components, MRR, IGPP, and DMR (89% of total maintenance-related funding), will be funded through Laboratory operating funds; the remaining two function as ancillary components of the DOE direct-funded GPP and SLI line-items programs. In addition, some additional contributions toward DMR (not reflected in the numbers) are possible from third-part-financed Energy Performance Contracting program funding.

At the end of the planning horizon (FY 2018), we estimate DM of approximately $76.8 million (future dollars) and expect to achieve an overall ACI of 0.98. We will use existing prioritization processes to address the most urgent facility maintenance needs with available funds. The remaining (unmet) maintenance needs will be of lower priority and lower ESH&I risk. As growth in the rate of maintenance needs slows, funding levels will be maintained until the total DM is reduced to point that the Laboratory can achieve and sustain the 0.98 "excellent" rating.

D.9 Recapitalization and Modernization

A broadly based approach to and initial discussion of the recapitalization and modernization of existing facilities and infrastructure are in Section D.1.5. The sections below expand on this basis and elaborate further with respect to the funding mechanisms available to the Laboratory for the needed facility modifications.

D.9.1 Institutional General Plant Projects

Laboratory planning calls for beginning the use of IGPP funds in FY 2008. Over the planning period, these funds are estimated at $87 million. IGPP is expected to fill the gap created by the elimination of GPP funding as part of the DOE-SC modernization initiative, starting in FY 2009. A portion of the IGPP funds will address sustainment and maintenance needs to prevent further growth of DM. The remaining IGPP funds will address recapitalization and modernization needs. The types and sizes of the IGPP projects will follow the same model as the previous use of GPP funds. Project needs are prioritized as part of the ESH&I process, and project funding is allocated according to the established Laboratory and Argonne Site Office processes and project management

TABLE D.8 Estimated DM, DMR Funding, and ACI for All Facilities

	Funding ($ million)										
Fiscal Year	DM from FIMS or Estimated[a]	Estimate of DM Growth	DOE-SC DMR Funding Target (from TYSP)	Planned Laboratory DMR Funding[b]	Other Laboratory Contributions to DMR[c]	Total Laboratory DM Contribution	Other Contributions (Line Item) (ESPC)[d]	Expected DM at End of Fiscal Year	DM × Escalation @1.023	Estimated RPV	Estimated ACI
2007	63.4	19.5	2.6	(2.7)	(0.9)	(3.6)	(3.4)	75.9	75.9	1,598.4	0.95
2008	75.9	22.2	2.0	(2.0)	(4.5)	(6.5)	(2.0)	89.6	91.6	1,637.2	0.95
2009	91.6	26.6	2.9	(2.9)	(6.5)	(9.4)	-	108.9	111.4	1,657.1	0.93
2010	111.4	23.1	3.8	(3.8)	(7.0)	(10.8)	-	123.7	126.5	1,732.9	0.93
2011	126.5	9.0	3.8	(3.8)	(7.2)	(11.0)	-	124.5	127.4	1,863.5	0.93
2012	127.4	11.4	3.8	(3.8)	(7.7)	(11.5)	(40.2)	87.1	89.1	1,936.7	0.96
2013	89.1	22.4	-	(3.8)	(7.7)	(11.5)	-	100.0	102.3	2,051.9	0.95
2014	102.3	6.0	-	(3.8)	(8.3)	(12.1)	-	96.2	98.4	2,099.1	0.95
2015	98.4	18.4	-	(3.8)	(8.3)	(12.1)	-	104.7	107.2	2,812.6	0.96
2016	107.2	6.7	-	(3.8)	(8.6)	(12.4)	(3.9)	97.6	99.8	2,971.4	0.97
2017	99.8	6.8	-	(3.8)	(8.7)	(12.5)	(15.4)	78.8	80.6	3,043.8	0.97
2018	80.6	6.8	-	(3.8)	(8.7)	(12.5)	-	75.1	76.8	3,113.8	0.98

[a] The estimated growth of deferred maintenance is based on a percentage of the maintenance-related facility needs previously identified for later years in the planning horizon from the site CAS inspections, plus projections of newly identified maintenance-related needs resulting from further facility degradation or damage.

[b] Planned laboratory DMR funding is based on the initially required DOE-SC target funding projected through the end of the planning period to achieve the targeted ACI.

[c] Other Laboratory contributions to DMR include a percentage of the Laboratory's internally generated IGPP funds, plus MRR funding.

[d] Other contributions include an estimated 20% of the currently funded Building Electrical System line item, plus the projected DMR from the proposed SLI modernization projects.

requirements. IGPP funding plans for FY 2008-FY 2018 are shown in Section E4.

D.9.2 SLI Line Items

The Laboratory has identified line-item projects necessary to sustain and modernize the facilities and infrastructure and ensure that the facilities remain relevant in an environment of changing standards and missions. These projects have been strategically selected and prioritized to meet the Laboratory's vision and goals. These needs are estimated at $419.3 million during the planning period.

A prioritized list of the SLI line-item projects and related information is in Section E5. The implementation plan for these projects is described below and illustrated in Figure D.1.

SLI Program Implementation Plan. The implementation of the SLI Program over the planning horizon is guided by the priority of the Laboratory's needs and the funding provided by DOE-SC. The priority of needs was established jointly by the Laboratory and the DOE Argonne Site Office. The funding profile for the SLI Program was established per DOE-SC guidance.

Argonne's *first-priority* project (ANL-001; Multiprogram Replacement Building 1) will provide (1) critically needed adaptable space to enable renovation and modernization of existing buildings, (2) functionality needed for the R&D mission, and (3) the eventual removal of 1950s era substandard space. This project will construct approximately 140,000 GSF of efficient laboratory-office space, which in turn will help vacate approximately 200,000 GSF of substandard, inefficient space for modernization. This project (TEC $75 million) is planned for a start in FY 2010, with expected completion by FY 2012. The multiprogram building will be occupied by programs that need to be co-located for increased synergies or that require fully functional space not available in existing buildings. Special emphasis will be given to programs occupying Buildings 221 and 223, which are candidates for modernization under the second-priority project. Details will be refined as the project progresses through the Critical Decision process.

The *second-priority* project (ANL-002; Modernize Multiprogram Buildings Phase 1) will modernize existing multiprogram buildings with laboratory-office space totaling approximately 180,000 GSF, along with the chilled water system supporting these buildings. This project will also demolish approximately 200,000 GSF of substandard space. Buildings 221 and 223 are candidates for modernization under this project. These buildings are candidates for modernization early in the planning period because of their high potential for cost-effective modernization, in view of their age, condition, and functional layouts. These buildings will be vacated (except for the PBX center) in the early stages of the project, so that the modernization can proceed unencumbered. Some of the programs occupying these buildings are expected to be accommodated in new space, while the others will be accommodated in existing space vacated by programs that will have moved to new space created by the first project.

Upon completion of modernization of Buildings 221 and 223, this space will be occupied by multiple programs according to the same criteria as for the first project. A special emphasis will be to ensure that Building 202 is completely vacated and can be demolished as part of the project. Building 202 is the first of the 1950s era buildings slated for demolition, because it has the lowest D&D and demolition cost among the candidate buildings. Per discussion with DOE-SC management, the D&D ($10.2 million) and demolition ($5.1 million) costs for Building 202 are included in this project to permit expedient removal of the excess substandard space. This removal action will eliminate unnecessary surveillance and maintenance costs, while adding approximately 200,000 GSF to the space bank for future use. This project (TEC $89.3 million) is planned for to begin in FY 2012, with completion expected by FY 2016. Details will be refined as the project progresses through the Critical Decision process.

Argonne's *third-priority* project (ANL-003; Multiprogram Replacement Building 2) will construct a multiprogram building to replace 200,000 GSF of substandard laboratory-office space with an efficient 140,000-GSF state-of-the-art facility, similar to Replacement Building 1

(ANL-001). This second multiprogram building will be occupied by programs that need to be co-located for increased synergies or that require fully functional space not available in existing buildings. Special emphasis will be on relocating occupants from substandard space that is a candidate for demolition. This project (TEC $75 million) is planned to begin in FY 2012, with completion expected by FY 2015. Details will be refined as the project progresses through the Critical Decision process. The substandard space (approximately 200,000 square feet) planned for ultimate vacation through this project includes wings A-F and L of Building 200. Originally constructed in 1951 as the first permanent laboratory-office building, Building 200 has significant chemical and radioactive contamination. The vacated wings of Building 200 will be slated for demolition under a separate project expected to be funded by a DOE-EM-type program. The D&D and demolition cost of this space, estimated at $39 million, is planned to begin in FY 2016, with completion by FY 2018.

The *fourth-priority* project (ANL-004; Site Infrastructure/Utility Modernization) will upgrade critical portions of the site electrical power distribution system, replace portions of the laboratory and sanitary sewer systems, and rehabilitate or upgrade storm water conveyance systems. This project (TEC $45 million) is planned to begin in FY 2016, with completion in FY 2019. Details will be refined as the project progresses through the Critical Decision process.

The Laboratory's *fifth-priority* project (ANL-005; Multiprogram Replacement Building 3) will construct a multiprogram building to replace 200,000 GSF of substandard laboratory-office space with an efficiently laid out 140,000-GSF state-of-the-art facility, similar to Replacement Building 1. This project (TEC $75 million) is planned for a FY 2017 start with expected completion by FY 2019. The multi-program building will be occupied by programs that need to be co-located for increased synergies, and/or require fully functional space that cannot be provided within existing buildings. Special emphasis will be given to the programs now occupying Building 362, which is a candidate for modernization under the scope of the next-priority project. Details will be refined as the project progresses through the Critical Decision process.

The *sixth-priority* project (ANL-006; Modernize Multiprogram Buildings Phase 2) will modernize existing multiprogram building with laboratory-office space totaling approximately 180,000 GSF and will demolish approximately 200,000 GSF of substandard space. Building 362 is the candidate for modernization under this project because of its high potential for cost-effective modernization, in view of its age, condition, and functional layout. This building will be completely vacated early in the project, so that modernization can proceed unencumbered. Some of the programs occupying this building are expected to be accommodated in new space, while others will be accommodated in existing space vacated by programs that will have moved to new space created under project ANL-005 (Replacement Building 3). This project (TEC $60 million) is planned to begin in FY 2018, with completion expected by FY 2020. Details will be refined as the project progresses through the Critical Decision process

Upon completion of the modernization of Building 362, the space will be occupied by multiple programs, according to criteria similar to those stated above for similar projects. However, in this case, the emphasis will be on relocating programs from certain wings of Buildings 200 and 205 that will be candidates for demolition under a separate project with DOE-EM-type funding. The substandard space (approximately 200,000 GSF) to be ultimately vacated through this project include the remaining wings of Building 200 that are not nuclear facilities (K, N, R) and most of the non-nuclear-facility portion of Building 205. Buildings 200 and 205 were both constructed in early 1950s, among the first permanent laboratory-office buildings. Both have accumulated significant chemical and radioactive contamination over the years. The vacated wings will be slated for demolition under a separate project expected to be funded by a DOE-EM-type program. The D&D and demolition of this space, estimated at $36.5 million, is planned to begin in FY 2021, with completion by FY 2023.

D.9.3 General Plant Projects

General Plant Projects funds are used for both sustainment and recapitalization/modernization of the site and facilities. Effective in FY 2009, this

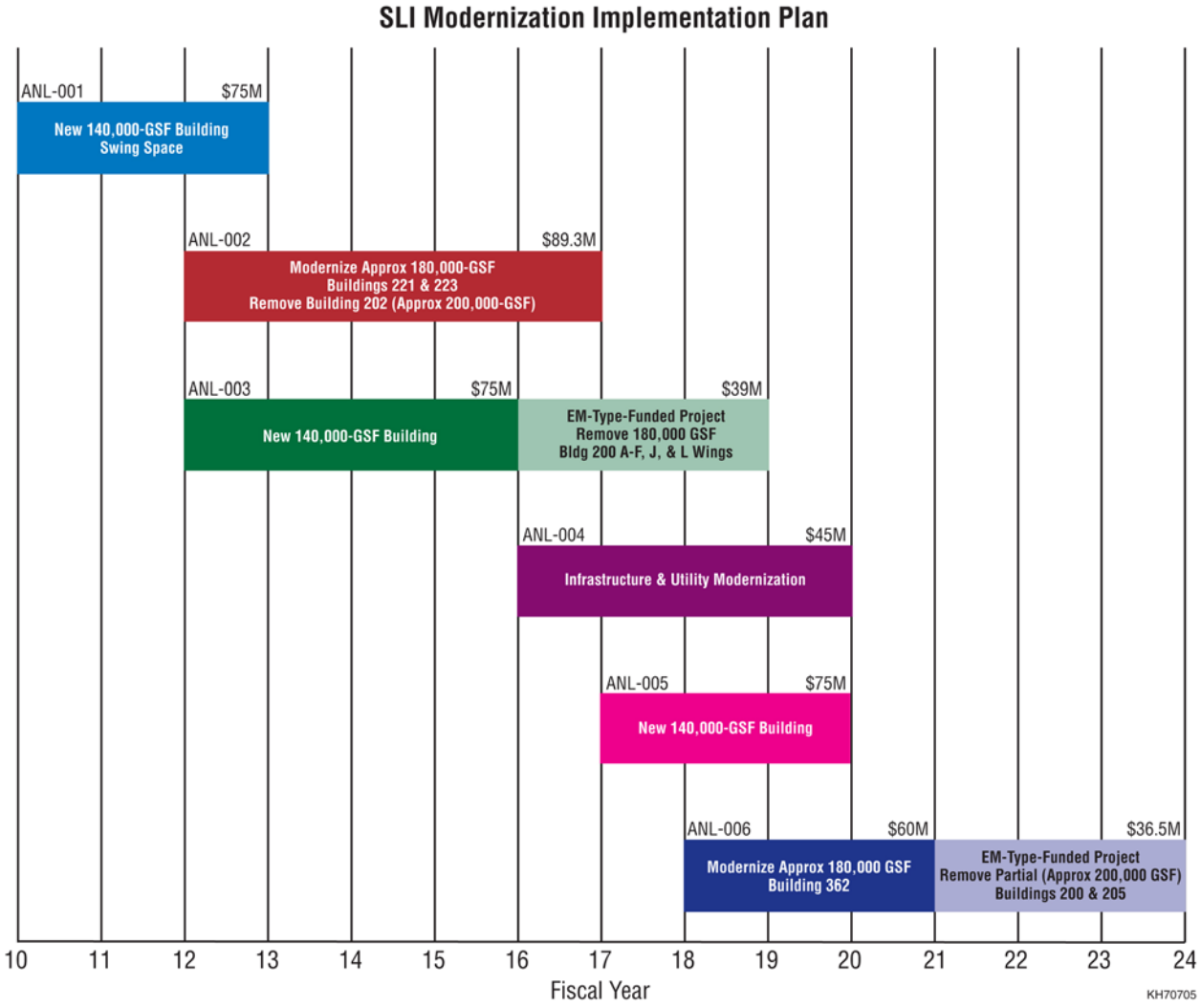

FIGURE D.1 Science Laboratories Infrastructure Program Implementation Plan

source of funding will be eliminated as part of the DOE-SC modernization initiative.

D.10 Space Bank Analysis

Argonne has a long record of timely removal of excess and unneeded facilities. Between FY 1991 and the initiation of the space banking program in FY 2001, more than 210,000 GSF of excess facilities were removed from the site inventory. Beginning in the early 1980s, more than 530,000 additional square feet had been removed — mostly prefabricated "temporary" metal facilities associated with the original buildings erected at the start of the Cold War.

Since March 2003, DOE has drawn from the 89,950-GSF space bank balance at Argonne to support construction initiatives at other sites lacking available balances. This has left Argonne with a depleted space banking balance. An additional impediment is a lack of DOE-EM-type funding for disposal of other larger facilities.

As Table D.9 shows, current construction of several initiatives under DOE funding sources (the SAMM laboratory, the expansion to ATLAS, and the build-out of the final laboratory-office module [Building 437] at the APS project) will exceed the available balance of remaining banked space in FY 2007. The current balance of space is sufficient to offset the construction of

TABLE D.9 Argonne Space Bank Balance

Fiscal Year	Beginning Balance (GSF)	Additions due to Demolition		Subtractions due to Construction	
		Space (GSF)	Facility	Space (GSF)	Facility
2002	0	27,900	004		
		37,530	005		
		19,000	006		
		2,300	026		
		420	027		
		2,800	028		
2003	89,950	3,526	202 partial		
2004	93,476	992	329	(93,056)	Waiver to DOE-SC
		3,529	202 partial		
2005	4,941	700	325C		
		1,100	317		
		2,321	202 partial		
2006	9,062	1,651	374A	Third party[a]	440 - CNM
		320	040 partial	(80)	891A
		50	old 891	(26)	New 891
2007	10,977	1,116	306 ancillary	(1,682)	203 - ATLAS Expansion
				(7,221)	216 - SAMM
				(20,500)	LOM 437
2008	(17,310)	4,576	040, remainder	Not applicable[b]	Ricketts Laboratory
2009	(12,734)	29,845	301	Third party[a]	TCS - 200,000 GSF
2010	17,111			Third party[a]	APCF - GSF TBD
2011	17,111	563	605, 606, 607	Third party[a]	ISC - 72,000 GSF
				Third party[c]	SBF - 150,000 GSF
2012	17,674	2,403	300	Third party[c]	SSC - 50,000 GSF
2013	20,077	52,743	330	(140,000)	SLI-B1
				Third party[c]	VVF
2014	(67,180)				
2015	(67,180)			(112,000)	AEBL
2016	(179,180)			(140,000)	SLI-B2
2017	(319,380)	208,657	202	TBD	ERL online
2018	(110,523)[d]				

[a] The CNM, TCS, APCF, and ISC are third-party-financed facilities, financed through state of Illinois direct funding or via state of Illinois bonding authority.

[b] The Howard T. Ricketts Laboratory is a third-party-financed and third-party-operated facility within the Argonne grounds. Operations are via the National Institutes of Health and the University of Chicago.

[c] The Systems Biology Facility (SBF), Systems Simulation Center (SSC), and Validation and Verification Facility (VVF) are planned to be third-party-financed facilities, directly supporting key programmatic initiatives. Funding sources are presently uncertain. Preconceptual estimates (order of magnitude) of the TEC for these initiatives were proxied by using rates comparable to those for the SLI modernization initiative line-item projects on a *pro rata* basis for projected gross square feet.

[d] Excludes ERL.

the ATLAS expansion and the SAMM facility. Construction at Building 437 has not included interior build-out, which is planned to be phased over the next three years (Table D.6) under user (nontraditional) funding *in lieu* of DOE sources. Thus, the time gap between the closure of the exterior construction phase and full operation of the final facility is about three years.

Building 301 (hot cells) has been in the DOE-EM funding stream pending D&D and disposal. We are seeking additional DOE-EM funding for the demolition and disposal of Building 330, as described in Sections D.4 and E6. A formal Critical Decision 0 request has been submitted and is currently under review by DOE-EM. Building 301 is entering D&D in the current year. Completion of the disposal process is projected to coincide with completion of the phased Building 437 interior build-outs. Argonne thus proposes to use the delayed realization of Building 301 disposal as an offset against Building 437, leaving a positive remaining space balance of approximately 17,100 GSF at the close of FY 2010, as is projected in Table D.9. After FY 2010, DOE-funded replacement buildings will require offsetting space banking allowances to compensate for the reduction of Argonne's space balance of 93,000 GSF in FY 2004. The location of other programmatic initiatives at Argonne, such as AEBL and the ERL project, are expected to bring the appropriate space banking authorization, with the appropriate programmatic funding approval decisions.

Because many of Argonne's immediate mission initiatives rely on alternate means of financing, our ability to guide our own destiny regarding the pursuit of cutting-edge infrastructure in support of changing missions is unique within the DOE-SC complex. Among the infrastructure initiatives are the CNM, beginning operation after completion of construction funded by the state of Illinois; the proposed APCF, to be funded directly by the state of Illinois; and the TCS Facility, which will be entering construction in the coming year. For the TCS Facility we are developing a prototype third-party leasing approach that relies on the bonding ability of the state of Illinois. Unlike the other alternatively funded initiatives, the TCS Facility will not contribute to RPV growth, as it will be owned by a development authority and leased to Argonne. Additional description of this emerging role is in Section D.13.

D.11 Performance Indicators and Measures

The new contract between UChicago Argonne, LLC, and DOE incorporates results-oriented performance objectives in the Performance Evaluation and Measurement Plan (PEMP; Appendix B), as well as in Work Authorization Directives issued annually.

Argonne's Associate Laboratory Director for Operations and Business Management collects, tracks, and coordinates reporting of all operations performance measurements identified in the PEMP. This information is compiled for internal use as a management tool. It also becomes the basis for the midyear status review with DOE and is a major component of the annual self-assessment requirement.

The PEMP describes the primary measures for the evaluation of the performance of UChicago Argonne, LLC, with regard to management and operation of Argonne for the evaluation period from October 1, 2006, through September 30, 2007. The performance evaluation provides a standard for determining whether the Laboratory is meeting DOE mission and performance expectations and objectives, as stipulated in the contract.

D.11.1 Infrastructure-Related Performance Goals for FY 2007

The primary goal related to infrastructure is Goal 7 of the FY 2007 performance goals. Goal 7 carries a weight of 20% in the overall FY 2007 Management and Operations (M&O) Contractor Evaluation Score Calculation. An effective and meaningful *Ten-Year Site Plan* is required to meet this goal successfully. Key portions of these criteria include the following:

- *Objective 7.1 — Manage Facilities and Infrastructure in an Efficient and Effective Manner that Optimizes Usage and Minimizes Life Cycle Costs (10% of M&O Total)*

7.1.1 Effectiveness and efficiency of maintenance activities to maximize the operational life of facility systems, structures, and components as outlined in DOE O 430.1B and demonstrated by meeting site specific MII, facilities ACI, and DMR goals.

• *Objective 7.2 — Provide Planning for and Acquire the Facilities and Infrastructure Required to Support Future Laboratory Programs (10% of M&O Total)*

7.2.1 Facility planning, forecasting, and acquisition activities translate business needs and facility condition information into a comprehensive facility strategic plan for effective and efficient execution, as demonstrated through the accomplishment of critical tasks:

- Develop a *Ten-Year Site Plan* in accordance with guidance.
- Conduct a FIMS Data Validation Assessment with the Argonne Site Office, and score the results in accordance with DOE guidance.
- Complete feasibility studies addressing infrastructure management cost savings or productivity improvement (or both), or implement cost savings or productivity improvement initiatives.
- Obtain concurrence from DOE on the methodology used to calculate RPV in accordance with the RPAM Order 430.1B definition of RPV; use this methodology to calculate RPV and populate the FIMS database with RPV data.
- "Projectize" the DMR program in accordance with the *Argonne Project Management Manual*, revised July 2005.
- Facilitate award of at least one delivery order, under the ESPC or Utilities Energy Savings Contract, in accordance with DOE Order 430.2A, DOE Headquarters policies, ESPC rules, and DOE legal opinions.
- Reduce energy use per gross square foot by 2% from the previous year.
- Complete goals outlined in annual energy management performance agreements.
- Complete scheduled CAS inspections.
- Submit the *Quarterly Maintenance Report* on time and in accordance with reporting guidance.

7.2.2 Project cost and schedule compliance, a performance indicator intended to encourage efficiency in meeting the cost and schedule performance index for infrastructure-related projects, as well as to demonstrate project cost and schedule implementation in accordance with approved baselines.

7.2.3 Demonstrate the Laboratory's commitment to continuous improvement of the Project Management System by completing improvements identified in Argonne's July 2006 *Report on the Application of the Project Management Institutes Organizational Project Management Maturity Model (OPM3) to the Project Management System at Argonne National Laboratory* and by completing the recommendations from the Argonne Site Office 2006 review of the Argonne Project Management System.

D.11.2 Other Contract Performance Measures for FY 2007

One other performance goal, Goal 5 (Sustain Excellence and Enhance Effectiveness of Integrated Safety, Health, and Environmental Protection, 30% of M&O total) has one objective and three tasks related to facilities and infrastructure management:

• *Objective 5.3 — Provide Efficient and Effective Waste Management, Minimization, and Pollution Prevention*

5.3.2 Effective FY 2007 Land Management and Habitat Restoration work plan activities:

- Develop a sitewide plan that integrates the requirements of DOE O 450.1 and Executive Order (E.O.) 13148 and Argonne's goals and objectives into site landscaping activities.
- Integrate this plan into the *Ten-Year Site Plan*.
- Establish an implementation schedule.

5.3.3 Effective oak tree health maintenance plan:

- Contract with an expert to survey the 200 area oak (and other hardwood) trees and provide a report.
- Prepare a plan to water during drought and to place mulch under native trees to prevent both damage to the trees and soil compaction.
- Provide areas for planting new trees.

5.3.4 Effective control of invasive species:

- Conduct prescribed burns of 20 acres of managed areas.
- Report wetlands monitoring data.

These tasks are three of six composing Objective 5.3, which makes up 25% of the total score for Goal 5.

In addition to the contract performance measures described above, the Laboratory developed a number of Energy Management Performance Agreements for FY 2007 in conjunction with the Argonne Site Office.

D.11.3 Infrastructure Performance Measures for FY 2008

The FY 2008 infrastructure performance measures are not yet identified. The dialog between DOE's Argonne Site Office and Argonne will begin in July or August 2007. However, current indications are that the performance measures will be substantially unchanged from FY 2007, so that similar agreements would be anticipated for FY 2008.

D.12 Energy Management

Energy management continues to be a priority at Argonne. Energy management — conservation and efficiency — are key strategy elements employed to reduce operational costs and manage scarce natural resources. In FY 2007, Argonne will spend over $23 million for energy, including nearly $16.3 million for electricity, $6.1 million for natural gas, and $1.3 million for coal. Argonne's *Comprehensive Energy Management Plan* identifies actions necessary for the successful execution of the energy management strategy. Commensurate with the requirements of the national Energy Policy Act (EPACT) of 2005, Section 102, Argonne's long-term goal (Table D.10) is an energy consumption reduction in FY 2016 of 20% relative the FY 2005 level. The laboratory is currently well positioned to achieve the long-range target. The FY 2006 reduction of 16.9%, compared to the FY 2003 energy intensity level, provides a solid foundation on which to achieve the remaining reduction goals for EPACT 2005 and E.O. 13423. The 16.9% reduction will be supported by the plan to reduce site energy consumption each year, from 1% in

TABLE D.10 Energy Management Targets

	Energy Consumption in BTU/SF						
			Target				
Performance Measure	Baseline FY 2003	Actual FY 2006	FY 2007	FY 2008	FY 2009	Long Term	Achieve Target
2005 Energy Policy Act: 20% Reduction from FY 2003 Baseline by 2015	327,746	272,273	268,188	265,475	262,197	262,197	FY 2015
E.O. 13423: 3% Annual Reduction or 30% Reduction by 2015	327,746	272,273	265,475	258,920	252,365	239,255	FY 2015 229,423 (30%)

FY 2006 to 2% in FY 2016. Concurrent with this goal is the objective target of improving energy management performance in the areas of energy efficiency, water conservation, and renewable energy procurement, as set forth in E.O. 13423, Section 2(a), (b), and (c).

Energy savings improvements implemented through the Laboratory's energy management program have reduced building energy use per square foot by 30% since 1985. Energy use is metered across the site, and users are charged only for the amount of energy consumed. Metering at the point of use has and continues to be an excellent incentive for energy conservation. As applicable, most buildings are metered for steam, electricity, water, and natural gas consumption. In concert with EPACT 2005, Argonne has begun enhancement of the existing metering program with the development of a comprehensive *Site Metering Plan and Program*. A key feature of this plan is the phased implementation of an upgrade to advanced metering for electrical consumption. Upgrades to water, steam, and natural gas metering are under development as well. These planned upgrades can provide tools to manage and control energy usage more keenly. Additionally remote readability and real-time data on usage will be available to facility managers.

Continued modification and retrofitting of existing energy-consuming systems is one of the key components of the Argonne plan. These projects are implemented through funding strategies such as operating funds support, the Federal Energy Management Program, and third-party financing. Ongoing comprehensive energy studies are identifying and developing feasible projects. The Laboratory has successfully completed a $2.5 million ESPC project. The simple payback for this initial project is 8.5 years. The Laboratory is currently constructing the second ESPC project. Eight distinct energy conservation measures form the basis for this $8.7 million project. These two projects are delivering energy-saving solutions geared toward improving the efficiency of building mechanical systems and lighting systems, the performance of outdoor steam and condensate piping, and operation of the site boiler house.

Cost-saving opportunities to incorporate the use of alternative fuels (biomass and K-fuel) continued to be explored. In addition, the feasibility of using co-firing and co-generation is being evaluated. Beginning in 2006 and continuing in 2007, Argonne is exploring the use of renewable energy. A candidate project in the Argonne Information Center is under development. These projects and a host of others are proceeding through the initial proposal development phase of the Laboratory's third ESPC. This initial development phase is expected to be completed in autumn 2007.

Through robust facility maintenance and operational programs, Argonne has institutionalized many energy-saving initiatives. Chief among these well-documented activities are regularly scheduled comprehensive energy audits, procurement of energy-efficient equipment and Energy Star-qualified products, new building energy efficiency design requirements, and demand-side load management performed in partnership with the local utility company. The Laboratory has planned a program to retro-commission large energy-consuming building systems in major buildings to assure efficient system performance. In 2006, the re-commissioning of Building 212 was completed. The energy management control system improvements potentially yield $20,000 per year. Capital-intensive retrofitting projects, developed as a result of earlier retro-commissioning work, have been submitted for FY 2007 funding from the Departmental Energy Management Program. Buildings planned for retro-commissioning in FY 2007 may include Buildings 202, 203, and 205.

Argonne continues to incorporate energy efficiency requirements into procurement specifications for purchased equipment, including desktop computers, workstations, printers, copiers, fax machines, and other energy-consuming equipment. Low standby power requirements are essential in many specified equipment items. New E.O. 13423 is being studied to ensure that the Labatory's programs incorporate the latest requirements specified. The DOE final guidance for implementation is being developed.

At a minimum, all new buildings constructed will conform to American Society of Heating, Refrigeration and Air Conditioning Engineers 90.1-2004. New envelope construction,

mechanical equipment, lighting, and service hot water heating systems will be evaluated to optimize energy consumption.

Argonne employs the services of the Defense Energy Supply Center to achieve the most economical procurement of electricity and natural gas. For several years the Laboratory's participation in competitive procurements with multi-agency bid packages has resulted in extremely cost-efficient purchases of electricity and natural gas.

In 2007, the option of incorporating the purchase of "green" electricity generated from renewable technologies such as solar, wind, and thermal energy sources was rigorously examined. In 2007 Argonne elected to incorporated green renewable certificates for power in the 2007 suite of energy options.

Argonne has established Energy Management Performance Agreements with DOE's Argonne Site Office to implement 13 energy and water conservation strategies involving energy use and greenhouse gas reductions, implementation of water conservation**,** best management practices, use of alternate funding for energy conservation projects, implementation of retro-commissioning, and comprehensive energy survey programs. In response to the Presidential Directive of September 2005, additional activities were incorporated into the Laboratory's program. The additional actions included minimizing the heat set-point in the cafeteria, building lobbies, loading docks, and storage spaces; lowering domestic hot water set-points to minimum requirements; using coal *in lieu* of natural gas whenever possible; ensuring that unnecessary lighting and appliances are shut off when not needed; avoiding the use of portable electric heaters; and ensuring that power-saving features on office equipment are enabled.

Argonne's outstanding energy conservation efforts have been recognized by DOE with Federal Energy and Water Management awards and a White House "Closing the Circle" award. Most recently, the Laboratory received DOE recognition for outstanding work on Argonne's initial ESPC Delivery Order #1 project.

A list of projects related to energy cost savings is in Section E7.

D.13 Leasing and Third-Party or Non-Federally Funded Construction of New Buildings

D.13.1 Conventional Leasing

Argonne leases one significant nearby office facility, Building 900, approximately 1.5 miles from the site. This facility accommodates approximately 258 personnel and includes 78,250 GSF of space (ingrant) at an annual base lease cost of approximately $750,448. Planned leasing of the TCS Facility, to be constructed in the northern part of the 200 area, is anticipated to make available space to facilitate return of the Building 900 personnel to the site when construction is complete.

Five other minor leaseholds (Table D.11), totaling 25,348 GSF, support activities at scattered locations outside Illinois. The most significant is 14,735 GSF for the Washington, D.C., liaison office.

TABLE D.11 Argonne Leased Facilities

Property Name	Area[a]	OCC[b]	Use	Leasing Plan
Catellus Development (Building 900) (ingrant)	78,250	258	Office	Relocation[c]
G.S. Investments LLC (Nebraska)	4,200	-	Storage	Continuing
Berndt and Sylvia Kornm (Germany)	947	2	Housing	Continuing
Potomac Creek (Washington, D.C.)	14,735	47	Office	Continuing
GDA Real Estate (Colorado)	2,466	8	Office	Continuing
Hallbeck Homes	2,750	9	Office	Continuing

[a] Area in gross square feet.

[b] Occupants.

[c] Occupants to be relocated on-site after construction of the Theory and Computing Science Facility.

D.13.2 Third-Party (Non-Federally Funded) Construction

Argonne is developing a framework in which the benefits of a leased facility can be attained on-site by developing land that is well-serviced by

site infrastructure and within the fabric of Argonne security measures. The central location with respect to the multiprogrammatic research community also provides an intellectual context scarcely matched throughout the Chicago region. The TCS Facility is proposed as a 200,000-GSF state-of-the-art computing facility and conferencing center. The TCS Facility is described in additional detail in Section C.8.2. The funding strategy, if it proves successful in this initial undertaking, may emerge as a national model for similar ventures. Such a success would ease the subsequent review and approval process, thereby enhancing the economic feasibility of obtaining additional facilities via this path.

Additional projects under consideration as third-party-financed ventures include facilities to house three biosciences initiatives closely linked to the TCS Facility. These initiatives — a Systems Biology Facility, a Systems Simulation Center, and a Validation and Verification Facility — are also referenced in the projections regarding RPV and space banking (Tables D.6 and D.9, respectively), although the data are pre-conceptual and subject to revision pending development of funding relationships.

D.14 Operating Costs for Sustainment and Operations

The operating costs for sustainment (maintenance) and operation of the Argonne buildings are collected and reported in the FIMS database. Table D.12 shows the current and projected cost per gross square foot for both sustainment and operations.

Operating costs-sustainment and DMR are based on the operating-funded maintenance and repairs that are included in the 2% MII target, along with the required DMR funding.

Operating costs-operations are composed of actual and projected costs for janitorial, pest control, refuse and recycle collection, grounds maintenance, and snow removal services. The square footage calculations are based on the actual and planned modifications to the site area in the reporting period.

TABLE D.12 Operating Costs for Sustainment and Operations

	Cost ($/GSF) in Fiscal Year				
			Target		
Performance Measure	Baseline FY05	Actual FY06	FY07	FY08	FY09
Operating Costs-Sustainment and DMR	4.59	4.76	5.87	5.62	5.91
Operating Costs-Operations	1.26	1.32	1.34	1.37	1.36

E1 Appendix: Land Use Plan

The latest land use plan (see Figure E1.1) reflects the continuity of land use plans developed under current and former DOE orders and subsequent directives from DOE-SC and its predecessor organizations regarding integrated facilities plans and strategic facilities plans.

E1.1 Background

The policy of DOE is to manage all of its lands and facilities as valuable national resources. DOE's stewardship is based on the principles of ecosystem management and sustainable development, together with the integration of mission and economic, ecologic, social, and cultural factors into a comprehensive plan for each site that guides land and facility use decisions. This policy results in land and facility uses that support DOE's critical missions, stimulate the economy, and protect the environment. Under this policy, the comprehensive plan for Argonne (land use plan, site development plan) reflects the site's ongoing missions in the larger regional context and incorporates the forums for stakeholder participation developed by DOE under the auspices of future use planning as documented in *Charting the Course: The Future Use Report*, April 1996.

The comprehensive land use planning process identifies the current condition of existing land and facility assets and the scope of constraints across the site and in the surrounding region. Long-term goals for sustainable development focus efforts to steward these assets and identify options for land and facilities use. The options considered take advantage of opportunities and mitigate constraints in support of the site's identified missions and research initiatives, as developed in consultation with DOE programmatic guidance and during the annual On-Site Review. The missions and initiatives are documented in the *Business Plan* and programmatic strategic plans. At Argonne, the site planning process employs iterative updates and adaptive management techniques that adjust management practices and directions to changes in missions and in environmental, economic, cultural, and social factors.

DOE has given Argonne responsibility for tailoring its land use planning process to local conditions and coordinating existing activities that affect planning for land and facility assets. These activities include the process prescribed by the National Environmental Policy Act (NEPA), site planning and asset management, public participation (via the Community Leaders Roundtable) in conjunction with the DOE Argonne Site Office, site strategic planning, cultural asset management, historic preservation, and natural resource management. DOE and Argonne recognize the importance of enhancing and preserving biodiversity and are committed to supporting the *Biodiversity Recovery Plan* prepared by the Chicago Wilderness partnership organizations. Factors that can require considerable intergovernmental coordination at sites with changing or discontinued missions play a less influential role at Argonne because of the continuity of our missions. Such factors include economic development, community re-use organizations, privatization of assets, and environmental justice, to name a few.

E1.2 Site Planning Process

As originally established under DOE O 4320.1 (Site Development Planning); its subsequent modifications and related and successor orders (DOE O 4320.1A and DOE O 4320.1B); DOE O 4330 (Capital Asset Management Planning); DOE O 430.1A (Life Cycle Asset Management); and, most recently, DOE O 430.1B (Real Property Asset Management [RPAM]), the basis for the planning process must be documented so that others can follow the decision processes and factual conditions used to arrive at solutions and implementation plans. These orders and related guidance acknowledge that no single planning process is to be followed stringently, but that site-specific processes should be tailored to the needs of each site, within the bounds of industry-wide acceptance and recognized planning principles. The guidance also recognizes that unique requirements pertain to special situations. For example, a campus setting might be the most suitable working environment for research laboratories. Planning

processes for such settings should reflect the unique requirements.

At Argonne, site development planning has consistently been comprehensive, addressing the entire site, including the NBL. This independent DOE-operated facility, wholly within the Argonne site, receives the same consideration as Argonne facilities in planning for land use, facility siting, and DOE missions.

Site planning is inherently a collaborative process that facilitates open exchange of necessary technical information, and all affected parties have input into the process. For the Argonne site with its ongoing, continuing missions, DOE's Argonne Site Office has established mechanisms to engage the appropriate level of community involvement in site planning.

The site planning process is defined (originally in DOE O 4320.1B) as steps used to

- Identify and define current and future site missions;
- Evaluate existing site conditions and regional influences;
- Determine and quantify facility requirements to accomplish site missions;
- Formulate alternatives to satisfy facility requirements;
- Evaluate and rank the alternatives on the basis of their merits; and
- Develop a plan of action to implement the preferred solution.

E1.3 Planning Issues

No significant issues affect land use planning at Argonne. A wetlands mitigation strategy addresses the many small wetlands that pose an impediment to development. Because management of the extensive natural areas has not been an active consideration during the most recent half century, the remnant prairie and savanna habitats and surviving flora offer significant potential for habitat restoration.

From a development perspective, the Argonne site is ideally situated for its purpose as a multiprogram research laboratory. Its ready access to business, industry, and universities and its location on one of DuPage County's growth corridors ensure that Argonne will maintain its competitive position in attracting and retaining highly skilled and educated personnel, as well as its ability to foster business partnerships and high-technology enterprises in the future.

Existing physical, site, and regional location factors present no constraints to planned accommodations. The envisioned Laboratory growth would not encroach on neighboring areas, because the site is separated from them by the greenbelt forest. The exceptional road connections to major expressways and the local arterial network can accommodate the increased traffic that will accompany such growth.

In terms of land requirements, land suitable for development is not in short supply. Undeveloped areas available for functional uses equal the areas presently used. The capacity of areas dedicated for development should be sufficient to significantly increase current on-site developed space, at the current intensity. Including the reserve areas (those not immediately available for expansion) would permit significant additional expansion, if sufficient utility capacity and distribution systems were available.

E1.4 Revision Process

Figure E1.1 is the master plan for development and land use. This land use/master plan will be revised in conjunction with the *Ten-Year Site Plan*, in conformance with DOE guidance, and submitted for review and approval in response to directions contained in the call from DOE-SC. The approval process for the *Ten-Year Site Plan* is described in Section D.3.

E1.5 Land Use Plan

Future land development at the Argonne site reflects the existing development pattern that has served the Laboratory's changing needs adequately for 60 years. Two key concepts underlying the site development plan are as follows:

1. Redevelop or expand within previously developed areas of the site (for programmatic

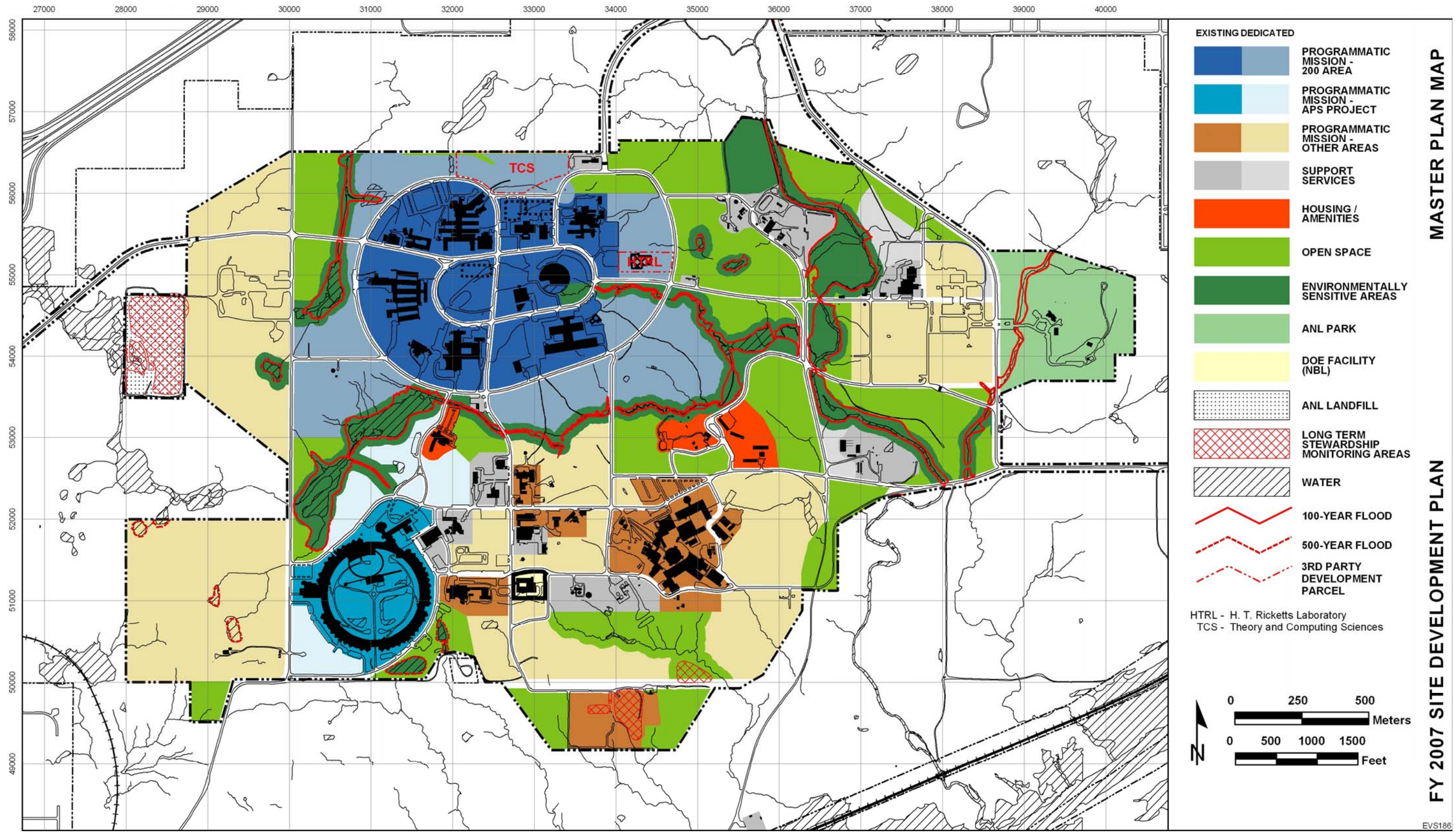

FIGURE E1.1 Master Plan — Land Use

missions, housing, and support services) to maximize interactive potential and flexibility; alternatively, where missions require, expand into dedicated expansion areas.

2. Delineate environmentally sensitive areas and existing natural open space for ecosystem management in permanent green space; delineate improved, interconnected areas of high-quality native habit or zones of transition between developed areas.

The site development plan includes a parcel inventory that identifies specific management units of the site that will be opened, developed, and maintained according to the appropriate site development standards. The former ecology plots are undeveloped parcels of land that will remain undeveloped to the extent possible. Future research objectives might require rededication of an ecology plot area to development; however, this action will be considered only if no other on-site parcel can reasonably accommodate mission requirements.

The key to an effective long-range master plan for facilities and site development is to ensure that the future potential of the site is not limited by adverse short-range actions taken for expediency. This assurance requires development of dedicated areas designed to be compatible with the established mission of the site and with agreed-upon Laboratory goals and objectives. Further, the Laboratory must have the greatest possible degree of flexibility in future site use within the overall master plan.

The site development plan at Argonne explicitly recognizes and records key safety and environmental concepts. This plan continues to include programmatic mission areas and housing and support service areas as important ongoing functional uses. Environmentally sensitive portions of the site along existing natural areas, floodplains, streams, and steep slopes will be retained in their natural state.

Argonne has identified the preferred locations of the major scientific initiatives. The Laboratory projects selective increases in some program activities within existing facilities. All such actions can be accommodated readily within present site boundaries.

E1.6 Future Functional Locations

For long-range planning purposes, the Argonne site is being considered a contiguous land area consisting of management area types. The site development plan dedicates large areas for expansion of present operations. Future land use assignments under this plan are discussed below. Site and facility characteristics are summarized in Chapter B and presented in greater detail in Sections E2 and E3.

A system of homogenous management units has been identified by using existing road alignments and patterns of development. Each of these management units is evaluated for utility service support and availability, circulation accessibility, and development potential on the basis of development standards and location criteria. Of the 67 management units, 19 are "fully developed," 7 are "partially developed," 3 are in the process of redevelopment, and another 15 are undeveloped but available for development. Some 20 management units are considered "open space" (including 4 former ecology plots that could be developed but constitute a strategic land reserve). Another 3 units (the closed Argonne landfill, the NBL area, and Argonne Park) are considered special management units. Within each of these management units, future construction will occur as discussed below, by general functional area.

E1.6.1 Programmatic Mission: 200 Area (Existing and Dedicated)

For the central 200 area of laboratory and office buildings within the Outer Circle Drive, the original site development concept remains sound. Many of the 200 area core buildings are approximately 50 years old and thus are in need of replacement by newer, more agile facilities that can provide significantly improved levels of performance and reduce aggregate space needs, while supporting the mix of missions and technologies central to Argonne's research role in the 21st century. A smaller number of buildings, constructed more recently in the late 1960s and 1970s, require significant rehabilitation or modernization to return them to state-of-the-art performance and extend their useful functional lives, consistent with today's technological requirements. In conjunction with the need to

retire older, less effective and technologically limiting facilities, other compelling needs are (1) to shift historical relationships of vehicles and buildings to achieve more interactive, pedestrian-oriented settings and (2) to increase the proximity of affiliated mission capabilities in the central campus and in other development nodes. Some space is available for construction between the Outer Circle Drive and the Inner Circle Drive, as follows:

- An area near Building 203 has been cleared to facilitate extension of the capabilities of the ATLAS user facility into the next generation of particle research. (The AEBL project and, if conditions remain favorable, the Illinois Science Center [ISC], would continue the proposed clustering of fundamental physics research facilities.) Currently, this area is undergoing modest expansion to house the CARIBU extension to the ATLAS beamline.

- The SAMM Facility east of Building 212 will provide a much-needed modern platform for state-of-the-art research in a facility unencumbered by the vibrational and electromagnetic interference found in older existing facilities.

The area near Building 202 has been identified for the expansion and growth of biology-related initiatives such as the Howard T. Ricketts Laboratory, currently being located to the south and east of Building 202. This area also has the potential for additional innovatively financed initiatives such as the Systems Biology Facility, the Systems Simulation Center, and the Validation and Verification Facility. All of these facilities are highly interactive with each other and with the proposed nearby TCS Facility, being located immediately west of the Northgate Road entry. This is also the general area where an initial increase in the density of multiprogram facilities is envisioned to begin enhancement of infrastructure capabilities, promoting collaboration and increasing the potential for interaction at the traditional center of the site.

For these projects, care will be taken to ensure that adequate parking remains available and that the collaborative campus setting and multi-programmatic character of the site are not jeopardized.

The TCS Facility, planned for a site just outside the Outer Circle Drive, is discussed at more length in the context of third-party-financed initiatives (Section D.13.2). The space between Freund Brook and the Outer Circle Drive also remains dedicated for future multidisciplinary research and administrative (office) buildings that might be tied to operations in the present facilities, the majority of which (Buildings 200, 205, and 212) serve Argonne's nuclear and radiological research.

E1.6.2 Programmatic Mission: APS Area (Existing and Dedicated)

Much of the 400 area in the southwest corner of the Laboratory is dedicated to the APS, which consists of two principal parts: a linear accelerator/booster synchrotron system to accelerate electrons to energies of 7 GeV or higher and a storage ring more than 2,625 ft in circumference, into which the electrons are injected. The electrons circulate around the ring, emitting beams of energetic synchrotron radiation or photons. The photon beams emerge along tangent lines from the ring for use in experiments. The APS project occupies approximately 79 acres and consisted of 15 permanent, interconnected utility support buildings. The nearby Argonne Guest House is a support facility developed with state of Illinois funds to serve the specialized residential needs of teams of visiting users working around the clock.

Recently completed work in this area includes (1) the CNM Facility and (2) the last of the planned laboratory-office modules (LOMs) supporting the user facilities around the storage ring, LOM 437, which consists of a foundation system, structural steel frame, life safety systems, and building enclosure. Interior build-outs will be staged in the coming three years as phased research program development occupies the finished space stepwise.

The APS is looking toward substantial upgrades to its beamline capabilities and is also the selected site for the APCF, funded by the state of Illinois for protein characterization research that uniquely combines Argonne's capabilities in the areas of life sciences and nanoscale imaging.

New initiatives include a new APS Storage Building to provide the 400 area with an additional

12,000 square feet to compensate for decreases in storage space in the APS Experiment Hall due to the installation of new user beamlines. Also envisioned is the expansion of the existing APS LOMs to provide additional office and laboratory space for current and future users.

E1.6.3 Other Programmatic Mission Areas (Existing and Dedicated): East Area, 300 Area, 360 Area, 400 Area, and 800 Area

Special-purpose facilities in the southern sections of the site include the Laboratory's initial reactor programs, such as the Experimental Boiling Water Reactor, the CP-5 Reactor, and the Juggernaut Reactor in the 300 area and the former ZGS facility in the 360 area. These facilities have been shut down. Most of the associated developed areas will continue to be dedicated to programmatic needs until they are eclipsed by more modern replacement facilities. The latter are initially to be located in the 200 area, where they will support the concept of a more collaborative, centralized campus concept. Throughout the effort to meet these changing mission needs, keeping future land use flexible is imperative for fully realizing and extending the capabilities of the existing infrastructure.

The largest portion of the east area remains dedicated for specialized major programmatic initiatives that would uniquely benefit from a public access interface with Cass Avenue. This location has the unique potential to be fenced off from the main site to achieve a modified security level unattainable elsewhere. Such a capability is seen both as a major resource to accommodate increasing interactions with industrial and academic interests and as a strategic land reserve suitable for large initiatives on the scale of 80 acres or more, with appropriate utility services and other infrastructure.

E1.6.4 Support Services Functions (Existing and Dedicated): 100 Area, 500 Area, and Portions of the East, 300, 360, and 800 Areas

The area north of Eastwood Drive and the Eastwood Extension and east of the Outer Circle Drive remains dedicated as one of the main service areas for the entire site. This area is anchored on the west by the Central Heating Plant. The Transportation and Grounds Facility (Building 046), completed in 1993 and subsequently expanded in 2002 and reconfigured as the Central Supply Facility, is the anchor for this area's continued redevelopment as a support area.

All remaining substandard, temporary buildings in the 800 area have been demolished, and the site has been cleared for reuse. At present the area is under consideration as a potential location for the Global Nuclear Energy Partnership initiative, although Argonne does not appear to pass the formal screening criteria developed to date for this program. Additional land dedicated to service facilities includes the following:

- The wastewater treatment area (500 area)
- Waste Management Operations, the Fire Department, and the Security Facility (300 area)

Adequate room is available for expansion of each of these support functions.

E1.6.5 Housing/Amenities Functions: 600 Area

The housing functions in the 600 area are not expected to change within the next 10 years and are being rehabilitated and upgraded in keeping with their mission. The 600 area will be maintained as a site amenity retaining much of the character of the original Freund estate. Several of the small ancillary facilities that reflect the origins of the property as a country estate are no longer operationally productive. They are not being replaced or upgraded and are pending disposal. Additional housing (Argonne Guest House) north of the APS complex accommodates APS users. No current plans exist to increase the housing function of the Laboratory.

E1.6.6 Managed Open Space

The managed open spaces throughout the center of the site will be maintained in their present condition as buffers between the developed portions of the site and more sensitive wetland and floodplain areas. Efforts are under way to reestablish native plant species in many of these areas, several of which are currently being

actively managed to increase biodiversity. These ecological restoration activities include enhancing oak woodland, savanna, wetland, and prairie habitats in the undeveloped portions of the site, controlled burning, hand clearing of invasive shrubs, and restoration of sunlight to native woodlands so that native flowers and grasses can grow.

The upland areas around a major site wetlands area have been planted with prairie species to cleanse water feeding the wetlands. The area surrounding the reflecting pond in front of the main administration building is being used to demonstrate the use of native plants for landscaping, after removal of invasive weedy plants and replacement with native species.

E1.6.7 Environmentally Sensitive Areas in and Adjacent to Identified Floodplains

Environmentally sensitive areas will remain undeveloped. Ongoing monitoring will ensure the environmental integrity of the interconnected watercourse system that helps delineate the developed areas and enhances the beauty of the site. These areas are increasingly important with regard to habitat restoration and land management. They include most of our wetlands areas and our wetlands "bank." Argonne's wetlands management strategy, as described in a September 2001 DOE *Environmental Assessment* included creating advanced compensatory mitigation as approved by the U.S. Army Corps of Engineers (COE). The advanced compensatory mitigation is similar to a wetlands bank and is to be used to offset wetlands losses at Argonne.

Argonne restored several acres of high-quality wetlands in the 400 area by disabling a drainage tile network installed when the land had been farmed. One acre of the restored wetlands will replace a small wetlands area lost after construction of the APS and resolve a COE enforcement order. Once the vegetation quality is acceptable to the COE, the remaining restored wetlands acreage will be available to offset loses of small wetlands areas in other portions of the Argonne site, many of which are so small and of such poor quality that they have little ecological value. Monitoring data for the past two years have shown improving vegetation quality on several acres of restored wetlands.

E1.6.8 Argonne Park (East of Cass Avenue)

Argonne Park has for many years been a much-used employee resource and is dedicated for continuation of this use. The Child Development Center, which opened in 1992, keeps this area in continued year-round use by Argonne and DOE employees. No plans are in place to significantly alter the facilities or operation of this area, although land is available to accommodate selected additional facilities.

E1.6.9 Former Ecology Plots

Several vegetation surveys of the Argonne site were performed in the early 1960s, as a consequence of interest in prairie restoration and in establishing a site ecology program. Ecological research and teaching have continued since that time. In recent years, these activities have focused in the extreme southwestern part of the site and the branch of Sawmill Creek containing the Freund ponds.

The largest of these areas, which is also the site of the meteorological tower (Building 489), contains several habitats, including a marsh wetlands area and a prairie pond ringed with cottonwood trees. The pond is of particular ecological value, because it is relatively undisturbed and very different from other ponds on the site or in the nearby forest preserve. This pond receives no sediments from surface drainage and has not been disturbed by either goose or beaver activity. Research is comparing this pond with the newly created mitigation pond on the APS site. For several years, this area has also been used for research projects as part of college curricula in ecology and botany.

Nearby Freund Brook contains several upstream ponds created by beaver activity, which were the focus of dissertation work with the University of Chicago. The pond is also the site of an ecology field experiment conducted by the University of Chicago on the effects of predation on competition among duckweed species.

Sawmill Creek has also been the site of additional field experiments conducted by University of Chicago faculty. These locations play an integral part in the current ecologically based land planning and continue to be used for research and teaching in the ecological sciences. The locations will continue in that status, unless significant programmatic initiatives require their conversion to alternative uses.

E1.6.10 Areas under Stewardship Management

In addition to the management area types discussed above, three special "overlay" areas reflect the Argonne landfill and several formerly contaminated areas now under long-term stewardship management. These areas are designated in Figure E1.1 with red cross-hatching. Consistent with their status as stewardship sites, no change is envisioned for the foreseeable future.

E1.7 Master Plan Map

Argonne's master plan is in Figure E1.1.

E1.8 Land Management

Since the site's inception, Argonne has pursued a policy of development that retains large open, undisturbed areas between developed research areas. This was a useful safety feature. Early environmental and meteorological monitoring and safety alert systems were established to provide warnings for potential radiological incidents that would be primarily prone to atmospheric transport, hence requiring early determination of near-ground-surface air flows for reliable predictive responses. These requirements, in turn, established the need for minimal ground-plane disturbances to undeveloped portions of the site, especially upwind (to the west).

Subsequent development patterns and increasing environmental research programs and capabilities have reinforced the pattern of using the unaffected areas as *in situ* laboratories for environmental studies. This use pattern has led to the identification of archaeological and environmental resources and has promoted a *de facto* process of preservation — by avoidance of disturbance — for such areas wherever possible. In the last decade, awareness has focused on these areas and their remnant vegetation as relic resources, potentially very much intact since presettlement times, if indeed now vulnerable to the increasing spread of nonnative plant species and neglect.

After several years of *ad hoc* management initiatives funded through operating budgets, Argonne has formalized an advisory committee to more systematically address emerging management issues related to habitat and to preview and propose, as appropriate, innovations in management of undeveloped areas of the site. The committee is also charged with identifying opportunities to increase environmental awareness within the Laboratory community. This committee creates a forum for addressing the new DOE requirements to develop a comprehensive long-term native landscape plan.

Land management and habitat restoration have been growing areas of concern. Preservation and husbandry are needed to protect the Laboratory's scarce habitat types from encroaching development through preservation and husbandry, as well as from the invasive species that are increasingly prevalent in the Chicago region. Argonne has established a Land Management and Habitat Restoration Advisory Committee to review policy and monitor actions by in-house personnel and contractors addressing on-site opportunities for improving environmental conditions or mitigating emerging problems. The policy framework is flexible enough to permit location-specific responses to needs for mitigation, environmental restoration, and diversification of landscape forms and materials. Increasingly used strategies are introduction of cost-saving native species and reduction or elimination of non-native or potentially invasive plant species.

Progress will be tracked by using area-weighted environmental indices for each of the management area types. As needs for additional or changed management practices are identified, the committee will seek consensus on a policy recommendation or will solicit support, as required, for necessary funding. The committee will also develop and recommend multiyear work program actions and monitor the effectiveness of implementation actions.

As summarized in Table E1.1 and as depicted in Figure E1.2 in application to the site, the policies and application guidelines will be the basis for continued improvement in habitat quality, diversity, and control of invasive species.

Projects coordinated with environmental compliance activities related to wetlands mitigation have complemented the committee's efforts to date. The committee is establishing site baseline conditions that will drive priorities for the site. Major issues include the control of invasive species and the management of areas that have not been addressed adequately. Argonne expects that DOE will continue its high level of interest, as evidenced in performance contract measures (see also Section D.11) and participation on the advisory committee.

TABLE E1.1 Land Management Strategy

Long-Term Objective for Continuous Improvement	Site Area[a]		
	Environmental Reserve	Development Reserve[b]	Developed Areas
Control of Invasive Species (Highest Overall Priority)			
Wooded Areas	Buckthorn, oriental bittersweet, honeysuckle	Buckthorn, oriental bittersweet, honeysuckle	–[c]
Open Fields	Canada thistle, teasel, crown vetch	Canada thistle, teasel, crown vetch	–[c]
Wetlands	Reed canary grass, cattails, common reed	Reed canary grass, cattails, common reed	Reed canary grass, cattails, common reed
Wetlands Banking (Highest Implementation Priority)	• Restore high-quality wetland environments. • Retain or re-establish higher water quality in monitored flows.	• Maintain upland areas. • Ensure that development does not encroach on lowland areas. • Control cattails and reeds.	• Supplement natural wetlands. • Introduce diversity and ecological benefits for outreach and LEEDS.
Habitat Restoration	• Retain existing and residual diversity. • Control or eliminate invasives. • Reestablish or increase diversity where continuity is needed.	• Convert old field to prairie habitat. • Maintain by using controlled burns rather than herbicides or mechanical controls. • Retain residual diversity.	• Establish viable wetlands and adjacent upland habitat in support of wetlands banking. • Use gained acreage to augment natural wetlands and compensate for removal of non-jurisdictional wetlands. • Preserve mature oak trees; establish age diversity.
Biodiversity	• Retain existing and residual diversity. • Control or eliminate invasives. • Reestablish or increase diversity where continuity is needed.	• Reintroduce former plant communities for economy versus mowing or herbicide use.	• Use new development and redevelopment as catalysts for environmental improvement and LEEDS certification. • Use introduced native species for outreach.

[a] Refer to Figure E1.2. These three areas of the site are approximately equal in size: Environmental Reserve, 34%; Development Reserve, 31%; Developed Areas, 35%.

[b] Strategies for the development reserve are for mid-term (rather than long-term) implementation.

[c] Invasive species in wooded areas and open fields in the developed portions of the site are largely controlled by mowing.

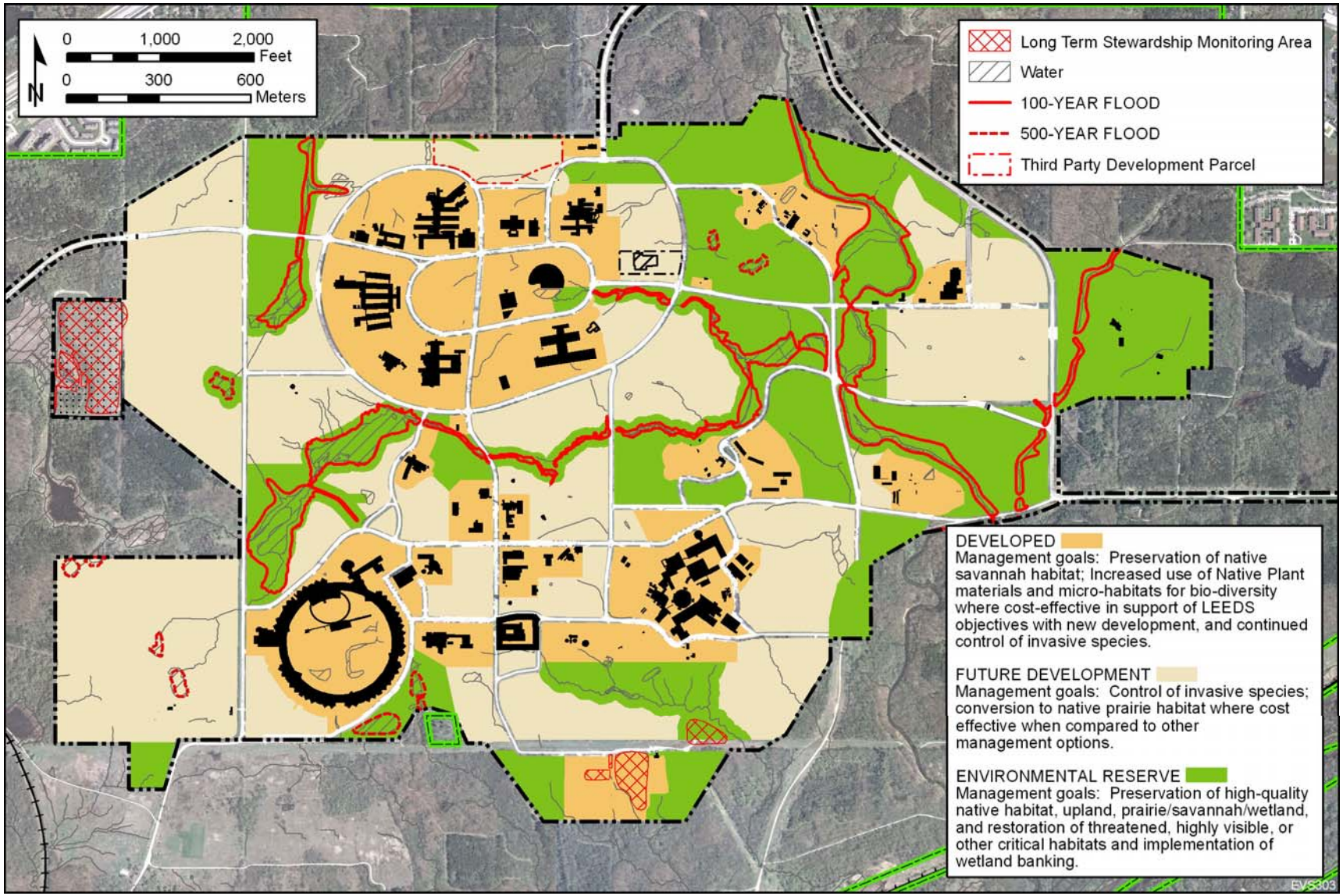

FIGURE E1.2 Land Management Areas

E2 Appendix: Inventory and Maps of Buildings

This section contains detailed information about each of the facilities summarized in Chapter B. These individual facilities and their intermediate groupings by location or function directly affect Argonne's site infrastructure and its support of DOE research missions. The organization of this section is based on a functional subdivision of the site between the various developed areas, sitewide nonutility infrastructure, and the utility systems reported through FIMS.

Development of permanent facilities has largely adhered to the initial architectural site development planning of the late 1940s and early 1950s. The Inner Circle Drive and the Outer Circle Drive form the pattern followed in most subsequent development. The first research buildings were constructed between the two roads. Early special-purpose nuclear facilities were located south of the two roads to provide meteorological advantage in the event of accidental releases. This precedent was followed in later development.

Most facilities are clustered the following ten distinct areas: east area, 100 area, 200 area, 300 area, 360 area, 400 area, 500 area, 600 area, 800 area, and Argonne Park (900 area). Detailed descriptions of each of these areas and the special concerns and opportunities associated with them are in the sections below. General sitewide infrastructure (roads and bridges, parking, and pedestrian circulation and walks) and security-related assets (guard posts and fencing) are also discussed, as are several large utility facilities that are separate from the cluster areas.

Argonne allocates facility-related funding on the basis of its ESH&I prioritization process by using the methodology described in Section D.2. Sitewide plans for elimination of the DM backlog address all needs, prioritized on the basis of risk as evaluated by management. These plans are therefore not addressed specifically in the discussions of the site subareas and infrastructure systems.

E2.1 Existing Developed Areas of the Site

The Argonne site (Figure E2.1) has historically been developed as a series of related but spatially segregated functional groupings. This pattern began in 1948–1950 with the designation of the 800 area for contractor staging, the east area for initial administration and research, and the 200 area for long-term scientific research. Concurrent development of the 100 area for the centralized steam utility and the water processing and distribution center and the 500 area for wastewater processing continued the functional pattern of development. Later, special-purpose facilities were initially clustered along the Meridian Road-Rock Road-Bluff Road accesses (300 area), housing facilities were located in the 600 area, and the ZGS was constructed in the 360 area. The APS project and its supporting housing facility, both located in the 400 area, continued this pattern.

Each of the following sections describes a different portion of the existing site's development pattern. Each section describes the approximate extent of the site area, contains a brief summary of the historical pattern of development and its purpose today, and includes a map of that portion of the site. For each area, Table E2.1 (at the end of Section E2) includes the gross floor area; current occupant count; and summary financial indicators based on RPV, including TRIC, reported DM, the ACI, and the SCI. The ACI is a decimal value based on the ratio of DM to RPV (1 – [DM/RPV]). The SCI equals the ratio of all known needs to RPV (SCI = TRIC/RPV).

E2.2 East Area

The east area (Figure E2.2) occupies approximately 113 acres immediately west of Cass Avenue and east of Sawmill Creek. Less than 10% of the east area is now developed, although it was

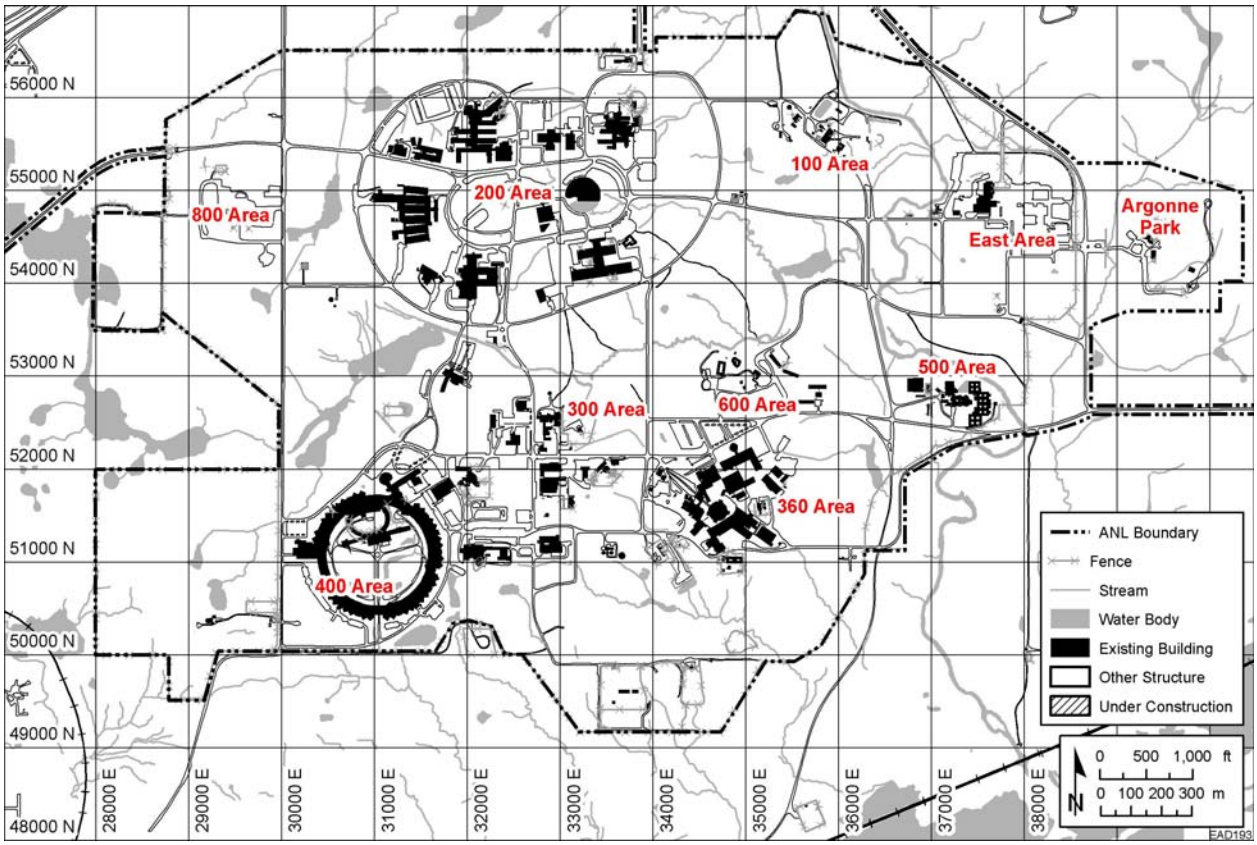

FIGURE E2.1 Developed Areas of the Argonne-East Site

heavily developed from the late 1940s through the 1970s, with over 80% coverage of buildings, walks, parking lots, and roadways.

The east area once contained some of the oldest facilities on the Argonne site. Only Building 040 remains. The remaining original buildings erected in about 1950 for interim use during initial site development have been demolished.

Revitalization of the northern portion of the east area began with the Central Supply Facility (originally constructed as the Transportation and Grounds Facility), located north of the Eastwood Extension. As the original buildings were demolished, foundations were removed, utilities were capped, and the sites were graded and seeded with grass cover as interim landscaping. Most recently the Laboratory has turned to use of native plants to reestablish prairie habitat and reduce the need for mowing.

The east area is not currently envisioned as a major contributor to overall modernization, though it is a potential alternate location for the Global Nuclear Energy Partnership initiative and remains available for a mid-to-large mission assignment. A primary factor affecting future missions in this area is its relative separation from the other developed areas of the site, which would reduce the level of informal interaction and collaboration for personnel working there. On the other hand, this relatively large, essentially impact-free brownfield location offers exceptional potential public access along Cass Avenue and ample room for expansion.

The predominant habitat type in the east area is old field, consisting primarily of nonnative grasses. Scattered areas of open oak woodland occur west of Tech Road. The riparian area along Sawmill Creek consists of intermittent open grassy

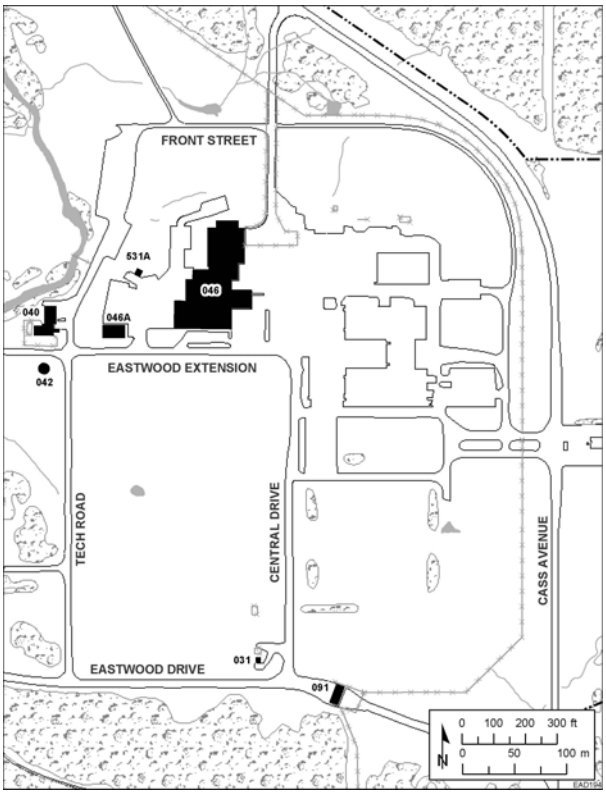

FIGURE E2.2 The East Area

areas and open woodland. A native tallgrass prairie is being restored on a six-acre plot in the far southeast portion of the area. Begun in 1997, the restoration has been expanded over the last several years to include areas where additional facilities have been removed. Progress of the restoration is being monitored closely. Future maintenance of the prairie will increasingly rely on scheduled burns to restore to dominance the environmental factors required for the prairie ecosystem. In much of the old field area, extra effort is needed to suppress invasion by weed species such as teasel and Canada thistle. Long-term habitat policy is to continue to convert old-field areas to a prairie habitat that is more resistant to invasive species and will ultimately require less maintenance. Heavily wooded and riparian areas along Sawmill Creek at the southwest fringe of the east area include some of the highest levels of remnant oak savannah habitat on the site. Maintenance/restoration of the heavily wooded and riparian areas through removal of heavy infestations of buckthorn and other woody and herbaceous nonnative plants is a high priority.

The D&D and subsequent removal of Building 040 began in late FY 2005. When the last active occupant (the Radiological Assistance Program) moves out of the facility by FY 2009, removal of significant original buildings in the east area will be complete. This area is now a strategic reserve for large-scale missions, being well-suited for a graded level of security access, given the proximity to Cass Avenue and the large physical separation from the remaining developed areas of the site. Overall, the condition of the facilities is adequate; DM is negligible, with a composite ACI of "excellent." Limited utility capacities and a lack of several specialized sitewide support utilities (chilled water, canal water, laboratory sewer), limited natural gas and steam, and significantly degraded roadways contribute to the need for recapitalization through new construction and mission-related redevelopment.

Because of the unique potential for graded security access offered by the east area's Cass Avenue frontage, Argonne has long planned for future development of a Technology Transfer Center or other unique facility there. The east area is also a potential future location for site support service facilities, should future expansion be required.

E2.3 100 Area (Central Heating Plant)

The 100 area (Figure E2.3) includes the steam generation and domestic water treatment plants

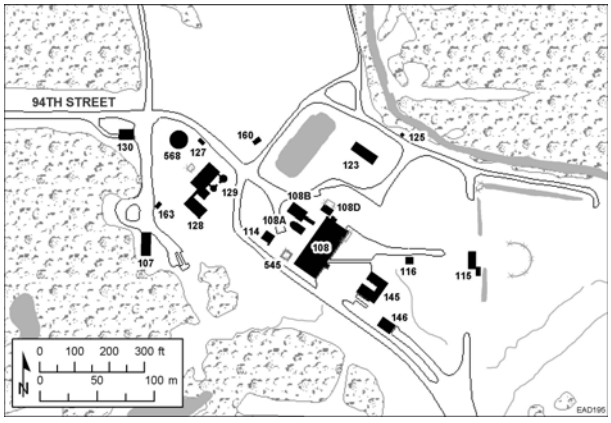

FIGURE E2.3 The 100 Area (Central Heating Plant)

and various ancillary facilities, such as the coal pile. Conditions at the steam generation facility are discussed in more functional detail in Section E3.3.1.1. Use of Lake Michigan water is discussed in Section E3.3.3.2.

Roughly 25% of the 62-acre 100 area has been developed. Most recently, the area has accommodated the site's control connection to the Lake Michigan water feed from the north corner of the east area. This area is bounded by Sawmill Creek to the east, Eastwood Extension to the south, the Argonne fence to the north, and the 200 area to the west.

Large areas of high-quality mature oak forest lie west and northwest of the 100 area; smaller areas of mature forest are to the northeast, across Sawmill Creek. A mosaic of pine forest, old field, and open woodland occur to the northeast and south. Open woodland is extensive within the riparian area along Sawmill Creek, while the floodplain consists primarily of old-field habitat.

The functionality of the 100 area is essentially steam production (Section E3.3.1). Therefore, the overall physical condition of this area closely follows that of the steam plant. As defined in the CAS inspection process, facilities in this area are generally in need of significant rehabilitation, though the main boilers at the steam plant remain operational well beyond normal expected service life. The level of DM is classified as "adequate," primarily reflecting needs in the central boiler plant. However, recent improvements in the coal-handling system and other ancillary support systems for the main boiler plant have led to small reduction in DM levels. The condition of the roads is below the standard for the site in general because of the truck traffic for coal deliveries and the relative remoteness from the other developed areas of the site. The future operational configuration of the steam plant remains under review to (1) identify strategies that will recapitalize the base plant and (2) evaluate modified service options that might improve the cost performance of the operations.

Continued maintenance and upgrading of the plant and equipment are scheduled for the 100 area. No immediate need for expansion of support facilities is foreseen at this time.

E2.4 200 Area

The 200 area designation for the central area of major development of the Argonne site is derived from the numbering of facilities within the area from 200 to 291. The 200 area contains the largest concentration of present R&D activity and virtually all Argonne and DOE management activities. This has traditionally been the center of the permanent, multipurpose Laboratory effort in terms of floor area and number of personnel.

The 200 area (Figure E2.4) comprises approximately 280 acres. About half of the 200 area land has been developed; about 100 acres are reserved for future development. The 200 area is bounded by Freund Brook to the south, a tributary to Wards Creek to the west, the Argonne fence to the north, and the 100 area to the east.

Most of the 15 permanent structures in the 200 area are research-oriented light laboratory and office buildings. Each typically includes a small auditorium or seminar room and other specialized support facilities, such as one or more shops for light work on machines, glass, and instruments.

Expansion and continued modernization of the scientific multiprogrammatic core, being sought through planning needs identified in the SLI modernization initiative, is being pursued largely through the revised funding strategy of DOE-SC.

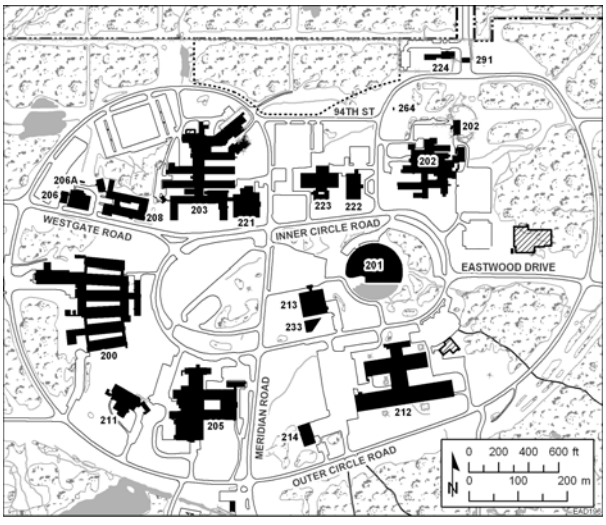

FIGURE E2.4 The 200 Area

Additional modernization efforts focus around the TCS Facility at the northern fringe of the site, being pursued under third-party funding. Longer-range expansion focuses on the capabilities of the existing ATLAS accelerator system north of Building 203, with the CARIBU project now under construction. Longer-term consideration of the AEBL initiative and the supporting Illinois Science Center is proposed for underwriting by state of Illinois funding. The 200 area includes two additional initiatives that are currently nearing completion of construction: the SAMM Facility east of Building 212 and the Howard T. Ricketts Laboratory being constructed by the National Institutes of Health and the University of Chicago southeast of Building 202.

Most of the infrastructure (roads and utilities) and permanent buildings in the 200 area were constructed in the early 1950s and are approximately 50 years old. Many building systems have exceeded their design lives, although basic structures are generally in good to excellent condition. Ongoing and planned rehabilitation projects are addressing these issues. Many of the specialized scientific facilities have reached the end of their programmatic usefulness.

Continued use of the three major nuclear facilities in the 200 area — the AGHCF in Building 212, the M-Wing Hot Cells in Building 200, and G- and K-Wings in Building 205 — is necessary throughout the planning horizon to address identified needs in Argonne's radiological operations. All of these nuclear facilities require rehabilitation, reinvestment, and continued operational support for safe handling and storage of existing radiological materials remaining on-site from previous Argonne research activities. No ready alternative is available for off-site shipment of these waste materials. Current estimates are that as much as 15 years will elapse before closure of these facilities and their subsequent decontamination and disposal become feasible.

The primary vegetation type in the 200 area is mowed lawn. Open woodland occurs in scattered locations throughout the area, and mature deciduous forest occurs in the eastern portion of the area. Wetlands consist primarily of narrow drainages and roadside ditches; however, two large wetlands lie west and southwest of the Outer Circle Drive.

The presence of most of the original multipurpose scientific buildings in the 200 area dictates the area's overall condition: significant improvements and modernization are needed. Although the level of civil infrastructure is quite high, compared to other areas of the Laboratory, the need for building modernization, in addition to the incorporation of new missions and scientific initiatives described in Chapter C, clearly establishes the 200 area as the predominant center of ongoing recapitalization. Deferred maintenance, notably the uniformly aging roofing systems, is proportionately higher only in the 600 area, which does not perform to the capabilities required for direct support of the research and scientific missions being conducted in the major laboratory-office buildings in the 200 area. The focus of the SLI modernization initiative on initially providing new multiprogram facilities in the 200 area broadly reflects the need for major rehabilitation throughout the area. These decisions recognize the acute need for more flexible, collaborative configurations, to be achieved both within the modern envelopes and by increasing density in more centralized locations at the heart of the campus. As summarized in Table E2.1 (at the end of this section), the overall condition of the 200 area is rated "adequate" (0.93) by the ACI measure.

E2.5 300 Area

The 300 area, located south of the 200 area, includes facilities numbered from 300 to 350 (Figure E2.5). Most of these facilities were constructed in the early 1950s to house nuclear reactors and other special-purpose nuclear work. All of the older buildings have major heavy laboratory subfacilities. Most of these highly specialized subfacilities are underused because they are not suitable for present programs. This area is also the location of a recent facility renovation to accommodate growing programmatic initiatives related to homeland security.

Compared to other areas of the site, the 300 area contains a greater variety of geographies,

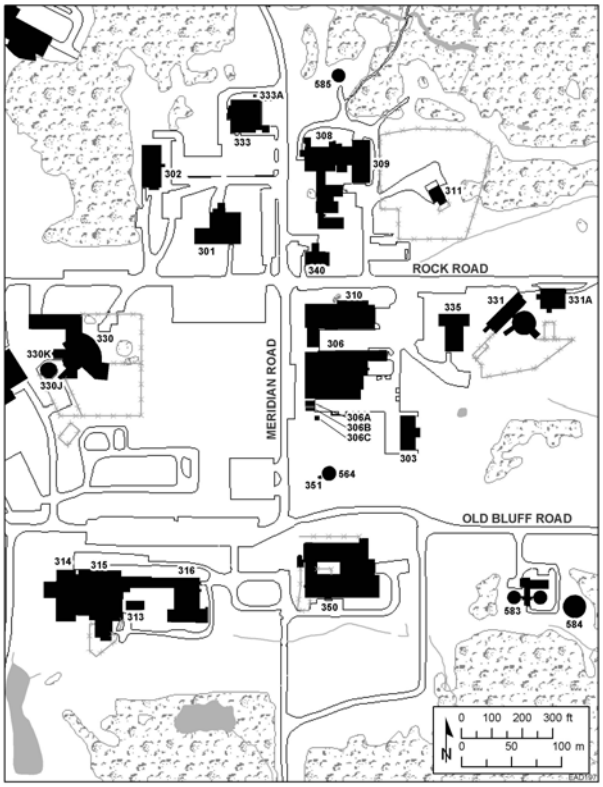

FIGURE E2.5 The 300 Area

running along Meridian Road south of Freund Brook and bounded by the APS (the 400 area) to the west and by Southwood Drive and the 360 area to the east. The 300 area extends southward to the Argonne fence and includes approximately 180 acres, about 30% of which is developed.

The most recently constructed facilities in the 300 area are the Mixed Waste Storage Facility (Building 303), the Security Building (302), and the Fire Station (Building 333). Building 350 was remodeled, renovated, and expanded (with a major addition constructed in 1977) to accommodate the NBL, formerly located in New Jersey. Building 350 recently received numerous additional safety and operational upgrades. Building 340 serves as Argonne's centralized mail distribution center.

Almost all 300 area facilities are permanent structures. Because of age, most require rehabilitation or replacement of mechanical and electrical systems. These identified needs are being addressed as funding allows and priorities dictate.

A significant long-term issue is D&D of former nuclear facilities, support space, and associated process equipment beyond what has been funded by DOE-EM. Completion of these efforts, as well as other D&D projects, depends on proposed future funding from DOE-EM and identification of additional funding from other sources. A more complete description of planned D&D activities is Section D.4. A second long-term issue is the low level of use for many of the other special-purpose facilities in the 300 area.

Like the 200 area, the 300 area contains several of the oldest scientific facilities on the site. Not surprisingly, the two areas are similar in terms of overall need. Unlike the 200 area, however, several facilities in the 300 area are in immediate need of demolition. These are outdated special-purpose facilities that have exceeded both their mission functions and their design lives, as well as several small former waste storage support facilities that are no longer needed. Among the former are (1) the CP-5 Reactor (Building 330), recently returned to Argonne for disposal from the DOE-EM program; and (2) the hot cells associated with the CP-5, Building 301, which is preparing to enter the DOE-EM cleanup process (see Section D.4). Several smaller waste storage facilities are scheduled for disposition in the current year (e.g., Buildings 306A, 306B, and 306C, as well as one of the waste storage trailers associated with support of the Building 306 waste processing operations). Additional older facilities in need of major rehabilitation — in part because they cannot be replaced in the foreseeable future — include Building 306, Waste Management Operations; Building 309, Energy Technology; Buildings 310, 335, and 340; and Building 302, Security.

The NBL (Building 350), also located in the 300 area, is in somewhat better condition than the area as a whole, though in need of some upgrades and recapitalization. This facility is discussed at more length in Section B.4, and it is the subject of needed DOE coordination and resolution discussed in Section D.1.6.

The 300 area also contains a significant proportion of older, inefficient roadways and parking areas that are not segregated from street traffic and are in need of both maintenance and

modernization. Overall, the area is representative of its prevalent age and in need of major rehabilitation, though current levels of DM are not problematic (ACI = 0.956). Nevertheless, the overall condition is classified as "requiring major rehabilitation."

Vegetation in the 300 area consists primarily of mowed grass and old field. High-quality mature oak forests occur to the northwest, south, and southeast, while a mosaic of pine forest, immature deciduous forest, and open woodland lies to the northeast and southeast. A rare, relatively undisturbed oak savanna is south of the Building 314/315/316 complex. Two large wetlands are located to the northwest, along the Freund Brook floodplain.

Ongoing rehabilitation and future D&D of contaminated areas, with removal of obsolete facilities, will continue in earnest. Disposition of Buildings 301 and 330 presents the greatest challenge in retaining Argonne's high ratings for building utilization. Consolidation and elimination of unneeded waste storage facilities offer further potential operational savings as current inventories of stored materials are eliminated. Reprogramming of older special-purpose facilities for emerging missions presents the most favorable outlook for continued utilization of the assets in the 300 area.

E2.6 360 Area

A large, high-energy (12.5-GeV) proton accelerator, the ZGS, was built in the early 1960s and operated from 1964 to 1979 in a complex — now known as the 360 area — comprising 30 distinct facilities that supported the accelerator and its research activities (Figure E2.6). Building numbers in the ZGS complex range from 360 to 399. The developed complex includes 42 acres of the nearly 97-acre developmental potential. Two light laboratory and office buildings, several specialized accelerator subsystem facilities, and numerous shop or heavy laboratory buildings provide the core for this specialized area.

The offices and light laboratories of Buildings 360 and 362 are used heavily. Some of the 360 area subsystems and facilities are used for the IPNS, a significant user facility. Argonne's

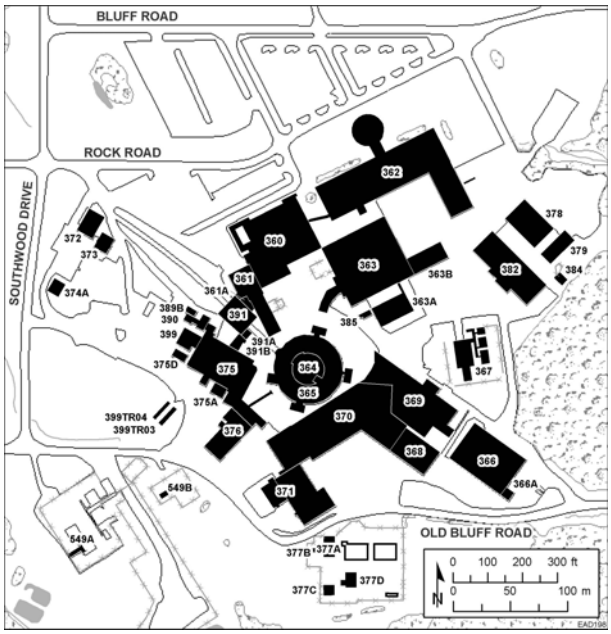

FIGURE E2.6 The 360 Area

Central Shops, with stock and equipment, occupy Buildings 363 and 382. A modular facility, Building 363B, provides additional office space. Generally, the condition of facilities in the 360 area is good. However, most buildings are more than 30 years old, and as the buildings age, the need for rehabilitation has increased. This area will be affected during projected mission changes related to the IPNS, when many ancillary and support structures will be evaluated for mission criticality and economic viability. The central facilities now housing the IPNS beamline and targets will require substantial D&D investment, following a cool-down period after operations have ceased. Accordingly, a number of decision points are well beyond the planning horizon, provided that appropriate alternative missions are not identified and developed in the interim.

The predominant vegetation near the 360 area buildings is old field, with mowed grass in the Bluff Road area. Extensive areas of high-quality mature oak forest lie to the east and south. These forests appear relatively undisturbed. They form a large contiguous tract and support a high diversity of species.

The 360 area benefits from somewhat newer conditions than the original areas of the site and

consequently has fewer age-related needs. Buildings 360 and 362, the two major multi-program facilities that anchor the area, contain over 400,000 GSF (nearly 60% of the total) and are in need of substantial rehabilitation. These are projected to be the focus of a secondary round of complete rehabilitation and upgrading as a part of the longer-range SLI modernization program that is initially being directed toward the 200 area of the site.

Many of the associated buildings in the complex are large-span metal or metal frame buildings, frequently containing high bays, for which modernization costs are significant in proportion to the current value. These conditions are offset somewhat by recent significant improvements to the cooling facility (towers and chiller plant) and to many of the electrical service support functions in the 360 area that now contribute to the IPNS user facility. The reuse of Building 369 as the unobstructed location for housing the test bed for the next generation of large-scale computational advances anticipates availability of the TCS Facility in the near future.

The 360 area as a whole requires minor rehabilitation, including continued maintenance and recapitalization of the undifferentiated parking and circulation areas supporting the cluster of facilities congregated around the original accelerator ring building dating from the 1960s. Deferred maintenance, due in part to the recent upgrades of infrastructure and electrical systems, is somewhat lower than in the other main research areas (ACI = 0.961), for an overall ACI rating of "good."

As with the 300 area, consolidation and elimination of unneeded and/or ancillary support facilities in the 360 area offers potential operational cost savings. Reprogramming older facilities for emerging missions, in particular reusing high bay capabilities, offers the most favorable longer-term outlook for continuation of the general-purpose uses in this area, which is seen as complementing the focus on modernization of the 200 area over the next 10 years.

E2.7 400 Area

The APS occupies over 100 acres of the 400 area in the southwest corner of the Argonne site (Figure E2.7). The facility consists of a linear accelerator/booster synchrotron system that accelerates electrons to energies of 7 GeV or higher and a storage ring into which the electrons are injected. The electrons circulate around the ring, emitting beams of energetic synchrotron radiation or photons. These photon beams emerge from the ring along tangent lines for use in experiments housed in the seven modular user facilities along the circumference of the storage ring. Argonne has completed construction of the CNM (Building 440) along sectors on the west side of the ring, and an additional user module (Building 437) has been framed out and is fully enclosed, in anticipation of planned future collaborative research expansion. Beyond these experimental facilities, the 400 area also includes nearly 50 additional acres, with an expansion capacity of 32 acres and a 4-acre user residence facility, the Argonne Guest House (Building 460). The existing permanent buildings in the 400 area began operation in 1996. The currently undeveloped area of the site immediately south of the CNM is pending state of Illinois

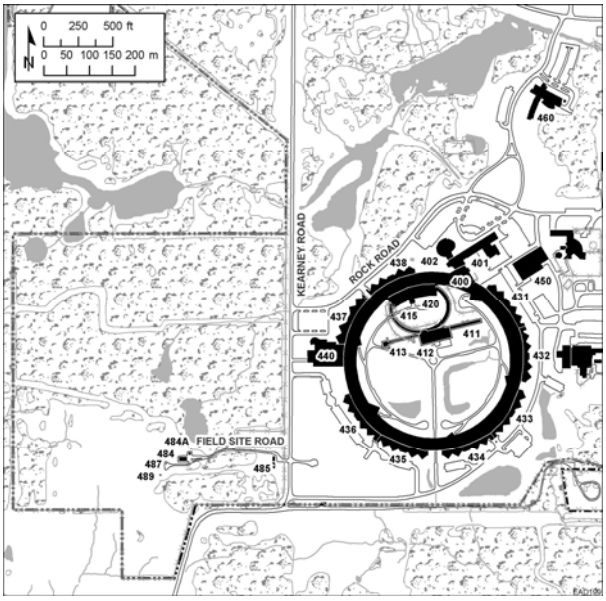

FIGURE E2.7 The 400 Area

approval for funding the conventional construction of the APCF in support of the Laboratory's growing microbiological and nanoscale research capabilities.

Other portions of the 400 area, including Ecology Plot 1, are now used for activities of several other small programs. Present plans call for continued use of these areas.

The meteorology experimental area is in the southwest corner of the 400 area, west of the APS site. For almost 50 years, a cleared area has been dedicated to the investigation of an essentially undisturbed volume of the lower atmosphere. To preserve an unobstructed local wind flow, no major construction or tree planting has taken place in the area. A 197-ft-high meteorological tower west of Kearney Road is used to monitor wind conditions for sitewide emergency response. Two smaller towers are used for atmospheric physics and chemistry research and for monitoring the deposition of atmospheric trace substances. Stations for two national monitoring networks are operated continuously at the site to provide baseline data for environmental assessments in the Midwest. Observations of local weather are also made available for routine and emergency use.

Although much of the 400 area consists of mowed grass and old-field habitat, high-quality native plant communities occur to the west and north. Mature oak forest is located west of Kearney Road and north of Rock Road. A relatively undisturbed tallgrass prairie (about 10 acres) west of Kearney Road represents the only intact prairie on the Argonne site. A smaller prairie (1 acre) nearby was part of a research program in the 1960s. Several relatively undisturbed high-quality wetlands occur west of Kearney Road. These wetlands support a high diversity of plant species, including several plant species not found in other Argonne wetlands. Two large wetlands occur to the north, and a wetland constructed in 1991 for mitigation of APS construction impacts lies to the southeast.

Ecology Plots 1 and 2 are west of the meteorology experimental area in the far southwest corner of the site. These plots are an on-site environmental research field station that supports several ongoing Argonne research programs. The plots provide a secure sample of a typical midwestern environment for ecological research. Although it is too small to be included in the DOE National Environmental Research Park system, the area is used in the same way, and scientists and students carry out many projects there.

The southern third of Ecology Plot 1 is used for dry deposition research. Most of the ecology plots have been left as undisturbed prairie or woodland to avoid interference with meteorological measurements.

The structures now located in the meteorology experimental area are Buildings 484 and 484A (the meteorological facility and associated storage building), Building 485 (the greenhouse, which is used periodically for ecology studies), and Facility 489 (the sitewide emergency response tower). Operation of the emergency response tower requires a minimum unobstructed area of 600 ft from the tower to provide representative wind conditions for sitewide emergencies. The present location of this facility is unique; it is the only area on-site with undisturbed near-ground airflow conditions to provide quality-controlled data.

As the newest area of the site, with all but 2,200 GSF built in the last decade, the APS is Argonne's infrastructure flagship. Deferred maintenance is virtually nonexistent, and the level of identified infrastructure need is less than 4% of RPV. Significant additions to vehicular parking are a need related to the success of the user facilities, and the recent addition to the central utilities plant, Building 450, is an additional indication of the facility's success and growth. Construction of the CNM is a key recently completed programmatic initiative. Funding from the state of Illinois is providing the building infrastructure for the DOE-provided research equipment. The challenge for the southwest portion of the site is to retain growth potential for additional utility services, along with a high degree of excellence in physical plant, as more pressing conditions in the remainder of the site demand resources for recapitalization. Increased central chilled water capacity is needed for planned expansion and to improve reliability. As the facility enters its second decade of service, early evidence of needs for age-related maintenance and growth-related upgrades is expected to appear, and levels of need are expected to grow accordingly. The scientific goals

of the continued operations are for significant advances to the beamline and accelerator capabilities, which are expected to entail some additional infrastructure requirements in excess of the normally anticipated service needs.

The 400 area east of Kearney Road will remain dedicated to programmatic expansion of facilities closely related to the APS. West of Kearney Road, the land is being retained as an undeveloped land bank for large-scale missions that cannot be accommodated in the other programmatic research areas or in the brownfield areas of the site (east area and 800 area), where large-scale redevelopment is encouraged.

The ERL represents a pre-conceptual vision for mission growth into areas that will transcend the general past planning framework, requiring potentially significant expansion in capacity and the reconfiguration of numerous site utility systems, as well as modifications to the on-site vehicular circulation network. Definition of the ramifications of these potential changes will improve as the scientific proof of concept proceeds and more specific conventional facilities are developed. These requirements currently cannot be determined with any degree of specificity. Consequently, their documentation in the *Ten-Year Site Plan* and land use plan will be reflected in the annual updating of Argonne's Inventory and Maps of Buildings (this Section E2).

E2.8 500 Area (Wastewater Treatment Area)

The facilities for treating sanitary sewage and laboratory drain water are located together on the southeast corner of the site (Figure E2.8). The individual facilities and buildings are numbered in the 570 series if they serve the sanitary wastewater treatment process and in the 590 series if their functions pertain to the treatment of laboratory wastewater.

The 500 area encompasses some 18+ acres east of Railroad Drive. The area is bounded by Sawmill Creek to the north and east and by the Argonne fence to the south. The area is presently 60% developed, with an expansion capacity

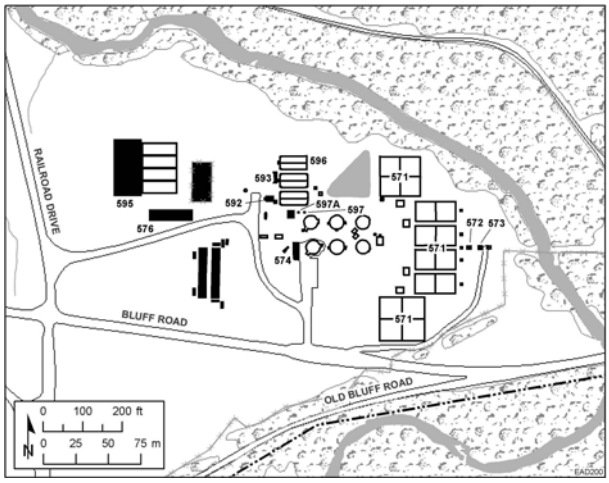

FIGURE E2.8 The 500 Area (Waste Treatment)

of slightly more than 3 acres. Additional plant expansion would require removal of obsolete or unused filter beds and associated support structures.

The predominant vegetation of the 500 area is mowed grass and old-field habitat. The riparian area along Sawmill Creek supports an extensive scrub/shrub community. A large deciduous forest dominated primarily by mature oaks lies northeast of Sawmill Creek.

The Argonne wastewater treatment plants were significantly upgraded and recapitalized in the 1990s to meet higher required levels of service and to reduce effluent concentrations in conformance with more stringent National Pollutant Discharge Elimination System (NPDES) permit requirements. As a result, the overall condition of the area is adequate, with an ACI rating of "excellent" regarding DM. As with the APS, as these facilities enter their second decade of operations, minor growth in needs and maintenance requirements is expected. No significant capacity expansions are planned, as the existing infrastructure can process considerable additional flow. Due for completion at the end of the current year is a feasibility study of recycling treated effluent from the laboratory and sanitary wastewater treatment plants as an alternative source for the canal water system feed. (See the discussion of the canal water system in Section E3.3.5.2.) Current flow is well below

historical levels because of changing technologies and research, as well as somewhat lower current and forecast site populations than in the past.

No additional development in the 500 area is foreseen at this time, beyond the recent treatment upgrades described above. The area east of Railroad Drive and immediately west of the existing development is being held as a strategic reserve for additional plant capacity in the future.

E2.9 600 Area (Lodging)

One of the parcels in the original Argonne site was the Freund estate, the country home of a private family. At the time of initial site development, about 1950, the only accommodations for visitors were in downtown Chicago, about 25 miles away. Consequently, the Freund residence (now Freund Lodge, Building 600) was converted to a guest house for visitors to the Laboratory. The facility provides meeting space and overnight accommodations for scientific and technical review committees and other business visitors and groups. The building also frequently serves as a site for high-level management meetings.

The 600 area (Figure E2.9) is adjacent to Freund Brook, which forms its northern boundary. The area is also bounded by Railroad Drive to the east, Bluff Road to the south, and Southwood Drive to the west. This area includes approximately 56 acres, 15 of which are presently developed. The remaining 41 acres are held as open space to enhance the environmental continuity of the central water course and to preserve aesthetic and recreational value.

In 1952, two cottages (Buildings 614 and 615) were constructed to provide accommodations for families of scientists on lengthy visits to Argonne, such as university faculty members on sabbatical. In 1958, three motel-style lodging buildings (617, 618, and 619) were built to provide "collegial" accommodations for foreign students attending the International School of Nuclear Science and Engineering (ISNSE) at Argonne. In 1962, an additional lodging building (621) and a combined lounge-dormitory unit (620) were built to accommodate faculty members and students visiting Argonne to perform research at the ZGS.

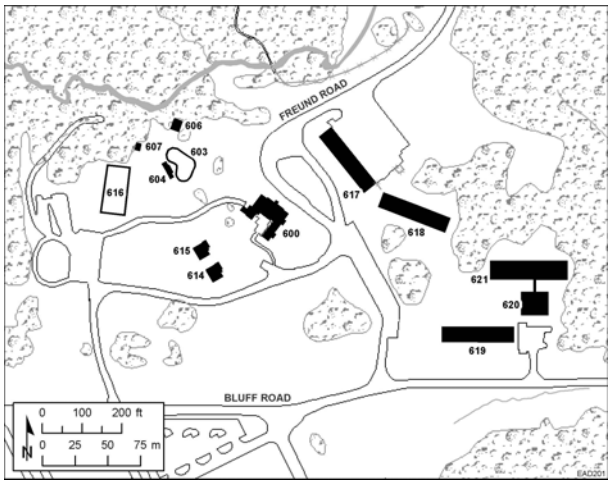

FIGURE E2.9 The 600 Area (Lodging)

Although the ISNSE ended in 1964 and ZGS operation ceased in 1979, other educational and scientific programs have generated a continuing need for lodging facilities. The newest of the 600 area buildings is 40 years old, and considerable regular maintenance is required. Significant architectural and mechanical rehabilitation is also required to improve the reliability of the various building systems. Since FY 1997, Sodexho Corporation has handled the daily operations and maintenance of the housing function, along with those of the Argonne Guest House (Building 460).

Extensive areas of open oak woodland and high-quality mature oak forest are the dominant vegetation of the 600 area. These forests appear relatively undisturbed. They form a large contiguous tract and support a high diversity of species. Large areas of immature deciduous forest lie to the west, north, and east. A large internal drainage area containing remnants of an open-water pond system lies to the north along Freund Brook. These features were created by stone dams placed across the stream. A third dam was destroyed during a storm in 1996, and the associated wetlands have subsequently reverted to upland.

The 600 area lodging facilities are evidencing their age more significantly than major scientific buildings of comparable vintage. Overall, this portion of the site is in need of significant major rehabilitation to the point of replacement. Because these facilities are not constructed to a standard comparable to that of the research facilities, and

because the tolerances to which they are required to perform are far less exacting, a *de facto* graded approach has long been used in reinvestment in and maintenance of the residential facilities and related amenities. Continued use of the area for housing out-of-town and foreign visitors and students is envisioned in support of several ongoing programs. The levels of DM are being reduced through several current replacements and upgrades of selected building systems in these facilities and will continue to be reduced as the Laboratory evaluates its risk-based allocation of funding and increases its commitment through the MII and other required funding measures to reduce the levels of DM.

The housing functions of the 600 area are not expected to change. The area, including the recreational facilities, will be maintained as a site amenity. Relocation of the Argonne Exchange Club to this area has enhanced after-hours use of that facility. (Exploring alternative means of increasing the capacity of the Argonne Guest House — additional housing located north of the APS complex to accommodate APS users — falls in the midrange of planning priorities.)

E2.10 800 Area

Facilities numbered in the 800 series were constructed near the site's west entrance in about 1950, as temporary storage and shop buildings, by the construction contractor for the initial Argonne site permanent construction. Demolition of the substandard 800 area facilities was completed in FY 1999, leaving in the 800 area only the newly constructed security post (Facility 891A) at the Westgate Road entrance (Figure E2.10).

A plot of about 25 acres just southwest of the 800 area buildings, used for landfill disposal of Argonne and DOE nontoxic solid wastes, was closed in FY 1993; monitoring of the landfill will continue. Nonhazardous wastes are now transported off-site for disposal under a separate contract. The 800 area contains large expanses of recently disturbed land and old-field habitat. A mosaic of pine, immature deciduous forest, and open woodland occurs to the north and south. A wetlands area west of the Argonne landfill (part of a large marsh in Waterfall Glen Forest Preserve), forms the headwaters of Freund Brook.

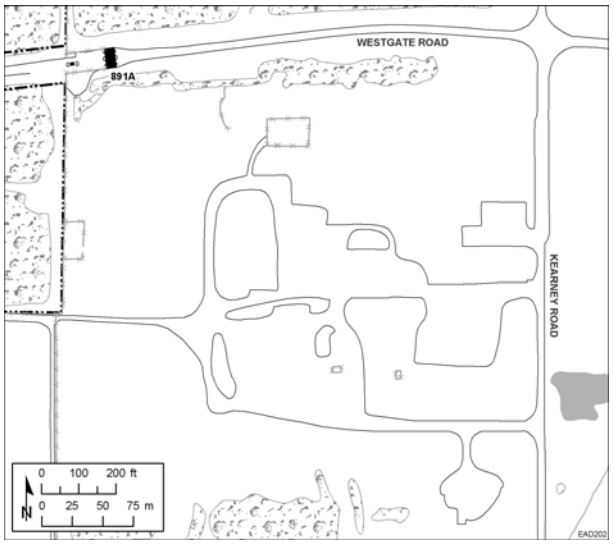

FIGURE E2.10 The 800 Area

The older 800 area guard post, Facility 891, is being retained as an ancillary guard shelter during high-traffic periods of the morning and midday, while the major new security post is located under a weather canopy at a more appropriate location set back from the security perimeter. This configuration enables better performance of the intended function and has significantly improved vehicular flow associated with population growth to the west of the Laboratory. Because of the nature of this facility, DM is not problematic, with an ACI rating of "excellent" (ACI = 1.000).

Clearing of the 800 area site has made it available as a clean parcel encompassing more than 51 acres. Landfill operations on-site were discontinued in 1992.

Consistent with its availability as a brownfield site, this location (along with portions of the East area, a possible alternative) is being evaluated for potential commitment to the Global Nuclear Energy Partnership initiative, although regional screening criteria heavily discount the likelihood of either location. The use of this area — tied to the ERL — is being strongly considered for expansion of the APS mission, as discussed in Chapter C and in the description of the 400 area (Section E2.7).

E2.11 900 Area (Argonne Park)

A plot of some 53 acres east of Cass Avenue has been used for recreational activities since the Argonne site was first developed in 1950 (Figure E2.11). The park setting and ready public access from Cass Avenue also provide an appropriate setting for the Argonne Child Development Center, which accommodates a preschool program (operated under contract) for approximately 75 children or dependents of Argonne and DOE employees. Warm-season use of the facilities and year-round use of the club building are high.

Much of the Argonne Park area consists of mowed grass and old-field habitat. Pine forests occur to the west and south. The mature oak forest along the north and east is part of a larger forest in Waterfall Glen Forest Preserve. A large area of open woodland, including many mature oak trees, composes the north-central portion of the park.

The northern, southern, and eastern boundaries of the park abut DuPage County Forest Preserve land (transferred from federal ownership in the mid 1970s). The narrow strip of forest preserve land on the eastern boundary separates Argonne Park from several privately owned apartment complexes. Despite its narrow width, the lightly developed character of the park serves an important purpose as an ecological bridge for the wildlife and plant communities of the forest preserve.

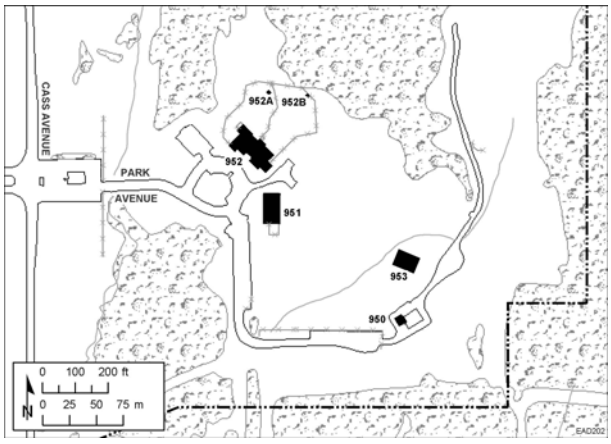

FIGURE E2.11 900 Area (Argonne Park)

Conditions at Argonne Park are bimodal. The older facilities, including the restrooms and the recreation center, are in need of significant age-related recapitalization and improvements, though the levels of DM are acceptable. The newer facilities are in good condition and have little DM. As with the 600 area, this area is not driven by scientific performance parameters, although the Child Development Center is required to meet high standards of operation and is continuously monitored under state of Illinois requirements and other reviews. Overall, the Argonne Park is in need of "minor rehabilitation," focused primarily on the two older structures, and is rated as "good" (ACI = 0.960) in terms of DM.

No significant land use changes are currently planned for the Argonne Park.

E2.12 Miscellaneous Facilities

Numerous utility structures are located throughout the site, either among the developed functional areas or as isolated improvements away from other structures. Utilities are discussed in general functional terms in Section E3.3.

E2.13 Trailers

Argonne relies on very limited numbers of trailers and modular storage containers to meet short-term fluctuations in demand for facilities. In the 1980s, the use of trailers plummeted as facilities in the older east and 800 areas were replaced by newer facilities in the 200 and 300 areas. In the early 1990s, as many as 86 trailers and storage containers, amounting to more than 61,350 GSF of enclosed space, were being used. Leased office trailers have now been eliminated. Modular storage containers amount to no more than 19,000 GSF of unconditioned storage.

TABLE E2.1 Facility Conditions by Area

Site Area	Building Area (1000 GSF)	OCC[a]	RPV ($1,000)	TRIC ($1,000)	SCI	DM ($1,000)	ACI	ACI Rating
East	59.418	70	15,870.3	1,646.2	0.896	123.8	0.992	Excellent
100	86.913	38	59,071.2	9,303.4	0.843	4,307.8	0.927	Adequate
200	2,127.224	2,883	505,135.8	192,455.3	0.619	35,588.8	0.930	Adequate
300	488.251	379	175,358.6	65,432.9	0.627	7,755.8	0.956	Good
360	705.101	600	212,081.6	31,953.6	0.849	8,285.9	0.961	Good
400	1,207.795	795	383,322.4	9,193.7	0.976	186.5	1.000	Excellent
500	20.918	0	19,540.7	623.0	0.968	225.3	0.988	Excellent
600	48.030	0	6,988.3	6,521.9	0.067	3,560.9	0.490	Poor
800	0.128	0	103.0	0.0	1.000	0.0	1.000	Excellent
900 (Argonne Park)	16.624	85	3,173.5	407.7	0.872	103.4	0.967	Good
Totals	4,760.402	4,850	1,380,645.2	317,537.9	0.770	60,138.2	0.956	Good
Miscellaneous (Dispersed)	9.486	0	214,160.5	15,197.6	0.929	3,590.4	0.983	Excellent
Totals	4,769.888	4,850	1,594,805.7	332,735.5	0.791	63,728.6	0.960	Good

[a] OCC, building occupants.

E3 Appendix: Inventory and Maps of Infrastructure/Site Utility Systems

E3.1 Sitewide Infrastructure

This section discusses site civil improvements, especially transportation systems. The site's ground transportation system provides the linkages between all of the developed areas and permits convenient, unobstructed circulation within each of these areas (Figure E3.1).

Transportation improvements include roadways and bridges, parking and vehicle loading areas, and pedestrian circulation, including sidewalks and trails. The approximately 28 miles of roadway at Argonne include the access roads to Cass Avenue and Lemont Road. Approximately 4.5 miles are unpaved; an additional 2 miles of roadway are maintained by DuPage County along Cass Avenue and Bluff Road. These roads serve unrestricted local traffic as part of the general county road system connecting to I-55 and Illinois Route 83.

E3.1.1 Site Vehicular Circulation — Roadways and Bridges

Most on-site travel is by private motor car. Within each area, employees generally walk between buildings. A few individuals bicycle to work and between buildings, but the routine use of bicycles on-site is rare, largely because of the often severe winter weather and frequent spring and fall rains. In pleasant weather, many employees in the 300 and 360 areas walk to and from the cafeteria (Building 213) for lunch. However, little work-related pedestrian travel occurs between areas, because walking time is excessive. Employees routinely use private cars for work-related trips between areas.

Vehicle circulation is controlled by the existing road configuration. Road use during most of the day differs from that at 7:00–9:00 a.m. and 4:00–6:30 p.m., when employees arrive or depart. The main (north) gate is open 24 hours a day, 365 days a year. The west gate is open Monday through Friday from 6:30 a.m. to 7:00 p.m. The east gate opens between 7:00 a.m. and 9:00 a.m. and between 4:30 p.m. and 6:00 p.m. to improve traffic flow during the concentrated arrival and departure of employee vehicles.

Construction, sales, and delivery people, as well as non-U.S. citizens, must obtain a pass at the Argonne Information Center (formerly the Visitor Reception Center) in Building 224. Passes are valid at any open gate, but most visitors enter at Post 291, on Northgate Road, because of its proximity to the Argonne Information Center. Visitors will not need passes for access to a non-secured parking area near the Northgate Road entrance or to the public portions of the planned TCS Facility.

Public transportation is available at the Northgate Road entrance, with scheduled bus service in the morning and late afternoon. This route connects with the Metra train stations in Westmont and Glen Ellyn.

While some employees travel to Argonne via alternative methods of transportation, most travel by private car. Laboratory efforts to promote car pooling and unsubsidized bus and van travel have had little effect on transportation patterns in the past.

Both limited availability of public transportation options and immediate access to expressway interchanges and the road system in the Chicago suburban area contribute to employees' preference for personal automobile commuting. This preference also has enabled a wide geographic distribution of employees' residences, because travel is relatively easy.

E3.1.2 Truck Traffic

Many truck deliveries are made directly to the Central Supply Facility dock at Building 046. Fenced direct access to Cass Avenue segregates truck deliveries and shipping/receiving capabilities. The deliveries do not contribute significantly to on-site traffic. Other on-site truck traffic is so light that minor problems occur only occasionally at entrance gates, though rerouting of errant trucks

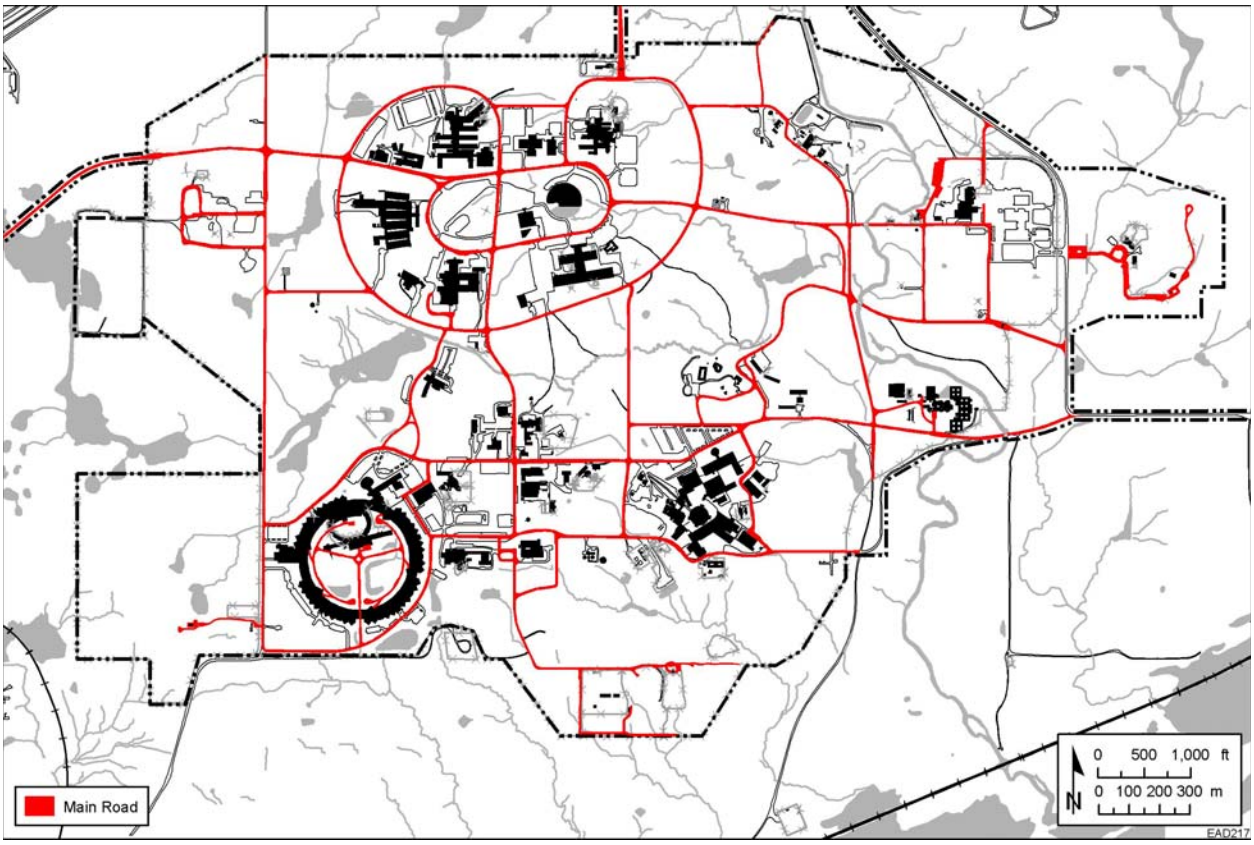

FIGURE E3.1 Road System

is problematic because room to maneuver at the gates is limited.

E3.1.3 Traffic Volume

According to Illinois Department of Transportation standards, vehicle accumulation at intersections and gates is minor, even during rush hours. On-site vehicle accidents resulting in significant personal injury have been extremely rare. Argonne maintains a traffic control light outside the west gate (at Lemont Road). Development along the frontage road south of I-55 has increased the use of Westgate Road at Lemont Road. This location is an area of increasing concern. It has been the subject of several traffic studies and is the subject of a proposed intersection redesign. Increasing employee residence in the expanding suburbs to the west has significantly increased the traffic load at the west gate during normal rush hours, necessitating redesign of the existing guard post to handle increased traffic flows and revised security procedures to move vehicles safely and without substantial queuing.

Redevelopment of the central 200 area and increased programmatic activity in the APS-related (400) area will ultimately affect the large-scale circulation patterns on the site, although circulation within and between subareas is not expected to change significantly over the planning horizon. Relocation of off-site personnel from Building 900 to the site will increase intra-site trips by roughly 5%, contributing to increased traffic congestion during the morning and evening peak hours. Projected near-term intra-site traffic patterns will be evaluated, and their effects on existing vehicular and pedestrian circulation will be analyzed.

With the planned introduction of several scientific initiatives in the 200 area and the relocation of the Building 900 population, congestion during the morning and afternoon rush periods will increase. This may necessitate restructuring of

the main entry traffic pattern serving new initiatives such as the TCS Facility, the Howard T. Ricketts Laboratory, and possibly the ATLAS expansion under the AEBL project. Lines of vehicles longer than 0.5 mile currently form at both exit gates during the afternoon rush. The proximity of the west entrance to the I-55 interchange on Lemont Road creates a problem for southbound employees turning left into the site; this problem is aggravated by the necessity for vehicles exiting I-55 to merge into stopped traffic across two lanes of moving vehicles on Lemont Road. Entering and exiting traffic control has consequently become an issue during peak usage at on-site intersections.

E3.1.4 Parking

Parking lots exist reasonably near virtually all facilities (Figure E3.2). The layout and design of parking lots vary greatly, but capacity generally slightly exceeds present needs, and the use of existing parking generally is unassigned. Sitewide parking capacity is adequate at existing levels of program activity. Two areas of exception to this general condition are in the eastern part of the 200 area, near Building 201, as well as in the vicinity of Building 401, Building 402, and some of the laboratory modules at the APS.

Many lots are in need of repairs because of age-related deterioration aggravated by severe winters. Rehabilitation projects are planned to correct this problem. In older portions of the site, parking and circulation routes are not segregated according to modern practices. In general, these are residual conditions occurring where longer-range objectives include removal of obsolete facilities.

An effort to increase collaborative interaction among researchers housed in different facilities focuses on selective, longer-term increases in the density of buildings in the 200 area, as well as potential expansion of user facilities in the

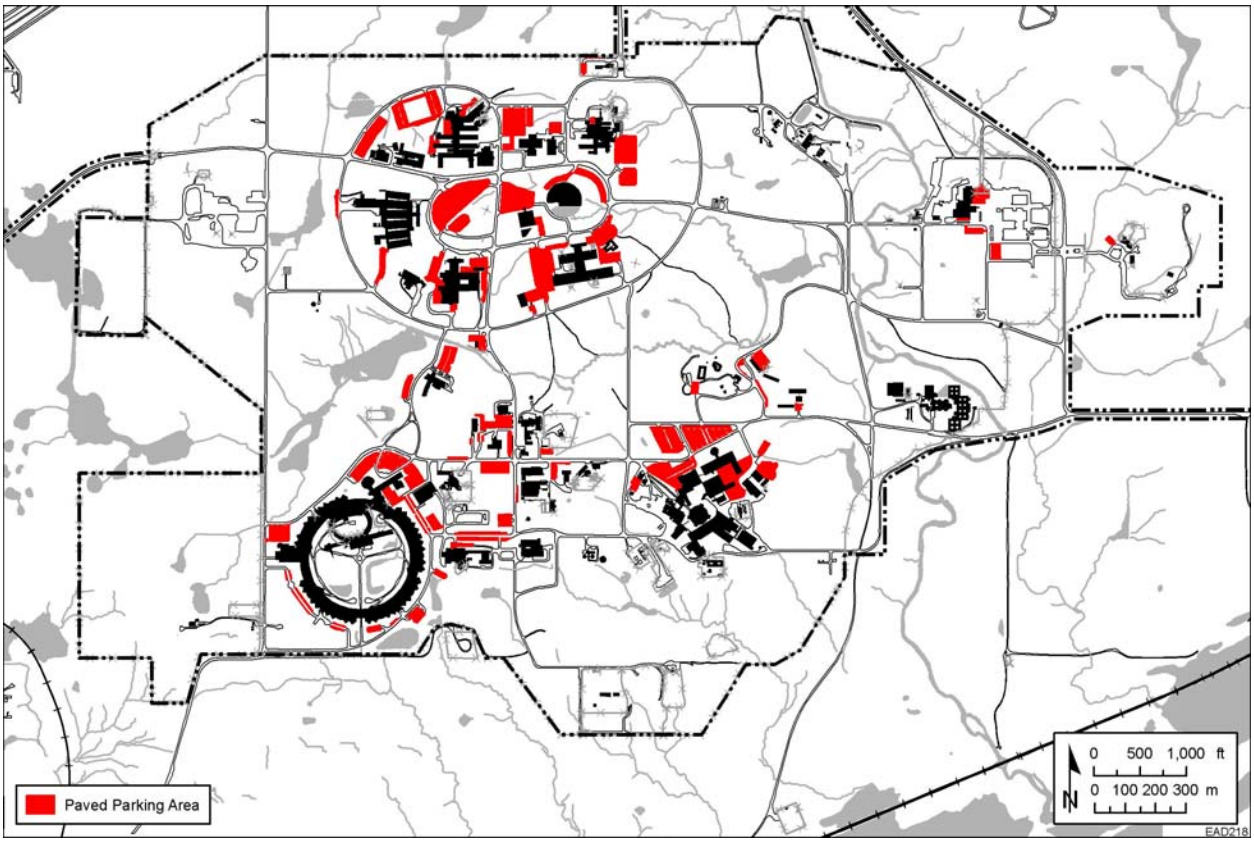

FIGURE E3.2 Parking Areas

400 area. Both approaches will require relocation of some existing parking. Housing significant future population growth, while retaining the current environmental ambiance and clustering buildings to foster desired collaborations, will require either conversion of some surface parking to structured parking or placement of increased surface parking in more distant locations.

E3.1.5 Walkways

Some 7,700 linear feet of sidewalk on-site connect parking areas with buildings and, in the 200 area, provide a pleasant connection between the buildings fronting on the Inner Circle Drive. Numerous trails cross the wooded portions of the site, connecting various subareas. The trails are used frequently during the summer and in fair weather and are a site amenity. These trails, as well as the roadways, serve as a recreational and physical fitness resource for employees during off-duty hours and lunch breaks.

Redefinition of relationships between newly constructed and planned facilities and existing construction will entail careful redesign of pedestrian travel routes between facilities in the developed areas, as well as the routes to and from parking areas. A more coordinated framework for evaluating pedestrian travel and interaction patterns between neighboring buildings will be developed concurrently with additions of new multiprogram and programmatically funded facilities and with the eventual disposal of buildings and reutilization of current building footprints.

E3.1.6 Civil Infrastructure Condition Summary

Overall, the site's civil infrastructure is in need of substantial recapitalization investment and improvement. Parking lots present the single greatest need for improvement, accounting for nearly 60% of all identified deficiencies, aside from needed additional capacity where shortages are now evident. The condition of the site sidewalks is rated as "adequate," with SCI = 0.954. Outside the 200 area, walks serve primarily to carry employees from nearby parking to and from building entrances; they do not constitute an overall all-weather pedestrian system. Roads, which constitute more than half of the asset class value, are in need of substantial upgrading, with SCI = 0.723 and ACI = 0.927, reflecting substantial recent progress in closing some of the most pressing maintenance needs. The most recent sitewide recapitalization of the roadway system was in the early 1980s. Pavement conditions have generally deteriorated to the extent that base damage might occur under harsh weather conditions. This situation is reflected in the lower overall summary condition statistic.

E3.2 Sitewide Security and Safety Infrastructure

The sitewide physical security infrastructure consists of three guard posts to admit vehicles and approximately 38,500 feet of perimeter fencing, with additional fencing inside the site that primarily serves a safety function, in contrast to the perimeter condition (Figure E3.3). Because of the function of these assets, they generally meet a high standard of repair and condition. The east gate guard post (Facility 091) was completely replaced and fully modernized in FY 2004, and the west gate guard post (Facility 891A) was relocated and rehabilitated in FY 2006 in conjunction with roadway improvements to facilitate improved traffic flows, accommodate increased commuter volume, and improve security capabilities. Overall, this infrastructure has an SCI of 0.986 ("adequate") and an "excellent" ACI rating (0.986).

The predominant asset in the security infrastructure category, the fire alarm system, is considered for deficiencies in relation to the various buildings and structures throughout the site, rather than as a single "system." This is because safety needs must be associated as directly as possible with each operating facility to reflect the way that site assets are managed. Several remaining on-site radio repeaters are co-capitalized with the ledger entries for the Security building and Fire Department (Buildings 302 and 333), but they are recorded separately under FIMS. The summary condition of the radio repeater requires minor upgrades, but the ACI ratio is "excellent" at 0.995.

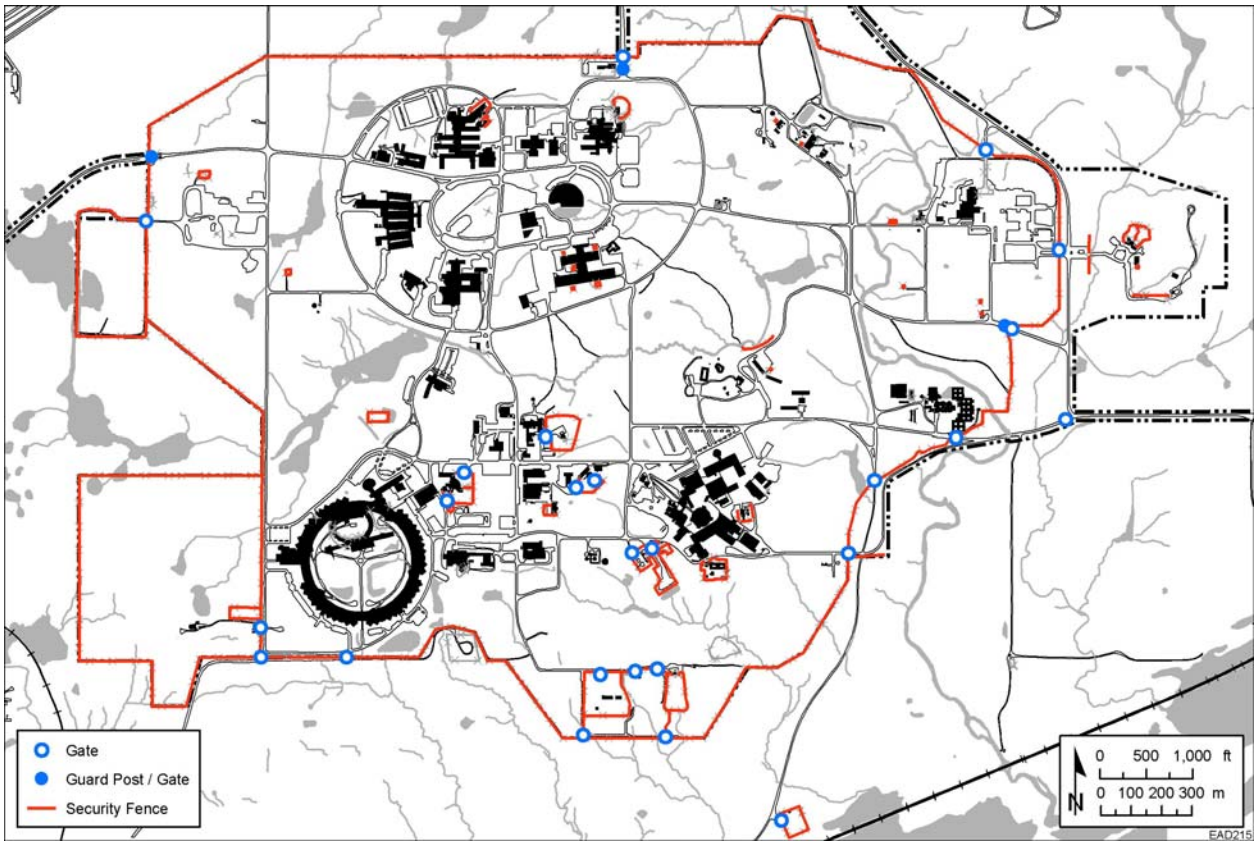

FIGURE E3.3 Sitewide Security System

Because of new DOE mandates, the entire current Argonne radio system migrated, in a joint effort with the state of Illinois and Motorola, to a statewide radio system that provides interoperability with many local, state, and federal agencies. This migration took place in FY 2007. Integration with an E-911 system was incorporated into the design but has not yet been implemented.

Fire protection remains an ongoing concern at Argonne, although the primary disaggregated needs in the facilities are in suppression and other physical systems, rather than the alarm and reporting systems. A $450,000 capital improvement project has been completed for a head-end replacement to accommodate node growth as additional reporting capabilities and equipment are added to the reporting system.

E3.3 Site Utility Systems

Argonne operates the following government-owned utility systems:

1. Steam generation and distribution
2. Natural gas distribution
3. Domestic water treatment and distribution
4. Laboratory water distribution
5. Canal water treatment and distribution
6. Sanitary wastewater collection and treatment
7. Laboratory wastewater collection and treatment
8. Storm sewer

9. Chilled water generation and distribution
10. Electric power distribution
11. Telecommunications

Vendors and public utilities supply natural gas, oil, coal, electric power, water, and telephone service to Argonne. The following sections contain descriptions of the site utility systems, simplified maps of the systems, assessments of the various utility systems, and suggestions or plans for improvements.

The condition of the infrastructure and utility systems is summarized in Table E3.1 (at the end of Section E3).

E3.3.1 Steam Generation and Distribution

The central heating plant (CHP) generates most of the steam required by the Laboratory. An extensive piping network distributes the steam to most buildings. Steam is used primarily for central heating.

E3.3.1.1 Steam Generation

The CHP consists of five Wickes conventional water tube boilers and various auxiliary systems. Four of the five boilers have a rated capacity of 85,000 pounds per hour (lb/h) each; the fifth has a rated capacity of 170,000 lb/h. The present maximum operating capacity of the small boilers is approximately 72,000 lb/h each; that of the large boiler is approximately 110,000 lb/h on coal. The maximum operating capacity of the total CHP is 398,000 lb/h of saturated steam at 190 pounds per square inch gauge (psig) on a combination of natural gas and coal.

Originally, all five boilers burned coal; however, in 1973 the plant was converted from coal to gas/oil to meet environmental requirements. In 1981, the large boiler was reconverted to coal only to reduce fuel costs. A flue gas dry-desulfurization scrubber was installed at the same time so that high-sulfur coal could be used. In 1997, the large boiler was modified again; natural gas burners were installed to enable use of two types of fuel. The large boiler is base-loaded in cold weather, but it is too large to provide stable operation at reduced loads in warm weather on coal. The four small (gas) boilers are used as required for peak loads and in warmer weather.

The principal fuels used for generating steam at the CHP are natural gas and low-sulfur Illinois basin coal. Gas supply is discussed in Section E3.3.2. Coal is purchased from brokers according to the prevailing cost, delivered by barge to the Lemont barge terminal, and then trucked to the site. Argonne has established "just-in-time" delivery of coal from the terminal to the site to minimize on-site storage and related environmental effects.

E3.3.1.2 Steam Distribution

The existing steam distribution system (Figure E3.4) starts at Building 108, between the east area and the 200 area. The CHP supplies the entire Argonne site, except for the 500 area (laboratory and sanitary sewer treatment plants) and the 600 area (lodging). Buildings in the 600 area are heated by packaged gas-fired boilers. The 500 area is serviced by propane systems.

Steam is distributed on-site through two 14-in. lines that leave the CHP and feed the 12-in. 200 area loop, a 10-in. line to the east area, and a 14-in. line to the 360 area. A 10-in. main, fed from the 12-in. 200 area loop, delivers steam to the buildings in the 300 area. The 200 area distribution system is located in concrete tunnels, with the building pipe connections in direct-burial steel conduit or in formed hydrophobic powder. Lines serving the east area, the 300 area, and the 360 area are mainly aboveground. The condensate return (pumped from receivers in individual buildings) runs through pipes parallel to the steam system and into two 100,000-gallon (gal) storage tanks outside the boiler plant. Distribution lines are insulated with 85% magnesia insulation, covered with waterproof felt, and painted. In FY 2004, additional insulation, with jacketing, was added to the abovegrade steam pipes. Currently, the system distributes steam at 190 psig to all buildings on-site. Local stations typically reduce the pressure to 15 psig. Lower-pressure steam is then used for space heating and miscellaneous building services.

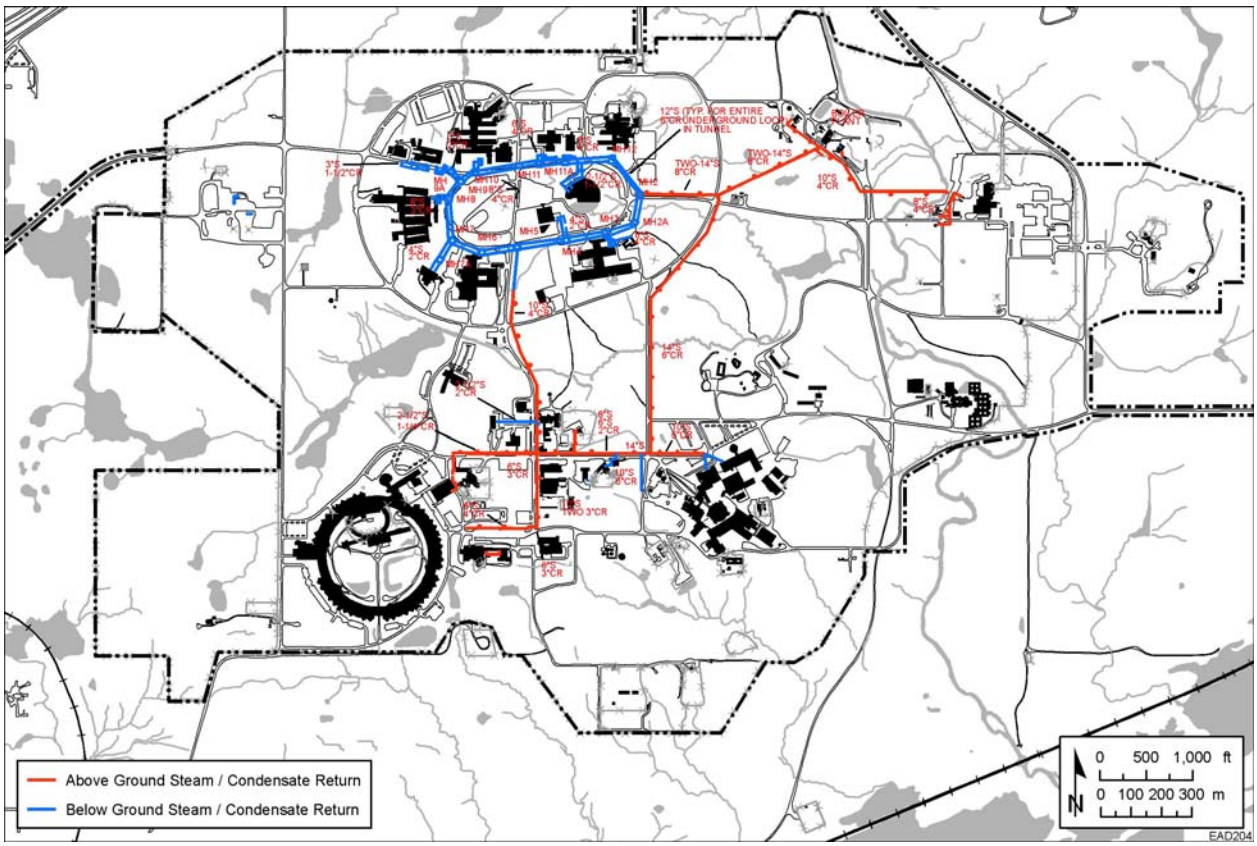

FIGURE E3.4 Steam Distribution System

The underground steam distribution system was rehabilitated in FY 1986. The existing aboveground steam distribution system is more than 40 years old. Ultrasonic testing in 1996 confirmed the integrity of the aboveground distribution piping.

The CHP was completed in 1951. Adequate maintenance of the plant became difficult and very costly, because replacement parts for many of the components were no longer available. To restore reliability of the steam supply, Argonne rehabilitated the CHP in FY 1999. Several of the major operating components have been upgraded, control systems have been upgraded to direct digital systems, and dual fuel capability has been added to Boiler No. 5. Major electrical switchgear and a standby generator have been replaced.

The average cost of steam generation depends on several variables, such as the costs of water, electricity, and fuel. However, fuel cost is the major factor in determining the average cost of steam.

The steam distribution system at Argonne is generally in "adequate" condition, with approximately $8.6 million (ACI = 0.940) in DM; overall, the system requires minor rehabilitation, totaling approximately $9 million over the next seven to ten years. The central steam plant itself, including the associated crusher house and shaker house, requires major upgrades. The distribution system has been updated more closely with DM (ACI = 0.982, "excellent"), and the majority of the near-term upgrades have been completed on the steam and condensate lines.

E3.3.2 Natural Gas Distribution

Natural gas is now purchased under an area-wide contract through the Defense Energy Supply Center (operated by the Defense Logistics

Administration). Nicor, Inc., delivers gas through its distribution grid to the Laboratory through a special-rate transportation contract.

A 6-in. branch line from the nearby high-pressure Nicor main supplies gas at 150 psig to a regulator at Building 108, which reduces the pressure to 60 psig. From that regulator, gas is piped to the CHP, where it is metered for the boilers. A branch line extends to the north of the CHP, where the sitewide gas supply is metered and regulated to maintain 10 psig. Gas is then distributed to the site for use in laboratory and experimental areas. Figure E3.5 shows the gas distribution system.

The entire gas distribution system was replaced in FY 1999 and FY 2000. The replaced on-site gas distribution lines were more than 40 years old. No CAS deficiencies are identified for the natural gas distribution system; the system is rated "excellent," with ACI = 1.00.

E3.3.3 Domestic Water Treatment and Distribution

Since 1996, water for Argonne has been supplied by the DuPage Water Commission from Lake Michigan. The supply comes from a DuPage Water Commission line that runs parallel to Cass Avenue and connects at a new pressure reduction station (Building 167) adjacent to the CHP. From there, water is pumped into the general distribution system, which provides for domestic and laboratory process use and for fire protection. Recent guidance from the Water Commission to all customers with independent sources (including Argonne) has been to keep such alternate sources available and on-line in case of an emergency interruption to county supplies or disruption to the county distribution system. This policy change, in keeping with safeguards identified by the Department of Homeland Security, requires Argonne to maintain the operating conditions of

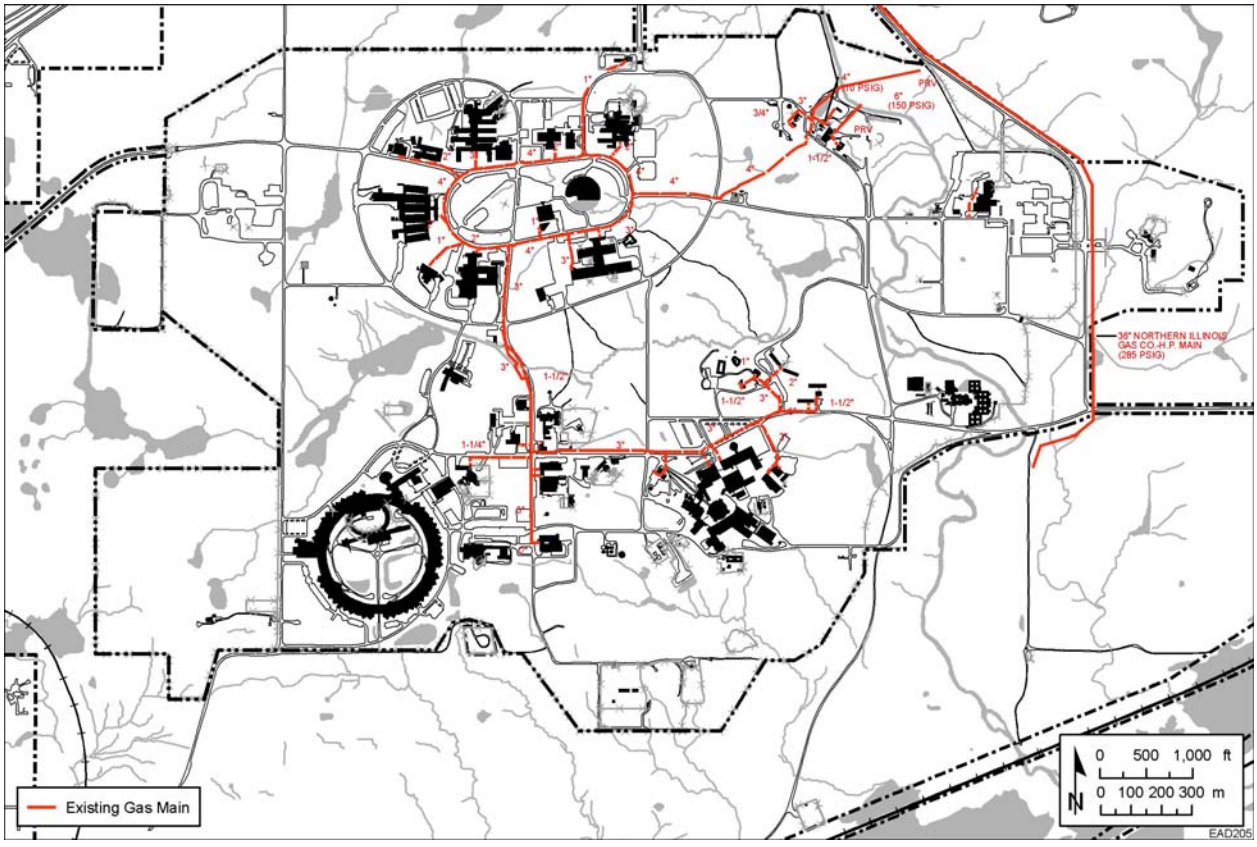

FIGURE E3.5 Gas Distribution System

its wells and on-site treatment plant in a higher state of readiness than was previously the case. This requirement is reflected in the reporting of mission-critical and mission-dependent facilities.

Prior to 1996, water was pumped from four wells and treated at the water treatment plant (Facility 129). The wells and treatment plant are maintained in standby condition in case of a major interruption in the DuPage line.

E3.3.3.1 Water Wells (Standby)

The four shallow wells, each approximately 328 ft deep, draw water from the Niagara dolomite aquifer; their combined capacity is approximately 2.23 million gallons per day (MGD). These wells pump only hard water, which must be treated before distribution to the site. One deep well, drawing from the Galesville sandstone formation, is the only underground source of soft water on-site; however, this well has been inactive since 1957 because of hydrologic problems.

E3.3.3.2 Water Treatment Plant (Standby)

The standby water treatment system covers the risk of interruption in the supply of Lake Michigan purchased water. Treatment at the water treatment plant (Facility 129) includes ion-exchange softening, iron removal, pH adjustment, filtration, and chlorination. The treated water is then routed to a 650,000-gal ground-level storage tank. High-lift booster pumps operating in parallel draw the treated water from the tank and send it into the distribution system.

A pumping station discharges regeneration waste from the ion-exchange water softeners into the DuPage County sewer system. Four pressure filter tanks, recently rehabilitated to maintain required water quality, remove fine particles and organic compounds from the water. The backwash from these filters is discharged into the equalization pond (at the CHP), which empties into the laboratory sewer system or to the DuPage lift station, depending on levels of total dissolved solids. The pressure filter tanks limit the capacity of the water treatment plant to approximately 1.0 MGD, which is adequate to satisfy current site-wide demand for domestic and laboratory water.

E3.3.3.3 Water Distribution Systems

The existing domestic and laboratory water distribution systems were upgraded in FY 1991. Most of the old cast iron piping was replaced with new cement-lined ductile iron pipe with polyethylene exterior wrapping. The capacity of the distribution systems is adequate to handle identified present and future water flows. Rehabilitation of the domestic and fire water pumping and storage system was completed in FY 1994.

E3.3.3.4 Domestic/Fire Protection Water System

Water for domestic use and fire protection is distributed through a common network that serves most of the site (Figure E3.6). The average daily flow rate in this system is approximately 0.442 MGD. The system has three elevated storage tanks: Facility 565 (500,000 gal) near the west area and south of Water Tower Road, Facility 42 (150,000 gal) in the east area, and Facility 564 (300,000 gal) in the 300 area. In addition, Facility 568, a ground-level storage tank, can hold 650,000 gal. Some of the water stored in these tanks is reserved for fire fighting and for automatic sprinkler systems in various buildings. All of the domestic water tanks were upgraded in 1992, and the tanks were cleaned and painted both inside and out. Extensive repairs were also made to extend the service lives of the tanks significantly.

The domestic/fire water distribution system is generally adequate, with approximately $800,000 (ACI = 0.954) in DM. The inclusion of the lateral distribution runs to buildings with the main distribution system would establish joint values of ACI = 0.938 and SCI = 0.904, both indicative of "adequate" condition.

E3.3.4 Laboratory Water Distribution

In on-site working laboratory facilities, the water supply can become contaminated by back-siphonage. To eliminate this hazard, a separate supply system (not directly connected to the main on-site water supply system) is used for laboratory purposes (Figure E3.7). Water is pumped from the

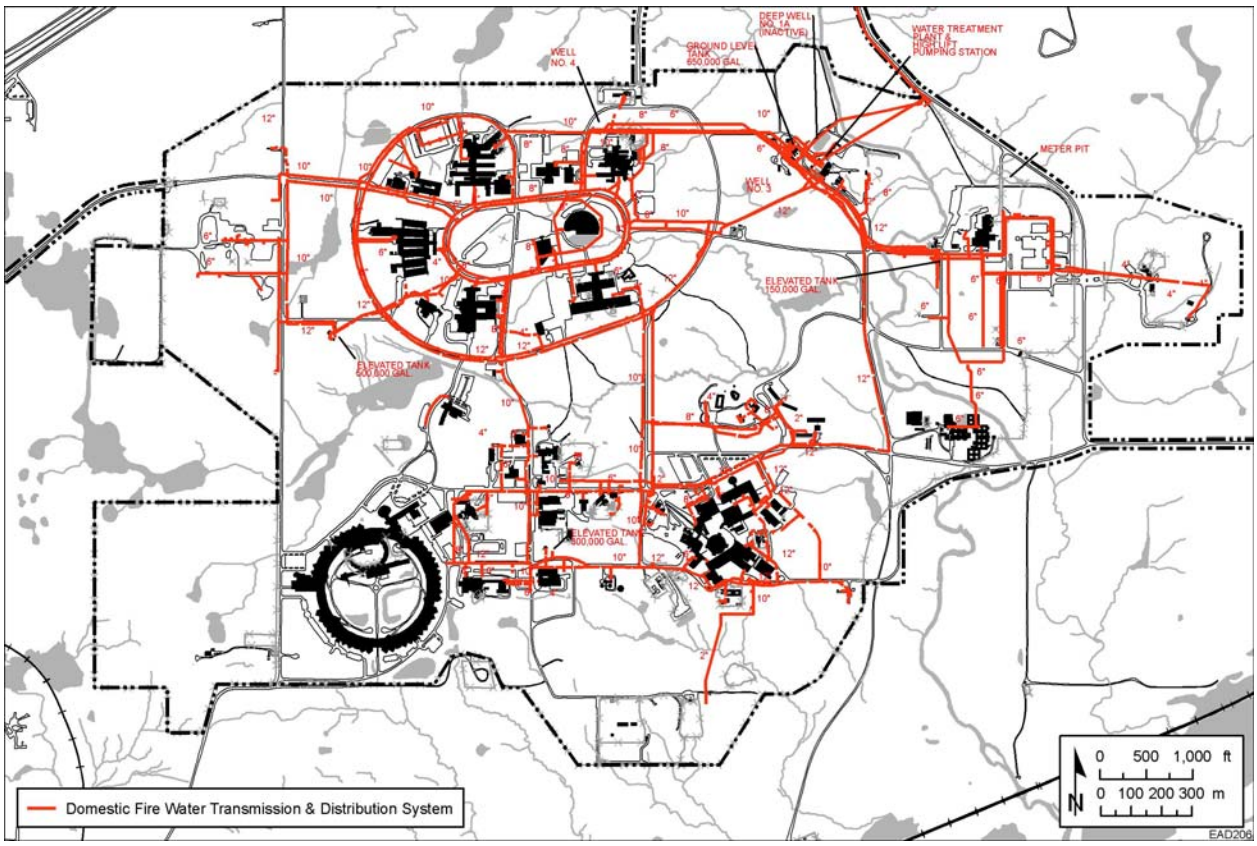

FIGURE E3.6 Domestic/Fire Protection Water Treatment and Distribution System

on-site water system to a point above the high-water level. From there, the water is discharged through an air gap into the 75,000-gal elevated storage tank (Facility 566) near the 800 area and south of Water Tower Road. From this tank, the water flows through a distribution system to the various laboratories. The laboratory water tank was upgraded in 1992, and the tank was cleaned and painted both inside and out. Extensive repairs were also made to extend the service life of the tank significantly. The flow through the laboratory water distribution system averages about 0.284 MGD.

Argonne's laboratory water distribution system is in need of minor upgrades, with approximately $1 million in DM (ACI = 0.960; "good" condition). The inclusion of the lateral distribution runs to buildings with the main distribution system would yield an SCI of 0.140, indicative of a requirement for minor rehabilitation.

E3.3.5 Canal Water Treatment and Distribution

The canal water system consists of a water treatment facility, storage tanks, and a distribution system. Nonpotable canal water is used on-site primarily in cooling towers and, to a lesser degree, for a variety of other cooling needs, such as building air compressors.

E3.3.5.1 Canal Water Treatment Plant

Nonpotable canal water is drawn from the Chicago Sanitary and Ship Canal through an inlet structure — a raw water pump station (Facility 582) equipped with traveling screen and pumping equipment. The raw water is then pumped to a clarification-type treatment plant (Facility 583) that contains upflow basins, chemical feeders, chlorinating facilities, and a 500,000-gal ground-level treated-water storage

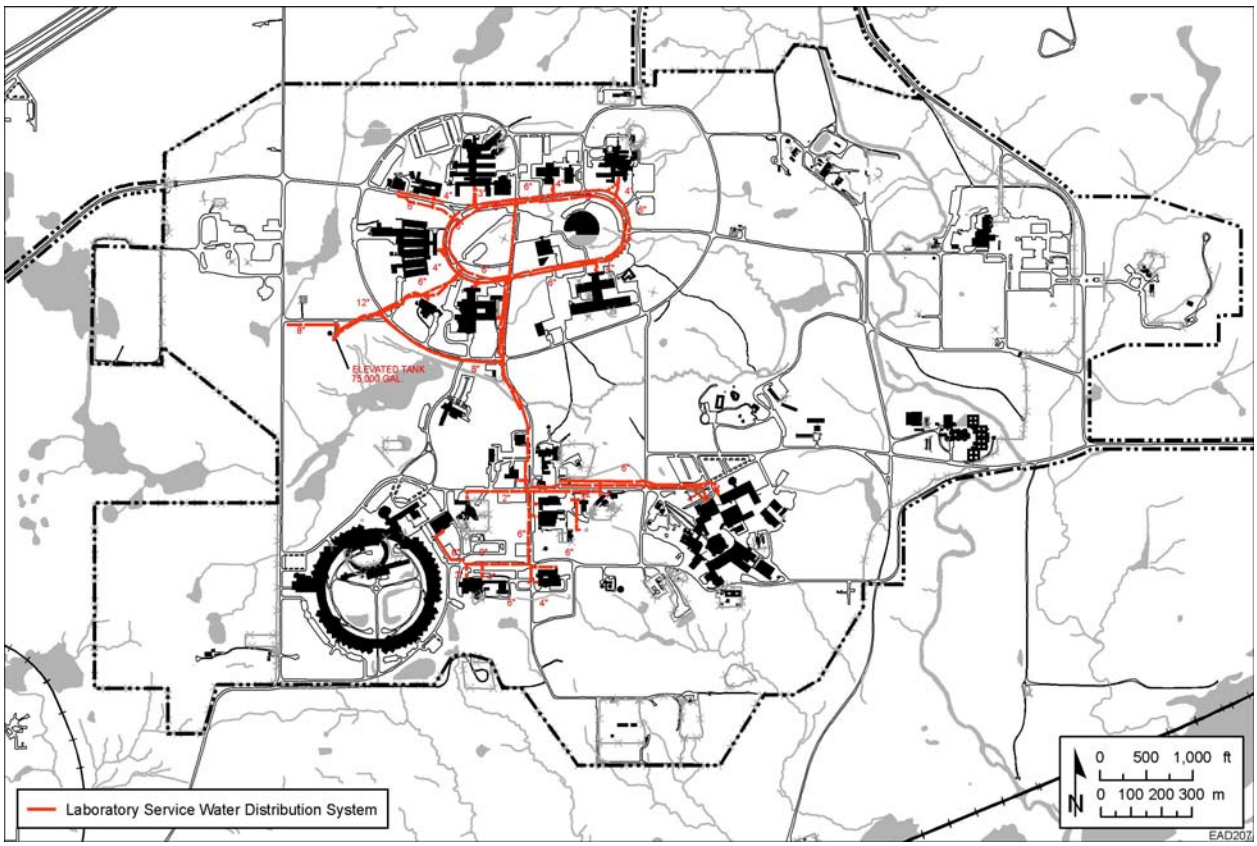

FIGURE E3.7 Laboratory Water Distribution System

reservoir (Facility 584). An additional 250,000-gal elevated storage reservoir (Facility 585) is located near the center of the site, east of Meridian Road and across from the Fire Station (Building 333). This last facility is degraded, and the tank structure may be in need of replacement rather than rehabilitation.

The existing design capacity of the treatment plant is 4.0 MGD. Both the raw water and treated water stations were designed for pumping capacities of up to 6.0 MGD, with principal pipelines sized for expansion. Since the addition of the APS complex, the treatment plant (Facility 583) is approximately 25% loaded. Because the plant was originally designed to accommodate expansion of cooling loads, planned maintenance activities keep the canal water treatment system readily capable of supporting all the planned (and even unforeseen) expansion needs of the Laboratory. As indicated in the discussion of the 500 area (Section E2.8), the use of recycled treated effluent from the laboratory and sanitary sewage treatment plants as input to the canal water system is being investigated for engineering feasibility, cost efficiency, and reversibility of flow through the canal water feed line. Discharge directly into the Chicago Shipping and Sanitary Canal would reduce the impact of all discharges from *limited recreational contact* with water in Sawmill Creek and the Des Plaines River to *no recreational contact* with water in the canal.

E3.3.5.2 Canal Water Distribution System

The canal water distribution system (Figure E3.8) serves the entire Laboratory. From the treatment plant, clarified water is pumped into a completely separate, nonpotable canal water distribution system, which includes a 250,000-gal elevated tank (Facility 585) that serves the 100, 200, 300, 360, and 400 areas. The existing canal water distribution system was upgraded in

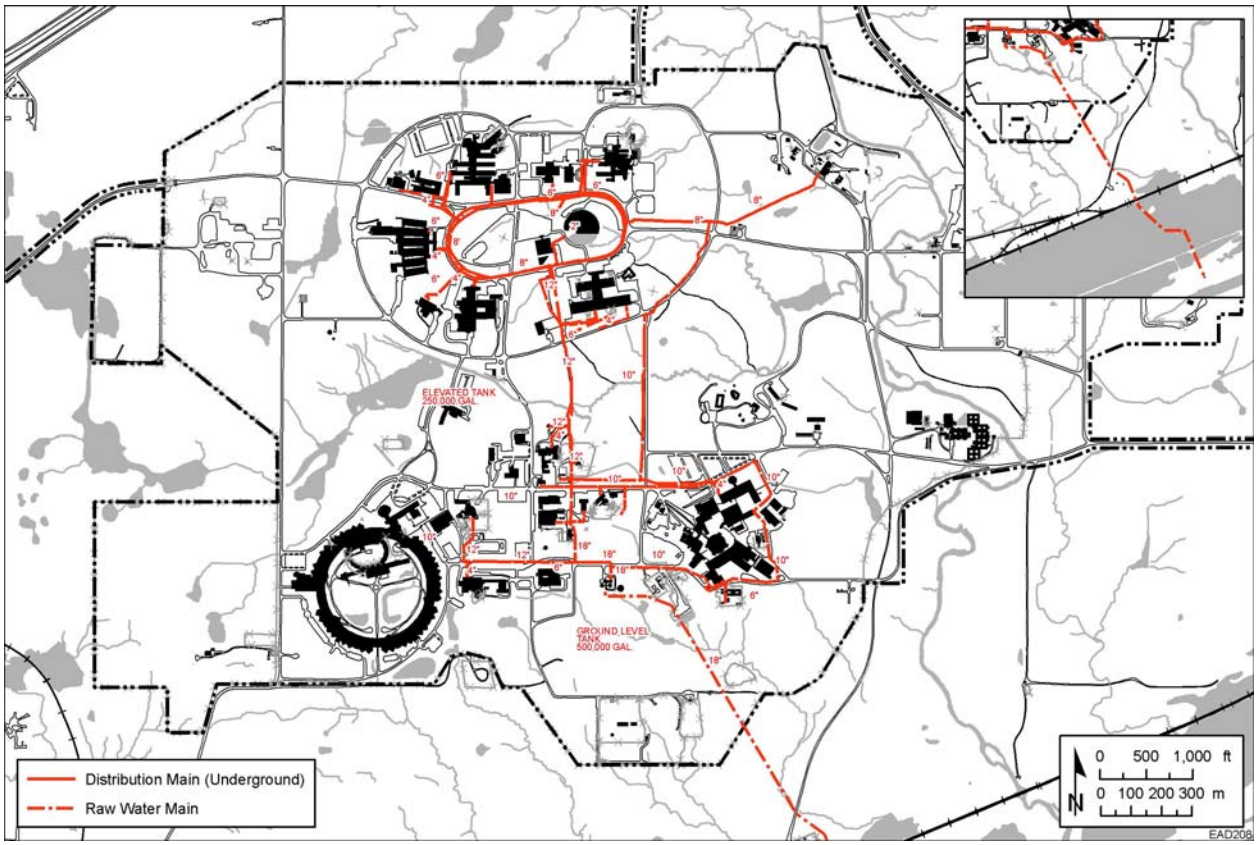

FIGURE E3.8 Canal Water Distribution System

FY 1991 by replacing most of the cast iron piping with new cement-lined ductile iron pipe with polyethylene exterior wrapping. The average daily flow rate in this system is approximately 0.501 MGD.

The canal cooling water system was introduced to relieve the general water supply system from additional demands due to forecast cooling load growth, especially demands associated with the development of the 360 area. Most of the present canal water treatment plant and associated systems were constructed and placed in operation in 1962. Additions and upgrades of the piping systems have occurred more recently, as have some treatment plant improvements. Many components of the treatment plant and distribution system are aged or beyond their expected useful life expectancies. The aging contributes to increased operating and maintenance costs.

Several areas of concern exist regarding continued operation of the canal water system. One the two existing clarifiers (west) and most of the supporting equipment need immediate repair or replacement. The east clarifier was replaced in 2003. The two water storage tanks have been in service for more than 30 years and need improved access for repairs to extend their useful service life. Although this line appears to be in an acceptable condition, concerns for long-term use require verification of its actual condition.

The Laboratory has carried out extensive work on the canal water system over the last two years. The elevated storage tank (Facility 585) was inspected, and some repairs were completed, though additional work is required. The ground storage tank (Facility 584) needs repairs. Extensive work has been carried out at the treatment plant (Facility 583). One of the clarifiers was replaced, and much of the major electrical support equipment was upgraded. Selected valves and operating equipment were also improved. Additional work on the system included improvements to the pump house (Facility 582),

rerouting of the treatment plant blowdown to the laboratory sewer treatment plant, and elimination of the sludge collection basins.

The canal water treatment and distribution system is in need of significant rehabilitation and has been the subject of significant work at the treatment plant itself. Approximately $822,000 in DM remains (ACI = 0.92), primarily in the treatment plant and the associated lines, but also in a nearby ground-level storage tank that requires significant refurbishing.

E3.3.6 Sanitary Wastewater Collection and Treatment

Sanitary sewage from various buildings is conveyed through an underground sewer system to the sanitary wastewater treatment plant (SWTP). The system is for domestic waste; drains subject to radioactivity or chemical contamination are not connected to this system.

E3.3.6.1 Collection System

The existing sewer collection system (Figure E3.9) consists of approximately 8.3 miles of main-line sanitary sewers, ranging in diameter from 4 in. to 18 in. Sanitary wastes from most of the buildings are conveyed by gravity through the piping system to the SWTP. Sanitary waste from the east area flows by gravity into a sewage lift station, which pumps into the gravity sewer main along Railroad Drive.

Because of upgrading and rehabilitation of the piping system completed in 1994, the collection system is now a mixture of old and new pipes and is composed of three main sections: original vitrified clay or cast iron pipe more than 25 years

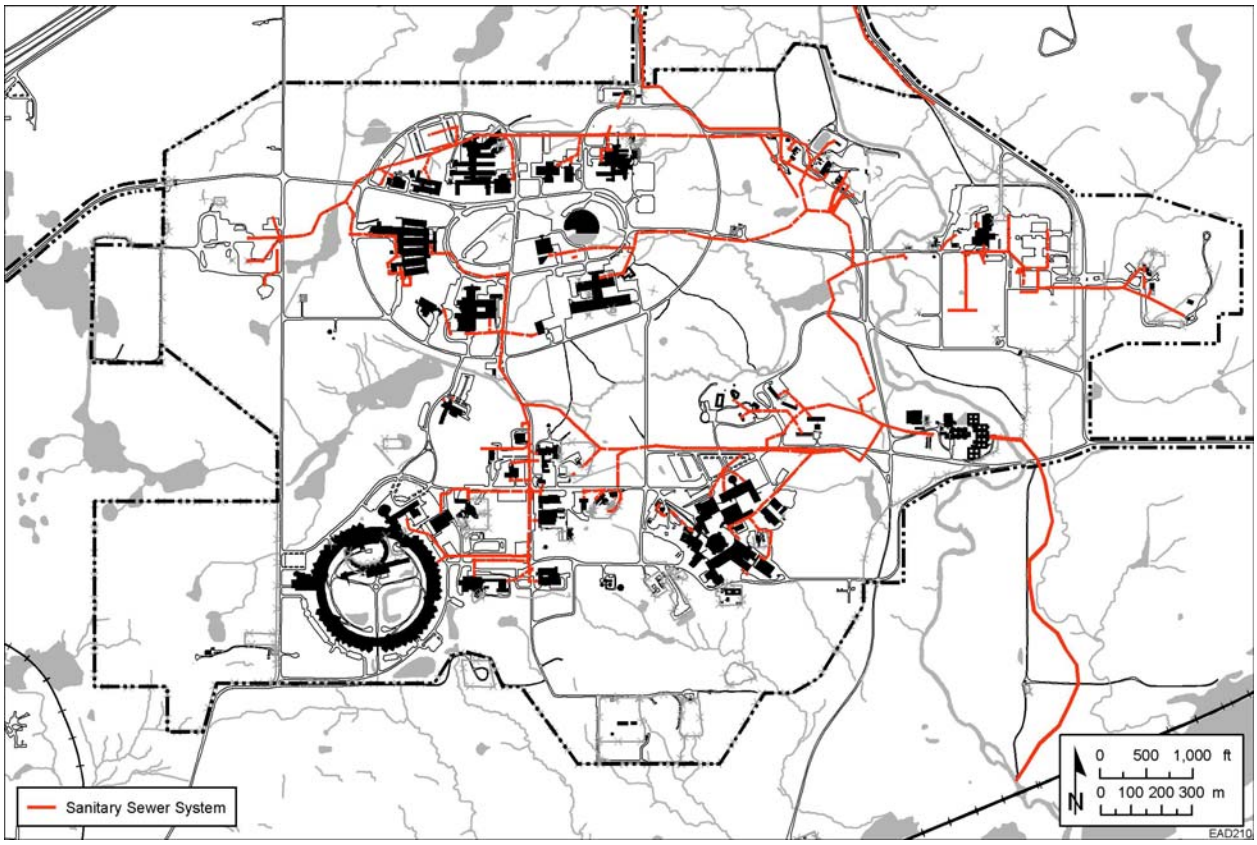

FIGURE E3.9 Sanitary Sewer System

old, original vitrified clay pipe that has been rehabilitated through the injection of acrylamide grout into cracks and pipe joints, and new polyvinyl chloride sewer pipe. The upgrade also increased the sewage-handling capacity of the collection system to accommodate increased flows from the APS area and eliminate surcharge conditions in other sections of the line. Computer modeling indicates that the new system can handle an average flow of 0.738 MGD.

E3.3.6.2 Sanitary Wastewater Treatment Plant

The SWTP, Facility 570 and Building 576, consists of influent flow meters; comminutors; primary clarifiers with an Imhoff tank below (clarigestor); trickling filters, final clarifiers, and intermittent sand filters; a mechanical sludge dewatering system; and sludge drying beds (Figure E3.9). The plant consists of two identical treatment trains (clarigestor, tricking filter, final clarifier, and intermittent sand filters). The original train was designed for an average flow of 0.217 MGD; the second train, added in 1959, doubled the plant capacity. Many components of the existing two-train treatment system were outmoded, undersized, or malfunctioning until a major overhaul to improve operational efficiency and reliability was completed in 1995–1996. The current capacity is an average daily flow of 0.5 MGD and a peak hydraulic flow of 1.4 MGD.

Additional rehabilitation work on the sanitary sewer system is required on some of the lateral lines (branching from the main lines) that service individual buildings. Excessive inflow and infiltration into the sanitary sewer collection system occur during precipitation or snow melt-off events throughout the year. The result is both overload of the treatment plant and dilution of the treatment process.

The sanitary sewer treatment plant and collection system is generally adequate, with approximately $245,000 in DM (ACI = 0.988), resulting in an “excellent” rating regarding the level of DM. This is primarily because of significant modernization and plant upgrades under line-item funding during the 1990s.

E3.3.7 Laboratory Wastewater Collection and Treatment

Established policy and practice require that Argonne employees put all known radioactive liquid wastes into special containers that are collected regularly and sent to a separate processing building for treatment to reduce waste volume. Residual wastes are prepared for further handling and disposal. To prevent inadvertent emptying of radioactive waste or other toxic substances into laboratory sinks or drains, a separate drain system is installed in all radio-chemical laboratories. All such laboratory sewers are connected to the laboratory wastewater treatment plant (LWTP).

E3.3.7.1 Collecting, Testing, and Discharging Laboratory Water

The separate laboratory sewer system serves all areas of the Argonne site, except the east area and the 800 area. Laboratory sinks or floor drains that might receive chemical or radioactive wastes are connected to tandem 1,500-gal retention tanks within each facility; wastewater is monitored for radioactivity before discharge to laboratory sewers. When tests show wastewater radioactivity to be within the permissible limits, the contents of the retention tank are pumped into the laboratory sewer system. When the radioactivity of the wastewater exceeds permissible limits, the contents of the tank are pumped into a tanker truck and transported to Building 306. Waste volume is then reduced by evaporation, filtration, ion exchange, and flocculation. Effluents from this process are discharged into the laboratory sewer system.

E3.3.7.2 Laboratory Wastewater Collection System

The existing laboratory wastewater collection system (Figure E3.10) consists of approximately 30,000 ft (5.7 miles) of main-line sewers, ranging in diameter from 4 in. to 18 in. At most locations, the laboratory and sanitary collection systems run

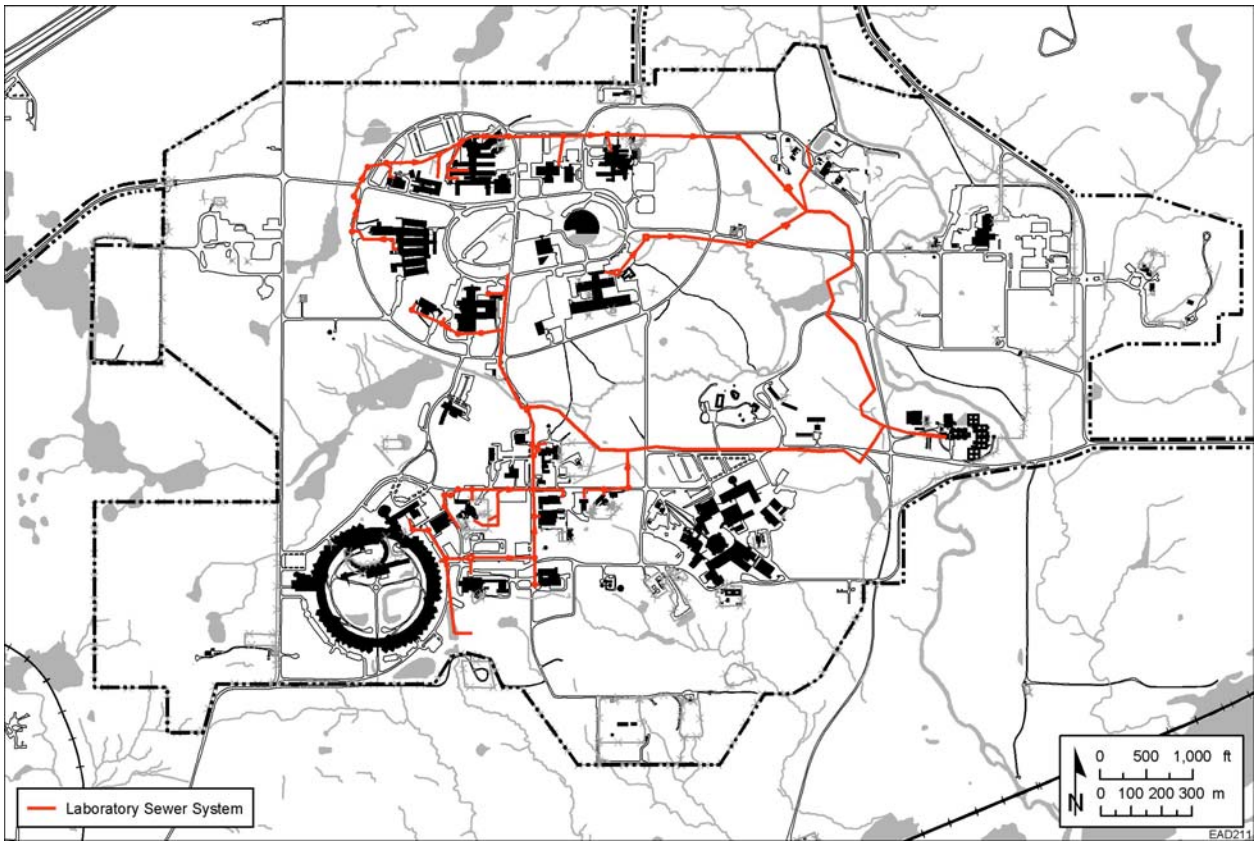

FIGURE E3.10 Laboratory Sewer System

in parallel, have the same slope, and are constructed of the same pipe material; they often run through a double manhole, with an internal concrete wall to segregate the flows. Laboratory wastes from most of the buildings are conveyed by gravity through the piping system to the LWTP.

Because of upgrading and rehabilitation of the piping system completed in 1994, the collection system is now a mixture of old and new pipes and is composed of three main sections: original vitrified clay or cast iron pipe more than 25 years old; original vitrified clay pipe that has been rehabilitated through the injection of acrylamide grout into cracks and pipe joints; and new polyvinyl chloride sewer pipe. The upgrade also increased the sewage-handling capacity of the collection system to accommodate increased flows from the APS area and eliminate surcharge conditions in other sections of the line. Computer modeling indicates that the new system can handle an average flow of 1.117 MGD.

E3.3.7.3 Laboratory Wastewater Treatment Plant

The original LWTP handled only influent flow equalization, chemical neutralization of acidic wastes, and primary sedimentation. Reported excursions from NPDES discharge permit limits, caused by inadequate treatment at the LWTP, posed an environmental liability. Therefore, a new facility was designed to provide treatment capability for heavy metals, suspended solids, volatile organic compounds, and semivolatile organic compounds. Construction of the new treatment works was completed in 1997.

The new treatment system combines portions of the existing LWTP with new equipment and facilities to provide increased flow capacity of 1.1 MGD and improved treatment capabilities.

Additional rehabilitation work on the laboratory sewer system is still required on some lateral lines (branching off the main lines) that

service the individual buildings. The outfall sewer from the LWTP (which contains the combined flow of the LWTP and the SWTP) to Sawmill Creek is also in need of repair.

As with the sanitary sewer system, the laboratory system has been the recent recipient of very significant recapitalization and plant modernization. The laboratory sewer treatment plant and collection system are therefore generally adequate, with approximately $26,000 in DM (ACI = 0.999), resulting in an "excellent" rating regarding the level of DM and an SCI value (TRIC/RPV) of 0.94, indicative of generally adequate overall condition and primarily referencing the remaining sewer mains not rehabilitated during line-item upgrades in the 1990s.

E3.3.8 Storm Sewers

Roof drains, downspouts, and certain non-contact cooling water discharges are connected to storm sewers at most permanent buildings (Figure E3.11). Storm sewers discharge into the nearest suitable outfall point, usually a creek or a well-drained low area. Existing storm sewer discharges do not contain provisions for detention or retention of storm water, other than natural capacities inherent in the surface drainage system.

Most of the storm sewers on-site are more than 25 years old. At present, the storm sewer system collects water from floor drains in several buildings and blowdown wastewater from cooling towers. All sources of storm water are directed toward collection systems that lead to the outfalls covered under the NPDES permits. Though the water is untreated, the discharges are permitted and are monitored as required by the NPDES permit; the results of the monitoring are transmitted to the state of Illinois.

Recent trends indicate that, in the future, regulating agencies will probably require stricter control of storm water discharges. Present

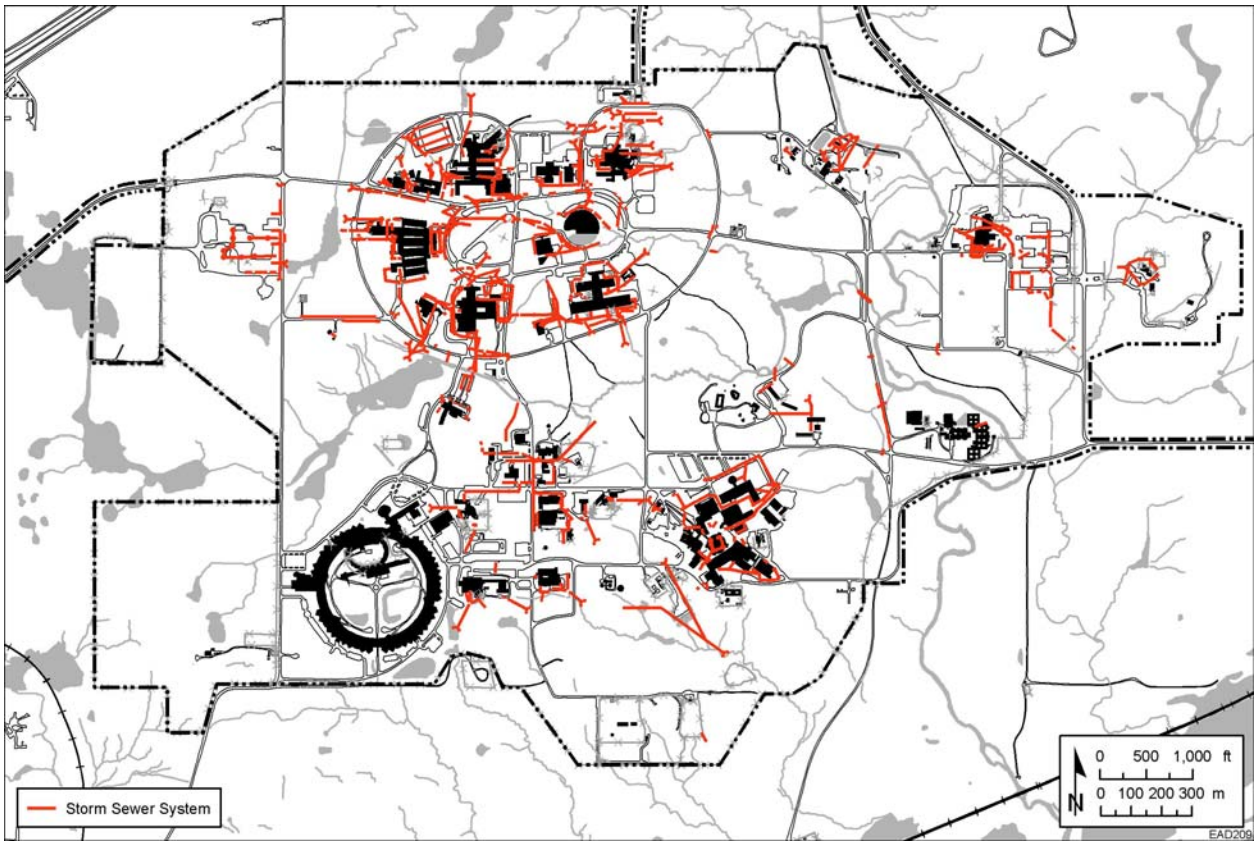

FIGURE E3.11 Storm Sewer System

discharges from treated water sources such as cooling tower blowdown, air compressors, and once-through cooling systems will probably require treatment prior to discharge, and building floor drains will probably need to be rerouted to the laboratory treatment system. Storm water presently enters the treatment systems through inflow and infiltration at percentages unacceptable for standard systems. In addition, storm sewer lines and discharges are aging and in need of major maintenance, including cleaning and repair of culverts, discharges, and swales along roads.

Planned maintenance is addressing these concerns through work now under way and via additional proposed projects. Discharge of untreated water from cooling towers, floor drains, etc. at selected buildings is being redirected to the appropriate treatment collection system, and investigations are continuing to identify specific locations of additional sources. A one-year study is also under way to identify large sources of storm water inflow into the wastewater treatment systems. Maintenance efforts are continuing to identify and resolve storm sewer system problems, which in some cases affect the daily operation of buildings and roadways.

The storm sewer system, consisting primarily of underground piping and road culverts, has been rehabilitated through significant maintenance actions in the recent past and is in overall satisfactory condition, requiring only $56,000 in DMR (ACI = 0.986; “excellent”) and slightly more than $96,000 in overall upgrades. The SCI is 0.024.

E3.3.9 Chilled Water Generation and Distribution

Chilled water for process and comfort cooling is provided by three separate chilled water systems, serving many of the major buildings on-site. These systems serve the 360 area, the APS, and the 200 area.

E3.3.9.1 360 Area Chilled Water System

The 360 area chilled water system has a present total cooling system capacity of 2,500 tons, provided by a 1,500-ton chiller and a 1,000-ton chiller in Building 364. The two chillers are operational and are dedicated to the 360 area. Presently, the chilled water system peak load for this area is 1,350 tons. The chillers are in need of replacement. Plans are to replace them under the ESPC.

E3.3.9.2 APS Chilled Water System

The APS chilled water system serves only the APS complex and has a present total cooling capacity of 9,000 tons provided by three 2,100-ton chillers, a 1,200-ton thermal storage chiller, and a 1,500-ton chiller in Building 450. The chilled water system peak load for this area is 7,470 tons.

An additional 1,500-ton chiller was installed in 2006 to provide for the new Nanoscale Fabrication Facility. In 2008, installation of an additional 1,500-ton chiller is planned to support the new Building 437, new beamlines, and a new linac storage facility, as well as to provide some reserve capacity.

E3.3.9.3 Central (200 Area) Chilled Water System

The central chilled water plant, located in Buildings 371 and 371D (Figure E3.12), consists of four electric-powered centrifugal chillers and associated circulating pumps. The original plant, built in 1989 in Building 371D, consisted of three 1,067-ton chillers. The plant was expanded in 1997 with the addition of a 1,200-ton electrical centrifugal chiller in the Building 371 high bay. Approximately 4.2 miles of buried chilled water supply and return piping connects most of the major buildings in the 200 area (202, 205, 212, and 223) to the central chilled water plant. Four additional buildings (203, 211, 221, and 222) were connected at the beginning of FY 1993. Building 200 was added to the system in FY 1999. In FY 2004 an additional 1,500-ton absorption chiller was installed in Building 212; it ties into the central chilled water loop for additional capacity.

Reliable chilled water systems are crucial to buildings on-site. The loss of cooling for even short times can invalidate long-term experiments. Many chilled water systems serving individual buildings, aside from the central chilled water system, also serve vital process loads. The central

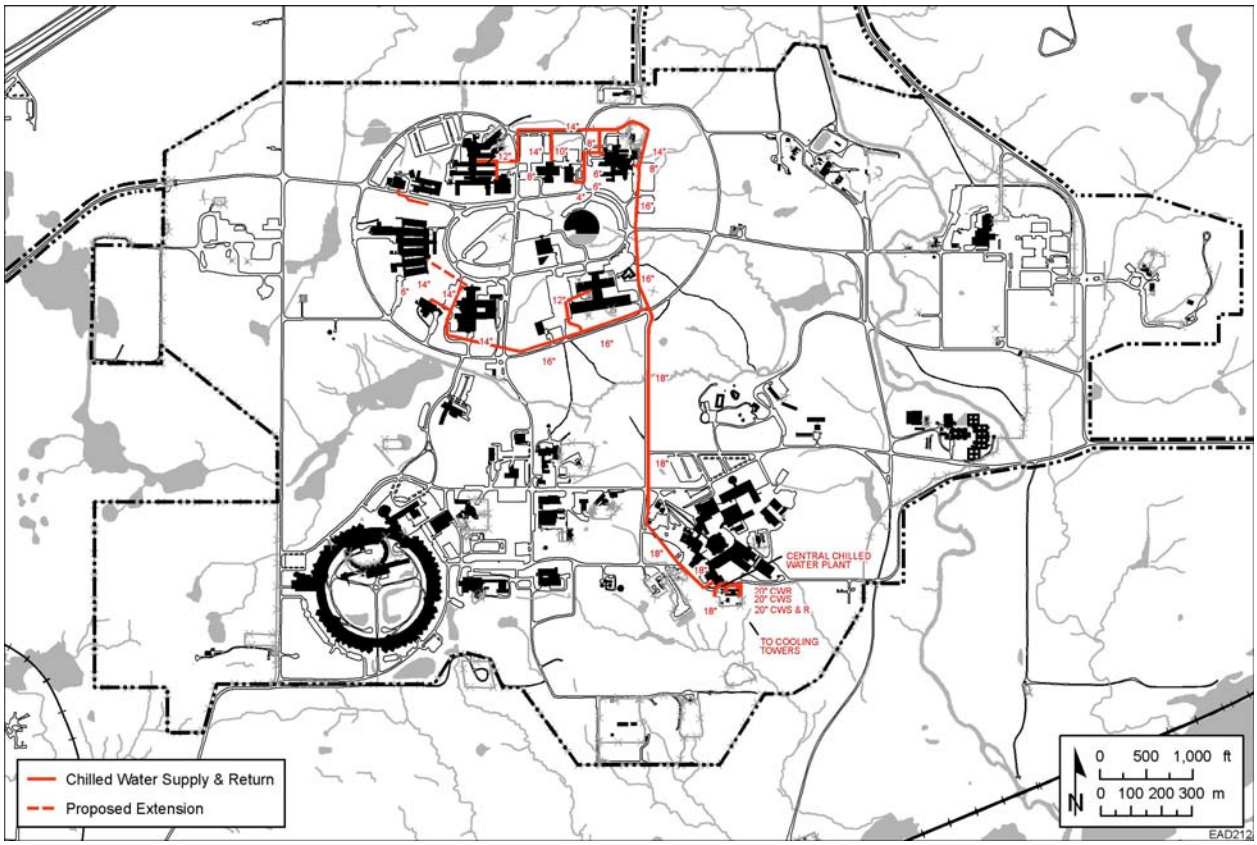

FIGURE E3.12 Central Chilled Water Distribution System

chilled water system cannot handle the combined peak cooling requirements of interconnected buildings. However, local chillers in several buildings (200, 203, and 222) reduce the demand on the central plant. The Laboratory conducted a chlorofluorocarbon replacement study to determine a course of action for phasing out these refrigerants. The study identified equipment for replacement, and replacement cooling capacity in Buildings 213 and 315 was installed in FY 2004. Work is scheduled through FY 2007 to replace the remaining five chillers (3,660 tons) servicing the 360 area and Building 203.

The total chilled water capability at Argonne, including the central system, local systems and the APS and 360 area systems, has been improved significantly in reliability and energy efficiency. Plans to interconnect the central chilled water system with the APS system, the 360 area system, or both have not been formalized. A project currently in design would provide year-around chiller operation to meet programmatic needs by improving non-peak chiller capacity during high-ambient-temperature days occurring occasionally during the off-season. This project would focus on eliminating the need for multiple (redundant) stand-alone cooling systems.

The chilled water system performance ratings are among the highest for all utilities and support infrastructure, primarily reflecting the relative youth of the system and its recent expansions in capacity and service. Because of the changing nature of research at Argonne, the system capabilities and its importance are expected to grow in proportion to overall plant modernization, as well as with the addition of new mission capabilities and initiatives. The system is currently in excellent condition (with ACI and SCI both exceeding 0.99), but projected future demands will require significant additional capacity. The system will require significant near- and long-term enhancement to meet anticipated load growth with the envisioned expansion of computer science,

nanoscience, and accelerator research at the Laboratory.

E3.3.10 Electric Power Distribution

Electric power for the Argonne site is purchased from the Commonwealth Edison Company (CECo) at 138 kV. The CECo transmission system consists of two lines, fed by the Joliet and McCook generating stations and routed along the Atchison, Topeka, and Santa Fe Railroad in the Des Plaines River valley south of the site.

The federally owned, Argonne-operated main distribution system (Figure E3.13) originates at Facility 543, which is adjacent to the CECo line facilities. Two 15/20/25/28-megavolt ampere (MVA) transformers (T1 and T2) and high-voltage switchgear at Facility 543 service two overhead 13.2-kV transmission lines that run north through the forest preserve to Facility 544. Distribution switchgear at Facility 544 services an underground cable distribution system that supplies most of the 200 area buildings. Overhead lines supply the rest of the site, except for the 300 area.

A separate power distribution system meets the heavy load requirements of the 300 area. Two three-phase, 138-kV lines (overhead and underground) connect the CECo transmission line at Facility 543 to the transformers at Facilities 549A and 549B in the 300 area. Three 18.75/25/31.25-MVA transformers (T4, T5, and T6) and two 30/40/50-MVA transformers (T7 and T8) provide 13.2-kV power to the 300 and 400 areas. A fourth 12/16-MVA transformer (T3) provides 13.2-kV service to buildings in the western 300 area and has an emergency standby cross-tie to Facility 544. Transformers T7 and T8 provide power to the 400 area (APS) through 13.2-kV overhead transmission lines. Three new diesel emergency generators, totaling 3,750-kW capacity, provide emergency power to the APS complex.

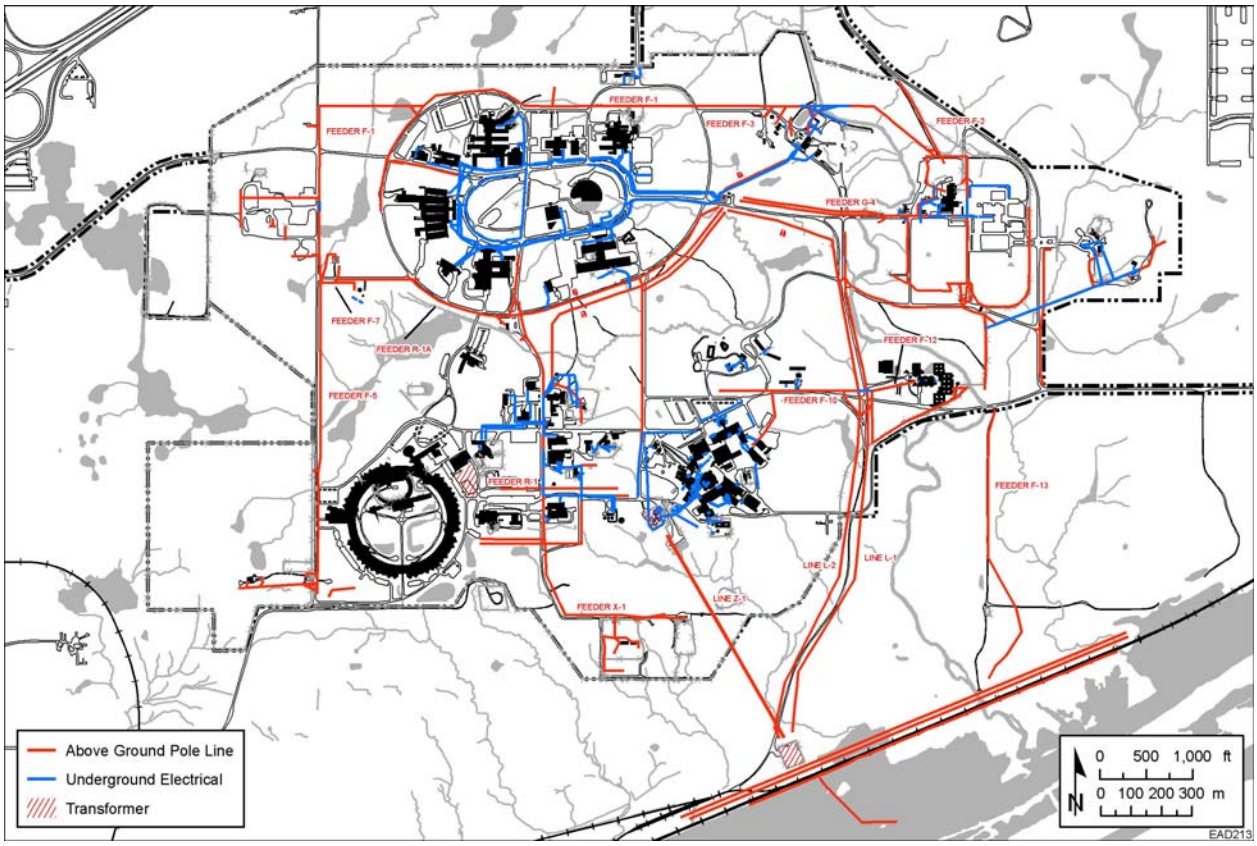

FIGURE E3.13 Electric Power Distribution System

Distribution lines are generally 13.2 kV throughout the site. Voltage reduction transformers and switchgear are adjacent to or within each program facility. However, in the east area and the 800 area, the distribution lines are 4.16/2.4 kV, provided by substations (Facility 546 and Facility 548, respectively).

The primary Argonne electrical distribution system, which originates at Facility 543, was constructed as long ago as 1949. To maintain high levels of reliability and safety, major system rehabilitation has been necessary. Significant upgrades to the system since the early 1990s include replacement of transformers and associated equipment at Facilities 543, 544, and 545 and replacement of all exterior transformers filled with polychlorinated biphenyls. The underground distribution cable system and equipment in the 200 area were also replaced and upgraded. A supervisory control and data acquisition (SCADA) system was installed in 1996 for remote control and monitoring of protective equipment at Facilities 543 and 544. In FY 2001 a second 138-kV transmission line and associated equipment were installed.

Emergency electrical generators on-site include 29 diesel-driven units and 1 steam-driven unit. The emergency generators are critical for protecting the environment, personnel, and vital data of long-term scientific experiments during potential electrical power outages. The single steam-driven unit is located in Building 315.

The Argonne electric power distribution system has benefited greatly from several plant upgrades that increased reliability and replaced aged equipment and switching systems and also increased service capacity to the APS and 300 areas. Two original antiquated services remain. First, the 800 area distribution transformer station and its service, now connected only to the Westgate Road guard post — the sole remaining facility in the 800 area — has been cleared for programmatic reuse and reassignment. Second, the antiquated street lighting system is of similar vintage. Approximately $77,000 remains in DM (ACI = 0.999; “excellent”), and the SCI is 0.03. Except for the two aforementioned obsolete systems, the measures are within a few tenths of a percent (ACI = 0.99+; SCI = 0.002) of the ideal. A significant service modification being implemented for portions of the 300 area will facilitate retirement and disposition of Building 301, after D&D of the hot cells is completed under DOE-EM funding. This improvement will provide additional service to accommodate load growth in the 200 area.

E3.3.11 Telecommunications Systems

E3.3.11.1 Telephone System

The PBX (private branch exchange) system that had served Argonne since 1987 was replaced during the summer of 2005. The new PBX is an EADS Pointspan M6880 communications system of Internet protocol (IP) networked control servers operating on a dedicated local area network. The digital TDM (time division multiplexing) hybrid design has a Voice Over IP-enabled (VOIP-enabled) architecture. The hybrid design allows for transition from a digital TDM core to VOIP at locations where the infrastructure can support the service. A limited trial was conducted with the CNM in 2006, and a second trial is scheduled for FY 2008. Approximately 7,500 analog and digital telephones serve the three major organizations on the Argonne site: Argonne National Laboratory, the DOE Argonne Site Office, and the NBL.

The PBX telephone system consists of north and south control nodes and seven distributed nodes connected to the main nodes by fiber optic cables (Figure E3.14). Each node serves a building or group of buildings through a copper-wire-and-cable plant. In addition to switched PBX services, the wire-and-cable plant provides point-to-point copper and fiber circuits for on-site data communications, alarm systems, control systems, and audio systems. The wire-and-cable plant also provides for extending external private lines and miscellaneous services from the SBC interface to on-site user locations. A buried conduit system facilitates installation of new cables to all major buildings. The original cable plant was installed in 1987 and has a life expectancy of at least 30 years. A fiber optic cable plant that interconnects all major buildings for network, high-speed data, and video applications was installed in the conduit system in 1993, with a life expectancy of at least 20 years. Additional cable is installed incrementally as service requirements expand.

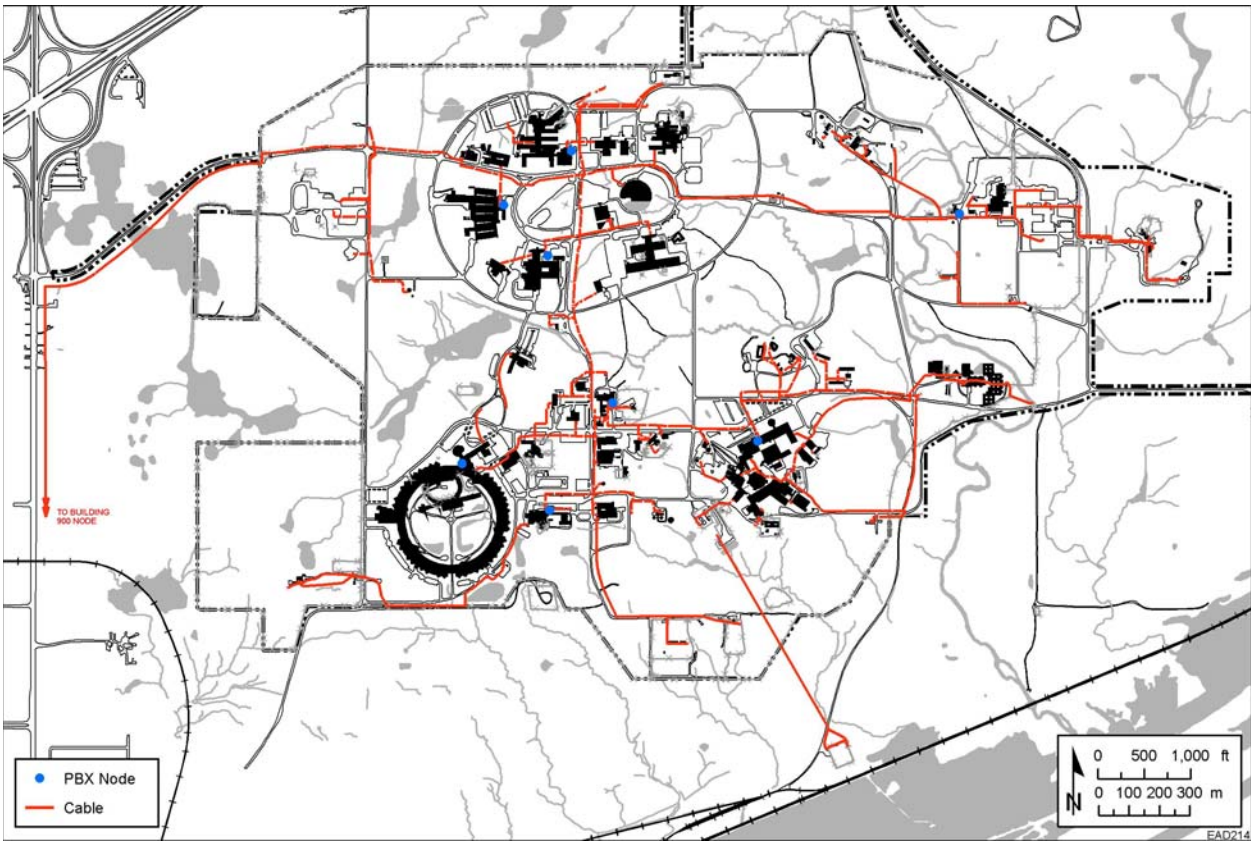

FIGURE E3.14 PBX Communications

A DMS 100 switch in the SBC central office, 0.75 mile west of the site, provides direct incoming and outgoing commercial dial service. An FTS/MCI DS3 circuit provides direct-access long distance service and high-speed data communications.

E3.3.11.2 Structured Cabling Infrastructure

The two primary components of the site's structured cabling infrastructure are (1) the outside fiber plant, which interconnects the buildings across the campus, and (2) the copper cabling within buildings, which provides voice and data connections to offices, computer rooms, and laboratories. The current outside fiber plant, installed in 1992, has served the Laboratory very well. Building-by-building maintenance of the copper cabling data infrastructure has resulted in vast local differences in quality and quantity. To provide for the Laboratory's future needs, both elements must be brought up to acceptable standards.

FY 2007 construction is addressing the need to increase the number of fiber optic cables that link the north and south areas of the campus, (thereby alleviating the dangerously low current levels of available single-mode fiber) and improving the route diversity between the north and south areas of the campus for increased reliability and resilience within the network.

The following renovation and upgrade needs have been identified for the outside fiber plant:

- Provide interconnection with external carriers and Internet service providers on both the east and west sides of the campus to improve reliability and resilience.
- Construct a replacement building for the current B308 Annex, which is used today as the primary facility for the south campus PBX. The current building has frequently been

designated for demolition. Development of an orderly process for relocating the voice and data infrastructure is imperative.

- Initiate a program to install fiber optic cable to buildings that were not included in the original build-out, but in which usage has since justified the need.

The following renovation and upgrade needs have been identified for the copper cabling infrastructure:

- Initiate a program to assess and renovate copper cabling in all buildings across the campus.
- Ensure that appropriate telecommunications closets exist, that all copper runs are well documented, and that all copper runs meet a minimum of Category 6 (ANSI/TIA/EIA-568-B.1-2001, -B.2-2001, and -B.3-2001) cabling standards.

Projects dealing with the following needs have been submitted to the site ESH&I process for consideration:

- Diverse fiber route between north and south campus areas: $695,000 (non-recurring). This project was funded, and a construction project was initiated in FY 2007.
- Replacement building for the current B308 Annex: $500,000 (non-recurring).
- Outside fiber build-out to buildings: $75,000 (recurring).
- Copper cabling infrastructure renovation: $100,000 (recurring).

A comprehensive assessment of the cable plant is still needed to capture and prioritize telecommunications system needs. Such systems generally require periodic upgrades to maintain current capability expectations long before physical deterioration or degradation of performance or reliability occurs. In this light, the financial basis for the summary condition of the telecommunications system in Table E3.1 does not completely represent the constant need for upgrading the infrastructure and extending capabilities.

E3.3.11.3 Radio and Pager Systems

The Illinois State Police installed a 195-ft antenna tower at Building 364 in 1993. This tower is now the property of the federal government. It supports Argonne's antennas, as well as other state and local antennas.

One on-site statewide radio system provides operational and emergency communications for security, fire, safety, and repair personnel. One VHF base station, 10 mobile units, and 75 trunked and VHF portable units are assigned for these purposes. A radio paging system provides one-way paging to more than 700 pocket pagers. The Laboratory has contracted for commercial paging service to maintain off-shift contact with key management and emergency service personnel throughout the Chicago metropolitan area.

Argonne added a NEXTEL transmitter to the top of the water tower (Facility 585, near Building 333) in the summer of 2004, and NEXTEL units are replacing most of the Laboratory's two-way radios. A multicarrier tower owned by U.S. Cellular was constructed in 2005 outside the security fence on out-leased property near the east area, near the intersection of Cass Avenue and Bluff Road. This tower is now in service outside the Laboratory; it offers collateral improvement to cell phone usage within the site's boundaries.

E3.3.11.4 Sitewide Emergency Public Address System

The sitewide emergency public address system links all the areas on the site through voice communication. It is used primarily to alert on-site personnel to emergency situations. The system can also be used to communicate selectively with occupants of a specific area or individual building(s) on the site.

The sitewide public address system has been upgraded to include capabilities to monitor the integrity and detect failures of the system that could jeopardize personnel safety. The system is tested monthly, and observed localized interruptions are reported at that time.

Because of the age of the system and many of the buildings it serves, significant upgrades are planned over the next several years to increase coverage and reliability.

The actual replacement cost of the sitewide radio system completed in FY 2007 was approximately $350,000. A new head-end system required for the public address system control and associated upgrades for the buildings are estimated at $200,000. A firm funding commitment to meet this need has yet to be made.

TABLE E3.1 Condition of Infrastructure and Utility Systems

System	Area (1000 GSF)	RPV ($1000)	TRIC ($1000)	SCI	DM ($1000)	ACI	ACI Rating
Civil Infrastructure	0.000	18,332.787	7,227.606	0.606	1,258.295	0.931	Adequate
Telecommunications	0.000	32,754.337	158.018	0.995	40.913	0.999	Excellent
Electric Power Distribution	0.884	57,103.167	1,721.033	0.970	76.768	0.999	Excellent
Natural Gas Distribution	0.000	1,704.515	0.000	1.000	0.000	1.000	Excellent
Sitewide Safety	0.080	1,893.760	9.346	0.995	9.346	0.995	Excellent
Security	0.150	1,403.888	19.572	0.986	19.572	0.986	Excellent
Collection and Treatment of Laboratory Wastewater	16.626	20,631.627	1,303.957	0.937	26.801	0.999	Excellent
Collection and Treatment of Sanitary Wastewater	4.442	20,906.224	1,270.269	0.939	245.556	0.988	Excellent
Storm Sewers	0.000	3,994.201	95.855	0.976	55.822	0.986	Excellent
Steam Generation and Distribution	66.495	69,956.786	8,587.832	0.877	4,207.656	0.940	Adequate
Canal Water Treatment and Distribution	7.840	10,085.267	2,089.145	0.793	822.014	0.918	Adequate
Generation and Distribution of Chilled Water	2.990	25,607.811	221.408	0.991	91.919	0.996	Excellent
Domestic Water Treatment and Distribution	10.318	26,500.768	1,799.623	0.932	1,060.487	0.960	Good
Laboratory Water Distribution	0.000	2,335.092	299.563	0.872	220.570	0.906	Fair
Total	109.825	293,210.230	24,803.227	0.915	8,135.719	0.972	Good

E4 Appendix: Integrated Facilities and Infrastructure Budget Data Sheet for FY 2007–FY 2018

TABLE E4.1 Integrated Facilities and Infrastructures Budget Crosscut for FY 2007–FY 2018: Blocks 1–4

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	DMR[a]	Building Area Added (GSF)	Building Area Removed (GSF)	Cost ($ thousand)											
				FY 07 Approp.	FY 08 Approp.	FY 09 Budget	FY 10 Budget	FY 11 Budget	FY 12 Budget	FY 13 Budget	FY 14 Budget	FY 15 Budget	FY 16 Budget	FY 17 Budget	FY 18 Budget
SITE NAME Argonne National Laboratory															
PROGRAM															
1.0 Capital Line Item															
1.1 New Infrastructure Construction (facilities and additions)															
ANL-001 Multiprogram Replacement Building 1		140,000					22,000.0	24,276.0	28,724.0						
ANL-002 Modernize Multiprogram buildings, Phase 1	34,363.0		200,000						10,561.0	16,285.0	16,181.0	15,270.0	31,003.0		
ANL-003 Multiprogram Replacement Building 2	7,657.0	140,000	200,000						14,000.0	29,000.0	19,000.0	13,000.0			
ANL-005 Multiprogram Replacement Building 3		140,000												24,000.0	30,000.0
ANL-006 Modernize Multiprogram buildings, Phase 2	16,129.0		200,000												11,093.0
Subtotal 1.1	**58,149.0**	**420,000.0**	**600,000**				**22,000.0**	**24,276.0**	**53,285.0**	**45,285.0**	**35,181.0**	**28,270.0**	**31,003.0**	**24,000.0**	**41,093.0**
1.2 All Other Infrastructure Projects (recap)															
Building Electric Service Upgrade, Phase II	3,400.0			3,000.0	6,000.0	5,000.0	3,000.0								
Site Infrastructure Modernization	4,070.0												14,306.0	14,095.0	15,000.0
Subtotal 1.2	**7,470.0**			**3,000.0**	**6,000.0**	**5,000.0**	**3,000.0**						**14,306.0**	**14,095.0**	**15,000.0**
Total Infrastructure Line Items (1.1 + 1.2)	**65,619.0**	**420,000.0**	**600,000**	**3,000.0**	**6,000.0**	**5,000.0**	**25,000.0**	**24,276.0**	**53,285.0**	**45,285.0**	**35,181.0**	**28,270.0**	**45,309.0**	**38,095.0**	**56,093.0**
1.3 Programmatic Line Items that Add Space															
None[b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal 1.3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Subtotal Line Item Projects (1.1 + 1.2 + 1.3)	**65,619**	**420,000**	**600,000**	**3,000**	**6,000**	**5,000**	**25,000**	**24,276**	**53,285**	**45,285**	**35,181**	**28,270**	**45,309**	**38,095**	**56,093**
2.0 General Plant Project (GPP) KC-03-01-01-0															
2.1 New Construction (facilities and additions)															
Subtotal 2.1 New Construction GPP		0	0												
2.2 All Other GPP Projects (recap including alterations and improvements)															
Upgrade Coal Handling System, Phase I	50.0			109.0											
Air Condition Bldg. 366				215.0											
ATLAS Expansion, Bldg. 203				48.0											
Rehab Office and Lab Space, K-Wing, Bldg. 200				400.0											
Interim Supercomputer Support Facility, Bldg. 369				2,400.0											
Central Chilled Water Plant Expansion				737.0											
Bldg. 212 Hot Dock Crane Replacement				385.0											
400 Area Chilled Water Expansion, Phase II				125.0	1,575.0										
Chilled Water Modifications				250.0	369.0										
Electron Microscopy Area Improvements				500.0											
Fire Safety Improvement Program				200.0	500.0										
TCS Power				80.0	1,056.0										
Elevator Rehabilitation					420.0										
Hood Upgrade Program					500.0										
Upgrade Refrigerant Monitoring Systems					230.0										
TCS Utility Extensions					250.0										
400 Area Low Temperature Heat Water Heat Exchanger Spare Tube Bundle					40.0										
Materials Science Workshop Facility					657.0										
Air Condition Room H117, Bldg. 363					200.0										
Subtotal 2.2 All Other (recap) GPP															
Subtotal GPP (2.1 + 2.2)				**5,449.0**	**5,797.0**										

TABLE E4.1 (Cont.)

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	DMR[a]	Building Area Added (GSF)	Building Area Removed (GSF)	Cost ($ thousand)											
				FY 07 Approp.	FY 08 Approp.	FY 09 Budget	FY 10 Budget	FY 11 Budget	FY 12 Budget	FY 13 Budget	FY 14 Budget	FY 15 Budget	FY 16 Budget	FY 17 Budget	FY 18 Budget
3.0 Institutional General Plant Project (IGPP)															
Rehab Office and Lab Space, K-Wing, Bldg. 200, Phase II					2,000.0										
Roof Replacement	22,000.0					3,000	3,000	3,000	4,000	4,000	3,000	500	500	500	500
Safety/ Fire Protection Modifications						500	500	500	500	500	500	500	500	500	500
Utility and Site Infrastructure Rehabilitation/Replacement						800	900	1,000	1,000	1,000	1,600	2,500	2,800	3,100	3,100
Electrical System/ Distribution Rehabilitation/ Replacement						900	900	1,200	1,200	1,200	1,600	2,100	2,100	2,100	2,100
Mechanical Systems Replacement/Upgrade						500	1,400	1,400	1,400	1,400	2,500	3,500	3,700	3,700	3,700
Multiprogram Facility/Space Modifications and Upgrades						300	300	300	300	300	400	500	500	500	500
Subtotal IGPP Projects					2,000.0	6,000.0	7,000.0	7,400.0	8,400.0	8,400.0	9,600.0	9,600.0	10,100.0	10,400.0	10,400.0
4.0 Operating/Expense for Excess Elimination and Other															
4.1 Excess Elimination (demolition, sale, lease, transfer) Show area eliminated in Gross Area column															
Bldg. 40 Demolition			4,896	221.0											
Bldg. 306 A, B, C and Trailer Demolition			1,116	120.0											
Bldg. 205 A-141 Cleanup				159.0											
Excess Facilities Program D&D					460.0										
4.1 Subtotal			**6,012**	**500.0**	**460.0**										
4.2 All Other (List direct O&E maintenance under 5.1)															
Provide project level detail															
4.2 Subtotal															
Subtotal 4.0 Operating/Expense Projects (4.1 + 4.2)			**6,012**	**500.0**	**460.0**										
TOTAL Capital & Operating Investment		**420,000**	**606,012**	**8,949.0**	**12,257.0**	**5,000.0**	**25,000.0**	**24,276.0**	**53,285.0**	**45,285.0**	**35,181.0**	**28,270.0**	**45,309.0**	**38,095.0**	**56,093.0**
TOTAL Overhead Investments (IGPP)		**0**	**0**		**2,500.0**	**6,000.0**	**7,000.0**	**7,400.0**	**8,400.0**	**8,400.0**	**9,600.0**	**9,600.0**	**10,100.0**	**10,400.0**	**10,400.0**

[a] DMR, deferred maintenance reduction.

[b] A number of currently proposed major projects will add space. However, these projects are third-party financed and are not subject to the space banking requirements.

TABLE E4.2 Integrated Facilities and Infrastructures Budget Crosscut for FY 2007–FY 2018: Blocks 5 and 6

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	Gross Sq Ft.	Cost ($ thousand) FY 07 Approp.	FY 08 to Congress	FY 09 Budget	FY 10 Budget	FY 11 Budget	FY 12 Budget	FY 13 Budget	FY 14 Budget	FY 15 Budget	FY 16 Budget	FY 17 Budget	FY 18 Budget
SITE NAME Argonne National Laboratory													
PROGRAM:													
5.0 Maintenance & Repair													
5.1 Direct Funded (by HQ or Site Program)													
List direct O/E maintenance projects >$500,000													
Subtotal 5.1 Total Direct Maintenance & Repair													
5.2 Indirect (from Overhead or Space Charges)													
Include indirect O/E maintenance projects > $500,000													
Ladder Remediation		258.0	300.0	500.0	500.0	442.0							
Site work		250.0	500.0	511.5	523.3	535.3	547.6	560.2	573.1	586.3	599.8	613.6	627.7
Operating Maintenance		29,692.4	28,813.0	30,052.0	30,945.0	31,767.3	32,594.7	34,097.9	36,697.2	38,148.7	40,437.8	41,367.9	55,623.6
Subtotal 5.2 Total Indirect Maintenance & Repair		**30,200.4**	**29,613.0**	**31,063.5**	**31,968.3**	**32,744.6**	**33,142.3**	**34,658.1**	**37,270.3**	**38,735.0**	**41,037.6**	**41,981.5**	**56,251.3**
Subtotal Total Maintenance & Repair (5.1 + 5.2)		**30,200.4**	**29,613.0**	**31,063.5**	**31,968.3**	**32,744.6**	**33,142.3**	**34,658.1**	**37,270.3**	**38,735.0**	**41,037.6**	**41,981.5**	**56,251.3**
5.3 Hqs Direct Funded Deferred Maintenance Reduction													
Subtotal 5.3 Total Direct Deferred Maintenance													
5.4 Indirect Funded Deferred Maintenance Reduction (from Overhead or Space Charges)													
Include indirect O/E maintenance projects > $500,000													
Roof Replacement Program		302.0											
Bldg. 212 F-Wing Fan Loft Structural Repairs		250.0											
Underground Storage Tank Upgrade		30.0	320.0										
Window and Door Replacement		50.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Lodging Rehab		300.0	300.0	300.0	300.0	300.0	300.0	300.0					
Replace Chillers, Bldg 350			530.0										
Replace HEPA Exhaust Fans, X-Wing Bldg. 205				500.0									
Repairs to HVAC Air Handling Units, L-Wing Bldg. 205				500.0									
VFD Replacement, Bldg. 450					450.0								
Plumbing Network Repairs/Replacement Bldg. 333					550.0								
Carpet Replacement, Bldg. 201					577.0								
Bldg. 221 Substation Replacements						500.0							
Replace Chillers (2) in Bldg. 201						600.0							
Building 362 Rotunda and Auditorium Rehab						500.0							
Replace Floor Tile 3rd. Floor, Bldg. 362							250.0						
Other DM Reduction Projects		1,642.0	232.0	991.0	1,323.0	1,300.0	2,650.0	2,900.0	3,200.0	3,200.0	3,200.0	3,200.0	3,200.0
Subtotal 5.4 Total Indirect Deferred Maintenance													
Total Deferred Maintenance (5.3 + 5.4)		**2,574.0**	**1,982.0**	**2,891.0**	**3,800.0**	**3,800.0**	**3,800.0**	**3,800.0**	**3,800.0**	**3,800.0**	**3,800.0**	**3,800.0**	**3,800.0**
Total Maintenance (5.1 + 5.2 + 5.3 + 5.4)		**32,774.4**	**31,595.0**	**33,954.5**	**35,768.3**	**36,544.6**	**36,942.3**	**38,458.1**	**41,070.3**	**42,535.0**	**44,837.6**	**45,781.5**	**60,051.3**
6.0 Indirect O&E													
6.1 Excess Elimination (demolition, sale, lease, transfer) funded from indirect funds. Show area eliminated in Gross Area column													
Operating Funded Demolition	0		300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
6.1 Total Indirect Excess Elimination			**300.0**	**300.0**	**300.0**	**300.0**	**300.0**	**300.0**	**300.0**	**300.0**	**300.0**	**300.0**	**300.0**
6.2 Other Indirect Funded (includes modifications, additions, improvements, etc. that does not qualify as GPP or maintenance)													
ESPC-1 contract payments		309.1	315.1	255.5	260.5	265.6	270.7	276.0	281.4	286.9	292.5	298.2	304.0
ESPC-2 contract payments			318.0	1,133.0	1,158.0	1,183.0	1,209.0	1,235.0	1,262.8	1,290.6	1,318.9	1,347.9	1,377.5
6.2 Total Other Indirect O&E		309.1	633.1	1,388.5	1,418.5	1,448.6	1,479.7	1,511.0	1,544.2	1,577.5	1,611.4	1,646.1	1,681.5
6.0 Total Indirect O&E		**309.1**	**933.1**	**1,688.5**	**1,718.5**	**1,748.6**	**1,779.7**	**1,811.0**	**1,844.2**	**1,877.5**	**1,911.4**	**1,946.1**	**1,981.5**

TABLE E4.3 Integrated Facilities and Infrastructures Budget Crosscut for FY 2007–FY 2018: Block 7

Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	Project Number	Gross SF Removed[a]	Area (GSF) in Fiscal Year												
			2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
SITE NAME Argonne National Laboratory															
PROGRAM:															
7.0 Summary of Area Added & Eliminated by Year															
7.1 Total Area to be Eliminated Each Year (List of projects, by type of funding, with project number, and AREA eliminated by fiscal year accomplished).															
Line Item from Block 1 (show each that removes space)															
ANL-002 Modernize Multiprogram buildings, Phase 1	ANL-002	200,000												200,000	
ANL-003 Multiprogram Replacement Building 2	ANL-003	200,000													
ANL-006 Modernize Multiprogram buildings, Phase 2	ANL-006	200,000													
Subtotal Line Items		**600,000**												**200,000**	
GPP from Block 2 (show each that removes space)															
Subtotal GPP															
IGPP from Block 3 (show each that removes space)															
Subtotal IGPP															
Operations/Expense from Block 4.1 (show each that removes space)															
Subtotal Block 4.1															
Indirect Operations/ Expense from Block 6.1 (show each that removes space)															
Subtotal Block 6.1															
Transfer by sale or lease, or transfer to an outside federal agency															
Provide detail															
Subtotal Transfer or Lease															
Subtotal 7.1 Sapce Removed		**600,000**												**200,000**	
7.2 Total Area to be Added by GPP, IGPP, and LI Construction (List of projects, by type of funding, with project number, and AREA add by fiscal year accomplished).															
Line Item (list)															
Multiprogram Replacement Building 1	ANL-001	140,000								140,000					
Multiprogram Replacement Building 2	ANL-003	140,000											140,000		
Multiprogram Replacement Building 3	ANL-005	140,000													
Subtotal Line Items		**420,000**								**140,000**			**140,000**		
GPP (List)															
Subtotal GPP															
IGPP (List)															
Subtotal IGPP															
Subtotal 7.2 Area Added		**420,000**								**140,000**			**140,000**		

[a] **Space removal will be achieved with DOE-EM-type funding.**

E5 Appendix: Detailed Information for Science Laboratories Infrastructure Line-Item Projects

The following line-item project is funded in FY 2007:

MEL001049 Building Electric Service Upgrade, Phase II

TEC: $17.0 million
CAMP: 59
CAMP Drivers: Mission and Investment; Asset Condition

The following line-item projects are proposed in support of the Laboratory's long-range modernization efforts. The projects are listed in priority order. Further details are in Table E5.1.

ANL-001 Multiprogram Replacement Building 1

TEC: $75.0 million
CAMP: 66
CAMP Drivers: Mission and Investment; Asset Condition

ANL-002 Modernize Multiprogram Buildings Phase 1

TEC: $89.3 million
CAMP: 66
CAMP Drivers: Mission and Investment; Asset Condition

ANL-003 Multiprogram Replacement Building 2

TEC: $75.0 million
CAMP: 66
CAMP Drivers: Mission and Investment; Asset Condition

ANL-004 Site Infrastructure Utility Modernization Phase 1

TEC: $45.0 million
CAMP: 66
CAMP Drivers: Mission and Investment; Asset Condition

ANL-005 Multiprogram Replacement Building 3

TEC: $75.0 million
CAMP: 66
CAMP Drivers: Mission and Investment; Asset Condition

ANL-006 Modernize Multiprogram Building Phase 2

TEC: $60.0 million
CAMP: 66
CAMP Drivers: Mission and Investment; Asset Condition

TABLE E5.1 Detailed Information for Science Laboratories Infrastructure Line-Item Projects

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand) Year 1	Year 2	Year 3	Year 4	Year 5	Project Description
MEL001049 Building Electric Service Upgrade, Phase II	$17,000	3,000	6,000	5,000	3,000		This project will upgrade critical portions of the electrical power distribution systems in multiple research buildings and their support facilities. The distribution systems include medium-voltage (13.2-kV) transfer and feeder switches, 200 area loop switches, overhead lines; 480-V and 120/208-V panel boards, transformers, switches and controls; and 480-V switchgear/motor control centers. This project will upgrade the electrical systems to current safety standards, greatly improve the systems' reliability and performance, support changed missions within the buildings, and reduce the facility maintenance and repair costs. The facilities and equipment identified in this project do not meet current environmental, safety, and health standards; are of questionable reliability; and are not adequate for some current facility missions.

TABLE E5.1 (Cont.)

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand)					Project Description
		Year 1	Year 2	Year 3	Year 4	Year 5	
ANL-001 Multiprogram Replacement Building 1	75,000	22,000	24,276	28,724			This project will construct a new modular 140,000-GSF multiprogram building that will eventually replace approximately 200,000 GSF of existing space in the 200 area of the site. The building will provide state-of-the-art research laboratory space for about 290 multiprogram research staff. The footprint reduction will result from overall space efficiency, sized to appropriate national laboratory and office benchmarks, capable of meeting and being adapted to changing office and laboratory programmatic needs. The new flexibly designed facility will improve efficiency of work flow and space utilization; increase synergy through co-location of multiple programs; provide areas for collaboration and informal interactions; and aid in recruiting and retaining “the best and the brightest.” Common materials, specifications, system designs, etc. will be employed to simplify ongoing maintenance and operation; support current instrumentation and technology requirements (humidity control, vibration, radiofrequency [RF], etc.); and achieve operational-maintenance cost reduction of 30-35%. Sustainable design will result in energy efficiency and other benefits. Energy cost will be reduced by 25-35%. An improved layout has the potential for 5% improvement in staff productivity, as estimated through use of the General Services Administration (GSA) productivity model, while meeting technology requirements (computational versus laboratory-based research, tolerances of test equipment, etc.). In addition, the project will reduce the average age of Argonne's building inventory. The full economic benefits of this project will be realized with demolition of substandard space included under ANL-002. Therefore, the return on investment (ROI) and payback shown here are for combined projects ANL-001 and ANL-002. The ROI is 7.49%, and the payback is 13.3 yr. Upon completion of this project, multiprogram staff will relocate to this replacement facility. The space vacated by those staff will be available for reassignment during modernization of existing Buildings 221 and 223 under project ANL-002.

TABLE E5.1 (Cont.)

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand) Year 1	Year 2	Year 3	Year 4	Year 5	Project Description
ANL-002 Modernize Multiprogram Buildings Phase 1	89,300	10,561	16,285	16,181	15,270	31,003	This project will modernize existing Buildings 221 and 223. (182,000 GSF) The 340 staff currently occupying these buildings will be relocated to space made available by project ANL-001. Upon completion, these buildings will be occupied by multiprogram staff currently occupying substandard space across the site. These facilities will require significant upgrades to be made appropriate for modern science programs, meet modern office and laboratory criteria, and become adaptable to changing needs. The facilities can be modernized cost-effectively, given their age, level of DM, and condition. The modernization will improve the efficiency of work flow and space utilization and will increase synergy through co-location of multiple programs and innovative building design features. The improved layout has the potential for 5% improvement in staff productivity, as estimated through use of GSA productivity model guidelines. The space will be adapted to support work patterns and technology requirements of modern science (team building; cross-functional, collaborative, and computational versus laboratory-based research; tolerances of test equipment; etc.). The chilled water system upgrade includes removal of three obsolete chillers containing ozone-depleting refrigerants and dilapidated wooden cooling tower cells and pumps with accessories, which are directly related to service to Buildings 221 and 223. The replacement 2,600-ton capacity chiller plant will include right-sized underground chilled water distribution piping with a direct buried high-density polyethylene piping system. These modifications will bring the system into compliance with the EPA-mandated chlorofluorocarbon phase-out, while improving energy efficiency by at least 20%. Maintenance cost reduction of $2,042,000 will be realized with efficiencies in Buildings 221 and 223 and the elimination of maintenance for Building 202. Energy cost reduction of $894,000 will be realized with efficiencies in Buildings 221 and 223 and the elimination of maintenance for Building 202. This project has an ROI of 11.53% and a payback period of 9 yr; however, combined with project ANL-001, ROI is 7.49% and payback is 13.3 yr. This project will remove $34.4 million of DM.

TABLE E5.1 (Cont.)

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand)					Project Description
		Year 1	Year 2	Year 3	Year 4	Year 5	
ANL-003 Multiprogram Replacement Building 2	75,000	14,000	29,000	19,000	13,000		This project will construct a modular building designed to adapt to the changing needs of existing multiprogram research. The 140,000-GSF facility will replace 200,000 GSF of existing space in Building 200 and will achieve 30% space reduction through overall efficiency improvements. Removal of Building 200 Wings A-F, J, and L will occur when the space is not needed during further modernization projects. This project will continue the creation of a collegial focus to the 200 area for approximately 290 multiprogram research staff. This project gives Argonne an effective, agile, state-of-the-art research laboratory that can be adapted to changes in scientific technology and missions. The flexible design, sized to appropriate national laboratory/office benchmarks, will be adaptable to changing needs; improve efficiency of work flow and space use; increase synergy through co-location of multiple programs; provide areas for collaboration and informal interactions; and serve as a recruiting and retention tool to attract “the best and the brightest.” The construction will use common materials, specifications, system designs, etc. to simplify ongoing maintenance and operation. The design will support current instrumentation and technology requirements (humidity control, vibration, RF, etc.) and will reduce operational-maintenance costs by 30-35%. Sustainable design will result in energy efficiency and other benefits. Energy cost will be reduced by 25-35%. The improved layout has the potential for 5% improvement in staff productivity, as estimated by using the GSA productivity model. The new building will meet increased technology requirements (computational versus laboratory-based research, tolerances of test equipment, etc.), while reducing the average age of Argonne's building inventory. This building has a 7% ROI and payback period of 14 yr. The avoided DM is $7.7 million. Upon completion of this project, multiprogram staff will be relocated to this replacement facility. The space vacated will be available for demolition. Total related D&D and demolition costs for the removal of space ($39 million) are not included, because they are not part of the SLI funding initiative. Funding for the D&D and demolition work is expected from a DOE-EM-type program.

TABLE E5.1 (Cont.)

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand) Year 1	Year 2	Year 3	Year 4	Year 5	Project Description
ANL-004 Site Infrastructure Utility Modernization Phase 1	45,000	14,306	14,095	15,000	1,599		This series of initiatives will upgrade and modernize site infrastructure and utilities. Specifically included are replacement of existing laboratory and sanitary sewers; extensive, concentrated upgrades to site utilities systems (steam, domestic/laboratory water, chilled water, wastewater); updating of the storm water conveyance systems; installation of new 138-kV lines and switchyard in the 200 area to increase system capacity for new research programs; and replacement of existing medium-voltage (13.2-kV) transfer and feeder switches in multiple buildings and facilities. The project will upgrade critical portions of the electrical power distribution system infrastructure serving various buildings and their support facilities. It will upgrade the electrical systems to current safety standards, increase system capacity, and improve the reliability and performance of equipment critical to accomplishing the objectives of various research projects. Site storm drainage will be improved to add longevity to the civil infrastructure, while the Laboratory's environmental footprint is decreased. This project will remove $4,070K of DM.

TABLE E5.1 (Cont.)

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand)					Project Description
		Year 1	Year 2	Year 3	Year 4	Year 5	
ANL-005 Multiprogram Replacement Building 3	75,000	24,000	30,000	21,000			This project will construct a modular building designed for adaptation to changing needs of existing multiprogram research. The 140,000-GSF building will replace 200,000 GSF of existing space (a 30% space reduction) through overall improvements in efficiency. Removal will occur when the space is not needed to house personnel displaced by further modernization. This project will create a collegial focus to the 200 area for approximately 290 multiprogram research staff and will give Argonne an effective, agile, state-of-the-art research laboratory that can be adapted to changes in technology and scientific missions. Flexible design, sized to appropriate national laboratory and office benchmarks, is adaptable to changing needs; improves efficiency of work flow and space use; increases synergy through co-location of multiple programs; provides areas for collaboration and informal interactions; and provides a recruiting and retention tool to attract “the best and the brightest.” Common materials, specifications, system designs, etc. will be used to simplify ongoing maintenance and operation; support current instrumentation and technology requirements (humidity control, vibration, RF, etc.); and reduce operational-maintenance costs by 30-35%. Sustainable design will result in energy efficiency and other benefits. Energy costs will be reduced by 25-35%. Improved layout that supports modern science has the potential for 5% improvement in staff productivity, as estimated by using the GSA productivity model. Technology requirements (computational versus laboratory-based research, tolerances of test equipment, etc.) will be addressed, and the project will reduce the average age of Argonne's building inventory. The full economic benefits of this project will be realized with the demolition of substandard space after the completion of ANL-006. Therefore, the ROI and payback shown here are for the combined efforts of projects ANL-005 and ANL-006. The ROI is 6.1% and the payback is 16.4 yr. Upon completion of this project, multiprogram staff will be relocated to this replacement facility. The space vacated will be available for use during the next modernization project (ANL-006).

TABLE E5.1 (Cont.)

Project Title and Site Identifier	TEC ($ thousand)	Proposed Funding Profile ($ thousand) Year 1	Year 2	Year 3	Year 4	Year 5	Project Description
ANL-006 Modernize Multiprogram Building Phase 2	60,000	11,093	24,179	24,728			This project will primarily modernize existing Building 362. Upon completion, the building will be occupied by multiprogram staff from other substandard space across the site. The facility will require significant upgrades to be made appropriate for modern science programs, but it can be modernized cost-effectively, given its age, level of DM, and condition. The facility will provide 200,000 GSF with a capacity for 300 staff. With an associated central chilled water system upgrade, the project will enable multiprogram world-class science by providing a work environment that meets modern office and laboratory criteria; is flexible in adapting to changing needs; and provides a recruiting and retention tool to attract the “best and the brightest.” The modernization will improve the efficiency of work flow and space utilization and will increase synergy through co-location of multiple programs. Innovative building design will provide areas for collaboration and informal interactions. Maintenance cost will be reduced by 15-25%, and energy cost will be reduced by 25-35%. An improved layout that supports modern science has the potential for 5% improvement in staff productivity, as estimated by using GSA productivity model guidelines. Space will be adapted to support work patterns and technology requirements of modern science (team building; cross-functional, collaborative, and computational versus lab-based research; tolerances of test equipment; etc.). This project has an ROI of 8.69% and a payback period of 12 yr; however, when combined with project ANL-005, the ROI is 6.1%, and the payback period is 16.4 yr. The project will remove $16,129,000 of DM.

E6 Appendix: Prioritized Listing of Excess Facilities (Cleanup and Disposal Actions)

Table E6.1 summarizes projects projected to clean up or remove contamination from existing facilities for reuse or disposal. Projects listed under proposed DOE-EM-type funding are also discussed in general terms in Chapter D, Sections D.1.6, D.1.8, and D.4.

TABLE E6.1 Argonne Excess Facilities Project List

Facility Eligible for Disposal or Remediation	Operating	Contamination	FIMS Excess	Area (GSF)	Reuse or Disposal	Disposal Method[a]	Estimated Disposal Cost ($ thousand)	Escalation (+2.3% annually)	Annual S&M Savings ($ thousand)	Estimated Disposal Date	Funding in FY
Proposed for Excess Facilities Disposition Funding											
Building 306 A, B, C, and Trailer Demolition	No	Radioactive	Partial Demolition[b]	1,116[c]	Disposal	Demol	120	120	11	2007	2007
Building 205 A-141 Cleanup	No	Radioactive	Rad Removal[d]	484	Reuse	Decon	159	159	5	2007	2007
Site Beryllium/Lead Dust Remediation – Selected Rooms, Phase II	Yes	Beryllium	Rad Removal[d]	550	Reuse	Decon	50	50	3	2007	2007
Bldg. 40 Demolition, Phase II	No	Radioactive	Current		Disposal	Demol	221	221		2007	2007
Bldg. 40 Demolition, Phase III	No	Radioactive	Current	3,588	Disposal	Demol	460	470	7	2008	2008
Bldg. 205 F-111 Excess/Contaminated Media and Equipment Cleanup, Phase I	Yes	Radioactive	Rad Removal[d]	1,530	Reuse	Decon	590	604	11	2008	2008
Bldg. 205 X-125 Cleanup	Yes	Radioactive	Rad Removal[d]	716	Reuse	Decon	181	189	6	2009	2009
Bldg. 308 Cathode Processor (CP) Demolition	Yes	Radioactive	Rad Removal[d]	1,200	Reuse	Decon	550	576	16	2009	2009
Bldg. 200 Heavy Isotopes Hood/Equipment Demolition and Cleanup MA 202	Yes	Radioactive	Rad Removal[d]	1,568	Reuse	Decon	215	225	13	2009	2009
Bldg. 310 A-128 and A-114 Cleanup	No	Radioactive	Rad Removal[d]	1,200	Reuse	Decon	525	550	11	2009	2009
Bldg. 205 F-111 Excess/Contaminated Media and Equipment Cleanup, Phase II	Yes	Radioactive	Rad Removal[d]	0	Reuse	Decon	710	743	17	2009	2009
Bldg. 202 Laboratory Radioactive and Biological Contaminated Equipment Demolition and Cleanup	No	Radioactive and Chemical	Rad Removal[d]	300	Reuse	Decon	75	79	12	2009	2009
Building 308 Sodium Loop Demolition	No	Radioactive	Rad Removal[d]	1,500	Reuse	Decon	1,000	1,0471	15	2009	2009
Bldg. 206 High Bay, D-Wing and B-133 Equipment and Sodium Tanks Cleanup	Yes	Radioactive	Rad Removal[d]	3,000	Reuse	Decon	800	838	18	2009	2009
Bldg. 206 Na K Heat Exchanger Demolition	No	Chemical	Rad Removal[d]	300	Reuse	Demol	500	524	10	2010	2009/2010
Clean up Historic Tanks and Debris in the 398 and 317 Bone Yard	No	Not Contaminated	Rad Removal[d]	0	Reuse	Demol	350	375	2	2010	2010
Bldg. 205 F-111 Vault Cleanup and Hood Demolition, Phase III – Vault/Corridor Cleanup	Yes	Radioactive	Rad Removal[d]	870	Reuse	Decon	1,000	1,071	0	2010	2010
Bldg. 203 Storage Hole Cleanup	No	Radioactive	Rad Removal[d]	240	Reuse	Decon	50	55	1	2010	2010
Bldg. 365 IPNS Modulator Disposition	Yes	Radioactive	Rad Removal[d]	200	Reuse	Decon	580	650	1	2011	2010/2011

TABLE E6.1 (Cont.)

Facility Eligible for Disposal or Remediation	Operating	Contamination	FIMS Excess	Area (GSF)	Reuse or Disposal	Disposal Method[a]	Estimated Disposal Cost ($ thousand)	Escalation (+2.3% annually)	Annual S&M Savings ($ thousand)	Estimated Disposal Date	Funding in FY
Clean up Historic Vessels and Debris in Misc. Site Bone Yards	No	Not Contaminated	Rad Removal[d]	0	Reuse	Decon	500	548	1	2011	2011
Bldg. 203 Cleanup of Radium Contamination	Yes	Radioactive	Rad Removal[d]	23,964	Reuse	Decon	3,000	3,439	0	2013	2011-2013
Bldg. 205 H-125/H-126 Cell Decontamination	Yes	Radioactive		2,360	Reuse	Decon	400	480	35	2015	2013-2015
Building 202	Yes			208,657[c]	Disposal	Demol	15,300	15,300	TBD	2016	2012-2016
Proposed for DOE-EM-Type Funding											
Excess Material Removal (Addresses Vault 40 Material Removal, CMT and AGHCF Additional Fuel Removal Costs, Undeclared Waste Disposition, and Legacy Waste Disposition)	No	Radioactive	Rad Removal[d]	1,500	Disposal	Demol	81,000	-	290	TBD	TBD
Building 330 CP-5 Reactor Demolition[e]	No	Potential Tritium	Current	52,743[c]	Disposal	Demol	23,500	-	25	2011	2008-2011
Building 200 (All wings except M-Wing)	Yes	Radioactive, Chemical		239,000[c]	Disposal	Demol	41,700		TBD	2018	2018-2021
Building 205 (All wings except H, G & K-Wings)	Yes	Radioactive		177,000[c]	Disposal	Demol	32,300		TBD	2021	2019-2021
Building 200 M-Wing Hot Cells Source Material Cleanup	Yes	Radioactive	Rad Removal[d]	0	Disposal	Demol	11,000	-	51	TBD	TBD
Building 212 AGHCF Demolition	Yes	Radioactive	Partial Demolition[b]	12,500	Disposal	Demol	150,000	-	1,500	TBD	TBD
Currently Operating Waste Facility RWSF 331 Shell	Yes	Radioactive	Partial Demolition[b]	46,600	Disposal	Demol	50,000	-	TBD	TBD	TBD
Grand Total				728,827			416,845	427,237	2,061		

[a] Disposal methods: Demol, demolition; Decon, decontamination.

[b] Partial demolition is assigned to FIMS entry; entry itself remains. This action will create space banking credits.

[c] Space banking is applicable to this area.

[d] Removal of radioactive material or contamination affects only portions of the FIMS entry; decontaminated areas will return to free reuse or be prepared for demolition or disposal.

[e] The estimate for the CP-5 Reactor containment building demolition is under revision. The total project cost and request levels for FY 2009 and FY 2010 therefore may increase.

E7 Appendix: Energy-Related Cost-Saving Projects

TABLE E7.1 Energy-Related Cost-Saving Projects[a]

Funding Program[b]	Title	Year Funded or Requested	TEC ($1000) Funded or Requested
DEMP	Upgrade Controls, Bldg. 213	2006	$198.0
DEMP	Upgrade Controls, Bldg. 223	2006	$346.0
DEMP	Convert Ventilation to Variable Air Volume, Bldg. 212	2007	$890.0
ESPC	Site Metering Program	2008	$360.0
ESPC	Traveling Grates	2007	$100.0
ESPC	ZGS Area Chiller Replacement	2007	$1,310.3
ESPC	Sitewide Condensate Return Piping Improvements	2007	$752.4
ESPC	Bldg. 200 K-Wing Window Replacement	2007	$59.4
ESPC	Lighting System Upgrades— 300 Area Buildings	2007	$466.7
ESPC	APS Storage Ring Heat Recovery and AHU Modifications	2007	$210.6
ESPC	Variable Frequency Drives and Controls for APS Storage Ring Process Pumps	2007	$707.6
ESPC	Lighting System Upgrades — 200 Area Buildings	2007	$2211.2
ESPC	EMCS Improvements	2007	$288.5
ESPC	Coal fired Boiler Upgrades (Stoker Feeders)	2007	$659.0
Major Repairs	Site Chiller 10 Year Overhaul Program	Annual	$300/yr
Major Repairs	Sitewide Steam and Chilled Water Coil Replacement Program	Annual	$200/yr
Major Repairs	Window/Door Replacement Program	Annual	$600/yr
Major Repairs	Hood Upgrade Program, Sitewide	Annual	$500/yr
Operating Funds	Low Cost Energy Saving Modifications Program	Annual	$50.0/yr

[a] Virtually all proposed facility-related projects have an energy savings component. The projects listed in this table have energy savings as one of the principal drivers.

[b] Funding programs: DEMP, Departmental Energy Management Program; ESPC, Energy Savings Performance Contract.

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