ORNL/TM-2002/1

Oak Ridge National Laboratory

Land and Facilities Plan

August 2002

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

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August 9, 2002

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Dear Mr. Malosh:

Contract DE-AC05-00OR22725, Oak Ridge National Laboratory Land and Facilities Plan Submission

Enclosed is the updated *ORNL Land and Facilities Plan* which is a contract deliverable for fiscal year 2002. This plan is intended to address the land and infrastructure planning requirements of DOE Order 430.1A, Life Cycle Asset Management. It replaces a number of planning documents, including the Site Development Plan, the Technical Site Information Document, and the Integrated Facilities Plan, previously required by earlier DOE orders which were canceled with the implementation of DOE Order 430.1A.

The ORNL Land and Facilities Plan will be available on the World Wide Web (WWW) at URL http://www.ornl.gov/~dmsi/landUse/.

Please contact A. R. (Tony) Medley (574-9156) or Pat Parr (576-8123) if you have any questions or require additional information.

Regards,

for WJM

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OAK RIDGE NATIONAL LABORATORY LAND AND FACILITIES PLAN

August 2002

Prepared by
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UT-Battelle, LLC
for the
U.S. DEPARTMENT OF ENERGY
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The information in the *Oak Ridge National Laboratory Land and Facilities Plan* was obtained with the cooperation of the professional staff of the Oak Ridge National Laboratory. For additional information, contact

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Comments on the 2000 *Oak Ridge National Laboratory Land and Facilities Plan* have been addressed and resolved, as appropriate, in this update. Recognizing that land and facilities planning is not a static process, this document will continue to address comments with additional updates electronically published as needed.

An electronic version of this draft document is available on the World Wide Web: http://www.ornl.gov/~dmsi/landUse/

Front cover designed by Brett Hopwood, ORNL Computing, Information, and Networking Division.

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ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
ADS	Activity Data Sheet
AEC	U.S. Atomic Energy Commission
AMCL	Advanced Materials Characterization Laboratory
AMSE	American Museum of Science and Energy (Oak Ridge)
ARIMs	Accelerator and Reactor Improvement and Modifications
ATDD	Atmospheric Turbulence Diffusion Division
BES	Basic Energy Sciences
BIO	Basis for Interim Operation
BMAP	Biological Monitoring and Abatement Program
BSR	biological significance ranking
BTC	Building Technology Center
BV	Bethel Valley
BVEST	Bethel Valley Evaporator Service Tank
CAIS	Condition Assessment Information System
CCII	Computational Center for Industrial Innovation
CCS	Center for Computational Science
CCTV	closed-circuit television
CCWS	Central Chilled Water System
CDR	conceptual design report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAR	Center for Engineering Systems Advanced Research
CFC	chlorofluorocarbon
CFM	Complex Facility Manager
CFR	*Code of Federal Regulations*
CH8	Corehole 8
CIP	Comprehensive Integrated Plan
CNMS	Center for Nanophase Materials Sciences
CRADA	cooperative research and development agreement
CROET	Community Reuse Organization of East Tennessee
CSB	Computational Sciences Building
CSMB	Center for Structural Molecular Biology
CTD	Chemical Technology Division
CTF	Central Training Facility
CWA	Clean Water Act
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOE-EE	U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
DOE-EM	U.S. Department of Energy Environmental Management
DOE-ORO	U.S. Department of Energy, Oak Ridge Operations Office
DOE-SC	U.S. Department of Energy Office of Science
DOELAP	Department of Energy Laboratory Accreditation Program
DOSAR	Dosimetry Applications Research Facility
DOT	U.S. Department of Transportation
DP	Office of Defense Programs (DOE)
DX	direct expansion

ACRONYMS AND ABBREVIATIONS (cont'd)

E^2SF	Energy and Environmental Systems of the Future
ED&C	Engineering Design and Construction
EM	Environmental Management
EREL	Energy Reliability and Efficiency Laboratory
ESD	Environmental Sciences Division
EPA	U.S. Environmental Protection Agency
ES&H	environment, safety, and health
ESH&Q	environment, safety, health, and quality
ESHQ&I	environment, safety, health, quality, and infrastructure
ET	evapotranspiration
ETF	Engineering Technology Facility
ETMC	East Tennessee Mechanical Contractors
ETNGC	East Tennessee Natural Gas Company
ETTP	East Tennessee Technology Park
EUWG	End Use Working Group
FAB	Facility Authorization Basis
FACE	Free Air CO_2 Enrichment
FAMMIS	Facility and Maintenance Management Information System
FDDI	Fiber Distributed Data Interface
FED	Fusion Energy Division
FEVA	Facility Environmental Vulnerability Assessment
FEVARI	Facility Environmental Vulnerability Assessment Recommendation Implementation
FFA	Federal Facilities Agreement
FIMS	Facility Information Management System
FMD	Facilities Management Division
FRC	Field Research Center
FRP	Facilities Revitalization Project
FSSD	Fabrication and Site Services Division
FTS	Federal Telecommunications System
FUA	Facility Use Agreement
FY	fiscal year
GAAT	Gunite and Associated Tank
GJC	Grand Junction Colorado
GPE	general-purpose equipment
GPP	general plant project
HEPA	high-efficiency particulate air
HFIR	High Flux Isotope Reactor
HPRR	Health Physics Research Reactor
HRIBF	Holifield Radioactive Ion Beam Facility
HSWA	Hazardous and Solid Waste Amendments of 1984
HTML	High Temperature Materials Laboratory
HVAC	heating, ventilation, and air conditioning systems

ACRONYMS AND ABBREVIATIONS (cont'd)

I&C	Instrumentation and Controls
IGPP	Institutional general plant project
IHEM	In-House Energy Management
IRA	interim remedial action
ISOL	Isotope Separator On-Line
IT&M	Inspection, Testing, and Maintenance
IWMF	Interim Waste Management Facility
JIBS	Joint Institute for Biological Sciences
JICS	Joint Institute for Computational Sciences
JINS	Joint Institute for Neutron Sciences
LAN	local area network
LCB	Life Cycle Baseline
LCFG	Laboratory for Comparative and Functional Genomics
LDRD	Laboratory Directed Research and Development
LEED™	Leadership in Energy and Environmental Design
LGWOP	Liquid and Gaseous Waste Operations Project
LI	Line Item
LINAC	linear accelerator
LLLW	liquid low-level (radioactive) waste
LSD	Life Sciences Division
LWS	Laboratory Waste Services
M&I	management and integration
M&O	management and operating
MAA	Material Access Area
MAB	Man and the Biosphere
MEL-FS	Multiprogram Energy Laboratory Facility Support
MFAB	master fire alarm box
MOU	Memorandum of Understanding
MS&E	Materials Science and Engineering
MSRE	Molten Salt Reactor Experiment
MV	Melton Valley
MVST	Melton Valley Storage Tanks
NABIR	Natural and Accelerated Bioremediation Research
NEON	National Ecological Observation Network
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NNSA	National Nuclear Security Administration
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRWTP	Nonradiological Wastewater Treatment Plant
NSAC	Nuclear Science Advisory Committee
NTRC	National Transportation Research Center

ACRONYMS AND ABBREVIATIONS (cont'd)

OCB	oil circuit breakers
ORAU	Oak Ridge Associated Universities
ORCAS	Oak Ridge Center for Advanced Studies
ORELA	Oak Ridge Electron Linear Accelerator
ORFICN	Oak Ridge Federal Integrated Communications Network
ORIC	Oak Ridge Isochronous Cyclotron
ORISE	Oak Ridge Institute for Science and Education
ORLaND	Oak Ridge Laboratory for Neutrino Detectors
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations Office (DOE)
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
OSR	Operational Safety Requirement
OSTI	Office of Scientific and Technical Information
PCB	polychlorinated biphenyl
PCSD	President's Council on Sustainable Development
PdM	predictive maintenance
PM	preventive maintenance
PMF	probable maximum flood
PVC	polyvinylchloride
PWTC	Process Waste Treatment Complex
PWTP	Process Waste Treatment Plant
R&D	research and development
RCRA	Resource Conservation and Recovery Act
REDC	Radiochemical Engineering Development Center
RIB	radioactive ion beam
RI/FS	Remedial Investigation/Feasibility Study
RMO	Reservation Management Organization
ROD	Record of Decision
RPM	Risk-Based Priority Model
RPSC	Robotics and Process Systems Complex
RPV	replacement plant value
RTBT	Ring to Target Beam Transport
RTS	Radiochemical Technology Section
S&M	surveillance and maintenance
SAMAB	Southern Appalachian Man and the Biosphere
SAMS	Space Allocation Management System
SANS	Small-Angle Neutron Scattering
SAR	Safety Analysis Report
SARUP	Safety Analysis Report Update Program
SC	Office of Science
SciDAC	Scientific Discovery through Advanced Computing
SDI	Shared Data Initiative
SLLW	solid low-level (radioactive) waste
SNF	spent nuclear fuel

ACRONYMS AND ABBREVIATIONS (cont'd)

SNS	Spallation Neutron Source
SSD	Solid State Division
SWSA	Solid Waste Storage Area
TDEC	Tennessee Department of Environment and Conservation
TERF	Terrestrial Ecosystem Research Facility
TLD	thermoluminescent dosimeter
TRU	transuranic
TS	Treatability Study
TSC	Technical Support Center
TSCA	Toxic Substances Control Act
TSD	Transportation Safety Document
TSDF	hazardous waste treatment, storage, and disposal facility
TSF	Tower Shielding Facility
TSRs	Technical Safety Requirements
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
UEFPC	Upper East Fork Poplar Creek
UL	Underwriters' Laboratories, Inc.
URL	Uniform Resource Locator
USDA	U.S. Department of Agriculture
USQD	Unreviewed Safety Question Determination
UT	University of Tennessee
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WM	Waste Management
WOCC	Waste Operations Control Center
WSI-OR	Wackenhut Services, Inc. - Oak Ridge
WSSs	Work Smart Standards

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1. INTRODUCTION

Oak Ridge National Laboratory (ORNL) is the nation's largest and most diverse energy research and development (R&D) institution in the U.S. Department of Energy (DOE) laboratory complex. Its activities are focused on basic and applied R&D to advance the nation's energy resources, environmental quality, and scientific knowledge. This plan has been prepared to assist DOE and contractor personnel in implementing ORNL's land and facility responsibilities for management and planning.

The Secretary of Energy has articulated the Department's overarching mission as national security, broadly construed. The Department's core science, energy, environmental cleanup, and national security programs have been placed in the context of that broad mission. As a nation we are taking urgent measures to increase our safety and security immediately, and the nation's science and technology institutions, including particularly the national laboratories, have been asked to bring today's technology to bear—rapidly and effectively—on urgent security needs. At the same time, the nation's political leadership has recognized homeland defense as an enduring challenge, and one that will require new technical solutions to a broad suite of very demanding problems over the long run.

Major DOE Office of Science (DOE-SC) research programs depend not only on the national laboratory facilities, but also on the land base of the Oak Ridge Reservation (ORR) to meet mission objectives. ORNL is managed by UT-Battelle, LLC, which has the management and planning responsibility for ORNL facilities and for most of the ORR's undeveloped land area. This responsibility includes planning for approximately 18,000 acres of undeveloped and developed land (Fig.1.1).

The ORR includes multiple, overlapping reservation land uses. Details on the various uses are discussed in Sect. 2. With major changes in mission at the East Tennessee Technology Park (ETTP) and the Y-12 National Security Complex, demonstrating current land use (by ORNL as well as other users) and planning for future land use needs by DOE and ORNL are critical. An irreplaceable asset, the reservation is a vital part of ORNL. Decisions on how to use the land area impact not only at local and regional levels but also nationally and internationally.

The ORR is a unique and irreplaceable resource for DOE to use for its national science and technology missions. The DOE ORR vision, as stated in the *ORR Comprehensive Integrated Plan* (CIP) (September 1999), emphasizes that the ORR serves as an integrated science, education, industrial, and technology complex managed by DOE in partnership with the private sector—supporting a dynamic regional and national economy. Future use is to include a mixture of activities that are compatible with and contribute to ongoing and anticipated DOE missions. According to current plans, the reservation will be used to support many of the same programs it currently supports while adapting to changing national goals and interests and reduced federal budgets. Portions of the reservation will be used to promote the development of private-sector enterprises in ways that are consistent with and complementary to DOE missions. DOE's environmental management and reindustrialization initiative is highlighted at the ETTP; defense support, manufacturing, and storage at the Y-12 National Security Complex; and research and development at ORNL.

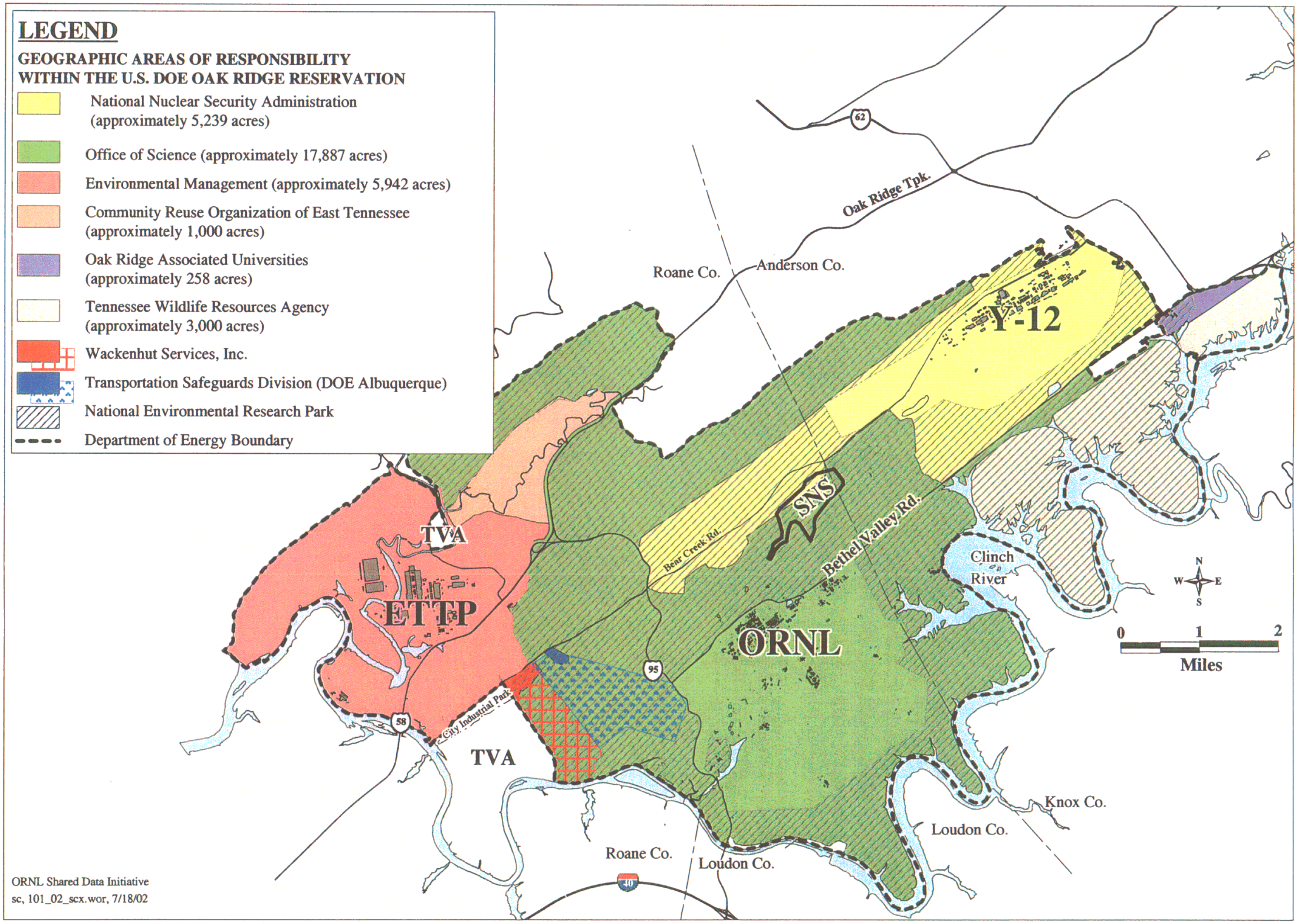


Fig. 1.1. Geographic areas of responsibility.

1.1 LAND USE HISTORY OF THE OAK RIDGE RESERVATION

The land area now known as the ORR was established on September 19, 1942, when General Groves, Commander of the wartime "Manhattan Project," ordered the immediate purchase of a tract of land along the Clinch River between the cities of Kingston and Clinton, Tennessee, to be converted into a government reservation. The 58,575-acre military reservation (17 miles long by 7 miles wide) was to contribute to the manufacture of an atomic bomb within three years. It became the site of rapid construction of three separate production facilities (code named X-10, Y-12, and K-25) and a remote residential Townsite, all of which were managed behind a heavily guarded barbed-wire fence under strict military security (Souza et al. 1997).

1.2 SHIFTING OWNERSHIP

Of the original 58,575 acres of land acquired by the federal government, 24,340 acres were disposed of and 34,235 acres remain, as indicated in Fig. 1.2. Approximately 25% of the disposed land was conveyed to the City of Oak Ridge for developmental purposes (almost 6,000 acres). It includes 2,371 acres of self-sufficiency parcels for residential, commercial, and industrial development; 270 acres for school sites; 1,172 acres for electrical, water, sanitary and storm sewer, drainage, roads and streets; 1,475 acres for municipal properties; and 29 acres for public housing. Land was also conveyed to Anderson County (28 acres), Oliver Springs (9 acres), the Tennessee Valley Authority (2,992 acres), and other federal agencies (63 acres). Land conveyed to the State of Tennessee was for health, forestry, agricultural research, and a biomedical graduate school (2,315 acres). Land conveyed for private entities and homeowners (12,692 acres) includes permanent road easements granted to the city, counties, and State to provide access to the area; 108 acres conveyed for rail service; 123 acres for area churches; 11,000 acres for house lots, country club and golf course development, sportsman's clubs, quarry operations, a cemetery association, Girl and Boy Scout organizations, and the hospital association for the medical complex. Self-sufficiency land requests from the City of Oak Ridge are discussed and identified in Appendix B.

1.3 RESERVATION-WIDE PLANNING

The focus of the *ORNL Land and Facilities Plan* is DOE's ORNL land and facility needs on the ORR. ORNL needs identified in the *ORNL Land and Facilities Plan* are incorporated into a DOE reservation-wide planning document, the *ORR Comprehensive Integrated Plan*, that includes the needs of DOE programs at ETTP, the National Nuclear Security Administration (NNSA), Oak Ridge Associated Universities (ORAU), ORNL, and other ORR land and facility users.

1.3.1 DOE Land Use Planning Process

The DOE Oak Ridge Operations Office (DOE-ORO) has initiated a land use planning process involving extensive public participation regarding the future use of land, which may in the future no longer be needed for mission purposes. The planning process began the end of August 2001 with a time line of approximately one year. DOE program needs for current and future land uses have been reviewed. Discussions indicate that most of the ORR land, except for areas around ETTP, will be needed for future DOE missions during the next 5 to 20 years. Preliminary planning has begun for the northwest portion of the reservation around ETTP. Public participation is through a Land Use Planning Focus Group (monthly working meetings are open to the public); Town Hall meetings and workshops (winter, spring, and summer meetings); comments on draft documents (available at reading rooms); and correspondence by telephone, letters, or E-mail. Planning will take into consideration existing resources and interests

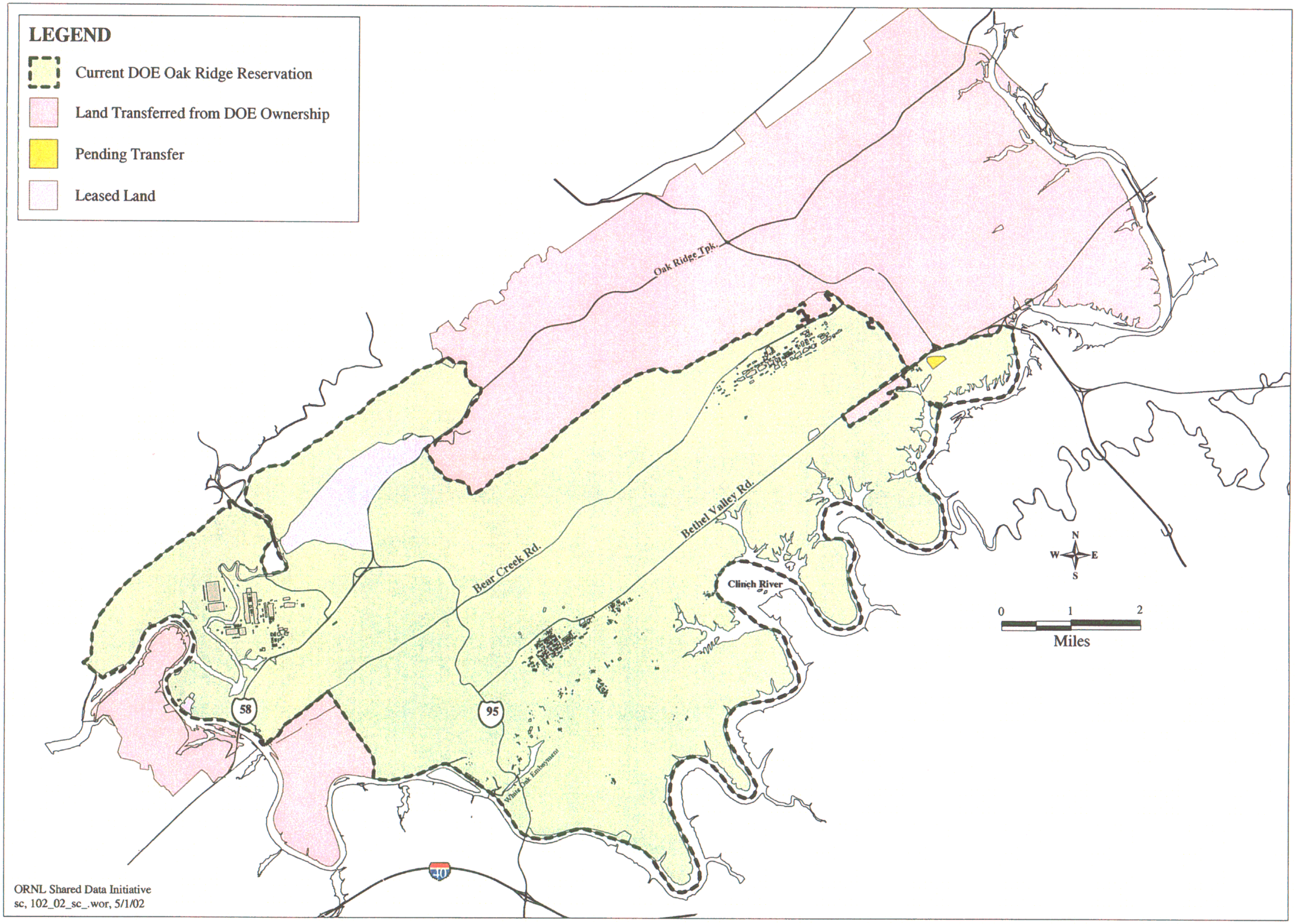


Fig. 1.2. Original DOE land purchase and current reservation boundaries.

including historic and preservation sites, wetlands and other sensitive habitats, research and monitoring, leased areas, and ongoing environmental remediation. The process will result in the development and analysis of various scenarios of how the land could be used. Site-specific and reservation-wide consequences will be considered for both individual and cumulative effects. The results will be incorporated into the *ORR Comprehensive Integrated Plan*. This process is not intended to replace other requirements such as the Executive Order 12512 Utilization Survey process or appropriate National Environmental Policy Act (NEPA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) reviews prior to initiating actions.

• *ORNL Land and Facilities Plan* • Other site plans • Land use planning scenarios • Stakeholder input	*DOE ORR Comprehensive Integrated Plan*

1.3.2 ORNL Land and Facilities Planning

Updated information on ORNL land and facilities use, revitalization, and planning is contained in this 2002 revision of the 2000 *ORNL Land and Facilities Plan*. Section 2, "ORNL Land Use Plan," provides information on current reservation uses (ORNL and others) and addresses ORNL plans for use of the land outside the ORNL fenced, developed site. Information on planned uses by non-ORNL projects (Bechtel Jacobs Company, LLC, Tennessee Department of Transportation, etc.) is included when known.

To accomplish its mission of scientific research, ORNL staff are dependent upon the availability of a wide variety of buildings and equipment, including specialized experimental laboratories, user facilities, hot cells and nuclear reactors, and a large complement of office space and associated utility systems. Section 3, "ORNL Integrated Facilities Plan," incorporates the details of facility conditions and uses and the Master Plan for facility projects. In addition to maintaining current facility infrastructure, the Master Plan includes revitalization projects to ensure that ORNL will meet the needs of a 21st Century Laboratory. Section 4 provides conclusions and recommendations for future land use and facilities at the Laboratory. Several appendices follow Sect. 4 to provide detailed information useful in understanding ORNL land and facilities plans and projects.

This plan complements and draws from recommendations provided in the DOE *Comprehensive Land-Use Planning Process Guide* (DOE 1996a) and feeds into the ORR comprehensive integrated planning document, *Comprehensive Integrated Planning Process for the Oak Ridge Operations Sites*, herein referred to as the *ORR Comprehensive Integrated Plan* (September 1999).

1.3.3 Integrated Safety and Planning

ORNL systematically and fully integrates safety into management and work practices at all levels so that the mission of the Laboratory is successfully accomplished while protecting the public, the worker, and the environment. Operations are conducted in compliance with regulations and in a manner consistent with the hazards associated with the work. Work processes are systematically evaluated by ORNL through an ongoing self-assessment program designed to ensure that the mission of the Laboratory is carried out in a safe and effective manner. ORNL has adopted Integrated Safety Management (ISM) by Contract (DEAR Clause 970.5204-2) and carries out the requirements of ISM by way of an integrated set of management systems that apply controls tailored to all the work being performed.

2. ORNL LAND USE PLAN

The U.S. Department of Energy (DOE) has made the commitment that as it conducts its energy mission on the Oak Ridge Reservation (ORR) on behalf of the nation, DOE will do so in a manner that is respectful of the land and local environment. Land use planning for the Oak Ridge National Laboratory (ORNL) identifies and prioritizes needs for preservation of reservation land to meet the requirements of existing and future scientific facilities, environmental research, education, and other compatible uses.

2.1 ORNL LAND AND FACILITIES PLAN DEVELOPMENT

The ORR is vital because the ability and/or opportunity to acquire another land area such as this is not feasible. In November 1996, an ORNL land use planning team was charged with developing a land use plan and a process for reviewing and evaluating proposed land uses. The ORNL Land and Facilities Use Committee, chartered August 1998, now has the responsibility of updating the plan. In addition, input to the plan was solicited from external stakeholders. This revision updates the 2000 *ORNL Land and Facilities Plan* (ORNL 2000).

The land uses identified in the plan include

- land for future DOE mission initiatives,
- areas for maintaining DOE mission objectives,
- diverse areas for pursuing new DOE initiatives for ORNL,
- areas for regulatory compliance,
- areas for protection of biological diversity,
- areas for historic preservation,
- areas for educational and recreational activities, and
- controlled-access areas for public recreation.

2.2 LAND USE DECISION MAKING AND PLANNING

Prerequisites to any decision include ensuring the health and safety of ORR employees and the public. Beyond health and safety and regulatory compliance, land use decision making and planning reflect the vision for land use. Recommendations on land use are made through the process described in Sect. 2.3.1 based on the land use vision statement and on guidelines for wise land use planning, land use priorities, and input by subject matter experts through a review process.

2.2.1 Guidelines for Land Use Planning

The following guidelines (not prioritized) are used in planning and evaluating land uses:

- ensure compatibility with DOE mission and vision for land use;
- cluster like uses;
- preserve clean areas;
- reuse disturbed areas;
- prevent pollution;
- protect natural, historic, and cultural resources;
- balance costs and benefits;
- create economic development opportunities;

- consider future generations;
- optimize appropriate recreational use;
- ensure compatibility with surrounding landscape;
- consider regional context;
- ensure consistency with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation agreements; and
- consider stakeholder input.

2.2.2 Land Use Priorities

For any parcel of land that will be used to support DOE's ORNL mission, potentially competing uses may or may not be compatible with each other. The following ORNL priorities for land use were developed by the ORNL Land and Facilities Use Committee for screening proposed projects prior to submission to the RMO (see Sect. 2.3.1). They have been established so that conflicts between competing uses, particularly those that are not compatible, can be resolved:

1. Preserve and protect land to meet the requirements of existing and future scientific facilities and research programs so that DOE can continue to address its national science and technology missions.

2. Preserve and protect land to meet the requirements of environmental research by ensuring that adequate areas within the ORR are protected and preserved for their biological, historical, and physical diversity.

3. Preserve and protect land to meet the requirements of scientific and technical education by ensuring that suitable land is available for facilities and research areas needed to support educational opportunities on the ORR.

4. Allow for land uses that are compatible with DOE mission uses and do not preclude future options. Decisions concerning these other uses are made on a case-by-case basis to ensure compatibility with higher-priority uses.

2.2.3 Review by Subject Matter Experts

The decision-making process includes review and evaluation of proposed land uses by subject matter experts. Reviews are conducted to determine the potential to impact the following (not prioritized) and work out acceptable alternatives to avoid or minimize impacts, if needed:

- current land uses;
- opportunities to pursue future initiatives;
- natural, historic, and cultural resources;
- health and safety;
- emergency preparedness;
- regulatory compliance;
- access control/security;
- real estate agreements;
- neighboring lands;
- utilities;
- public relations;
- changes to dose receptors;
- transportation;
- remediation and cleanup activities; and
- maintenance activities.

2.3 ORNL LAND AND FACILITIES USE COMMITTEE

The ORNL Land and Facilities Use Committee plans, reviews, and approves for recommendation to DOE all (ORNL and non-ORNL) proposed changes in the use of land and facilities within the ORNL developed area and ORNL projects proposed for the ORR outside the ORNL developed area (see Fig. 1.1). The committee, chaired by the ORNL Area Manager, is composed of representatives of various ORNL research and operations expertise and a representative of Bechtel Jacobs Company, LLC. Areas of expertise represented on the committee include security, research, safety, facilities, compliance, utilities, database management, remediation, and infrastructure planning. Review of proposed projects includes evaluation by appropriate subject matter experts. All projects are assessed to ensure compatibility with this revised *ORNL Land and Facilities Plan* and the *ORR Comprehensive Integrated Plan* (September 1999). Review through the ORNL Land and Facilities Use Committee ensures coordination of the site planning process described in Sect. 3.3. Planning goals and projects approved by the ORNL Land and Facilities Use Committee are incorporated into the *ORNL Land and Facilities Plan* and the *ORR Comprehensive Integrated Plan* updates. Approved ORNL projects for areas outside the ORNL developed area are submitted to the Reservation Management Organization (RMO) for review and concurrence and to the DOE ORR Management Team as described in the *ORR Comprehensive Integrated Plan.*

2.3.1 Review Process

Proposals for changes in land and facility use are submitted first to the ORNL Land and Facilities Use Committee for screening. This includes proposals from anyone planning activities within the ORNL developed area, as well as proposals initiated by ORNL projects or activities for areas outside the ORNL developed area.

Proposed actions within the ORNL developed area. Once approved by the ORNL Land and Facilities Use Committee, the proposed changes in land or facility use are then discussed with the DOE ORNL Site Office. If approved, an ORNL project review (i.e., National Environmental Policy Act) and other required reviews are initiated.

Proposed actions by ORNL outside the ORNL developed area. Once approved by the ORNL Land and Facilities Use Committee, the proposals are submitted to the RMO. If approved by the RMO, the proposals are submitted to the DOE ORR Management Team as described in the *ORR Comprehensive Integrated Plan* (September 1999).

Actions proposed within ORNL developed area	➡	ORNL Land and Facilities Use Committee	➡	DOE ORNL Site Office		
Actions proposed by ORNL outside ORNL developed area	➡	ORNL Land and Facilities Use Committee and DOE ORNL Site Office	➡	RMO	➡	Process in CIP

2.3.2 Overlapping Land Use/Management Responsibilities

Some land areas for which ORNL has responsibility (e.g., the National Environmental Research Park) overlap the Y-12 National Security Complex or Oak Ridge Associated Universities (ORAU) areas of responsibility. Within the overlap areas, the DOE contractors have day-to-day responsibility for management, operation, and maintenance as described in the *Oak Ridge Reservation Management Plan* (February 1999). Any proposed changes in land use within these overlap areas are reviewed by the RMO.

2.4 DESCRIPTION OF THE OAK RIDGE RESERVATION

2.4.1 Location

The ORR consists of 34,235 acres of federally owned lands within Anderson and Roane counties, Tennessee (Fig. 2.1). Most of the ORR is within the corporate limits of the City of Oak Ridge, Tennessee, and is located approximately 2 miles southwest of the population center of Oak Ridge. The ORR is bordered on the north and east by the population center of the City of Oak Ridge and on the south and west by the Clinch River/Melton Hill Lake impoundment. Knoxville, the largest city in east Tennessee, is located approximately 15 miles east of the ORR (Fig. 2.1).

2.4.2 DOE Facilities

About one-third of the ORR is occupied by the three major DOE facilities: ORNL, ETTP (formerly the K-25 Site), and the Y-12 National Security Complex. Figure 2.2 is a detailed map depicting areas of responsibility. About 3500 acres are waste sites or remediation areas. The large land area surrounding the developed areas and waste sites serves as a buffer between the City of Oak Ridge and DOE activities. Use of this buffer area has been primarily for environmental research, remediation, education, compliance monitoring, utilities, security, protection of natural and cultural resources, wildlife management, and limited recreation. There are additional miscellaneous DOE land parcels not shown on the map.

2.4.3 Physical Characteristics

2.4.3.1 Topography, Geology, and Hydrology

The ORR is the most complex geologically and hydrologically of all the DOE sites. Located in the Valley and Ridge Physiographic Province, the ORR is characterized by a series of narrow, elongated ridges and slightly broader intervening valleys that follow a northeast to southwest trend (ORNL 1992). Major valleys within the ORR include East Fork Valley, Bear Creek Valley, Bethel Valley, and Melton Valley. Major ridges within the ORR include Blackoak Ridge, East Fork Ridge, Pine Ridge, Chestnut Ridge, Haw Ridge, and Copper Ridge.

Topography is shown in Fig. 2.3. Elevation within the ORR ranges from a low of 750 feet mean sea level (MSL) along the Clinch River to a high of 1260 feet MSL along Pine Ridge (DOE 1989). Topographic relief between valley floors and ridge crests within the ORR is generally about 300 to 350 feet (ORNL 1992).

Bedrock geology is shown on Fig. 2.4. Valleys within the ORR are underlain by bedrock formations predominated by calcareous siltstones and limestones, including the Conasauga Group and the Chickamauga Group. The Conasauga Group, consisting primarily of calcareous shale interbedded with shaly to silty limestone, underlies Melton and Bear Creek Valleys. The Chickamauga Group, which underlies Bethel Valley and East Fork Valley, consists primarily of limestone, with interlayers of siltstone and other clastic material. Ridges within the ORR are underlain by two different types of bedrock: (1) formations predominated by weathering-resistant sandstones, siliceous shales and siltstones (Rome Formation and Post-Chickamauga rocks) and (2) siliceous dolostones of the Knox Group (ORNL 1992). The Rome Formation underlies Haw Ridge, Pine Ridge, and a smaller ridge northwest of Pine Ridge, while Post-Chickamauga rocks occur in one ridge on the northwestern perimeter of the ORR. These rock units are typified by steep slopes and shallow depths to bedrock. Together with the Conasauga and Chickamauga Groups, they are generally characterized as aquitards, meaning that they have limited capacity to transmit or store groundwater. The Cambro-Ordovician age Knox Group

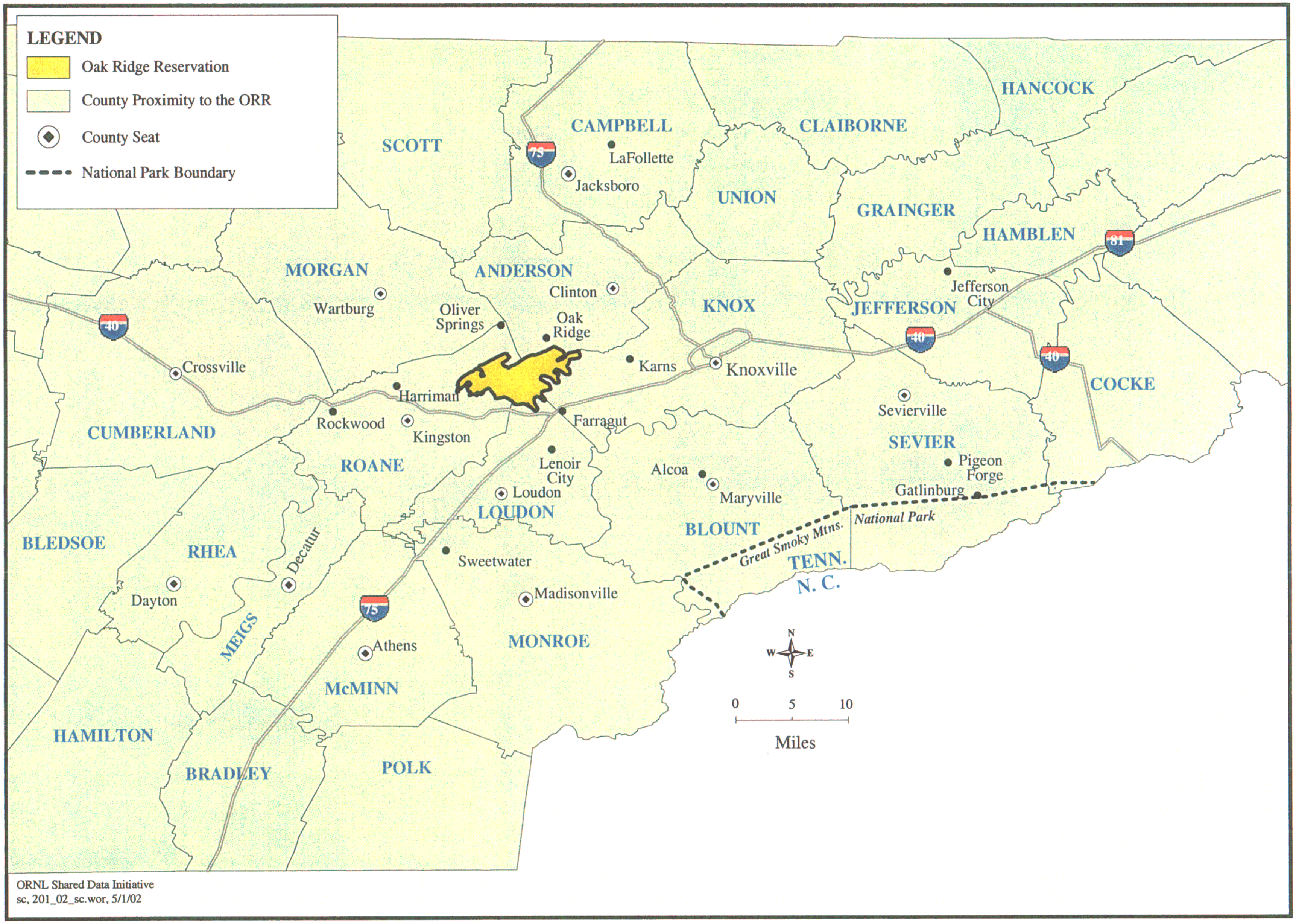


Fig. 2.1. Location of the ORR and surrounding region.

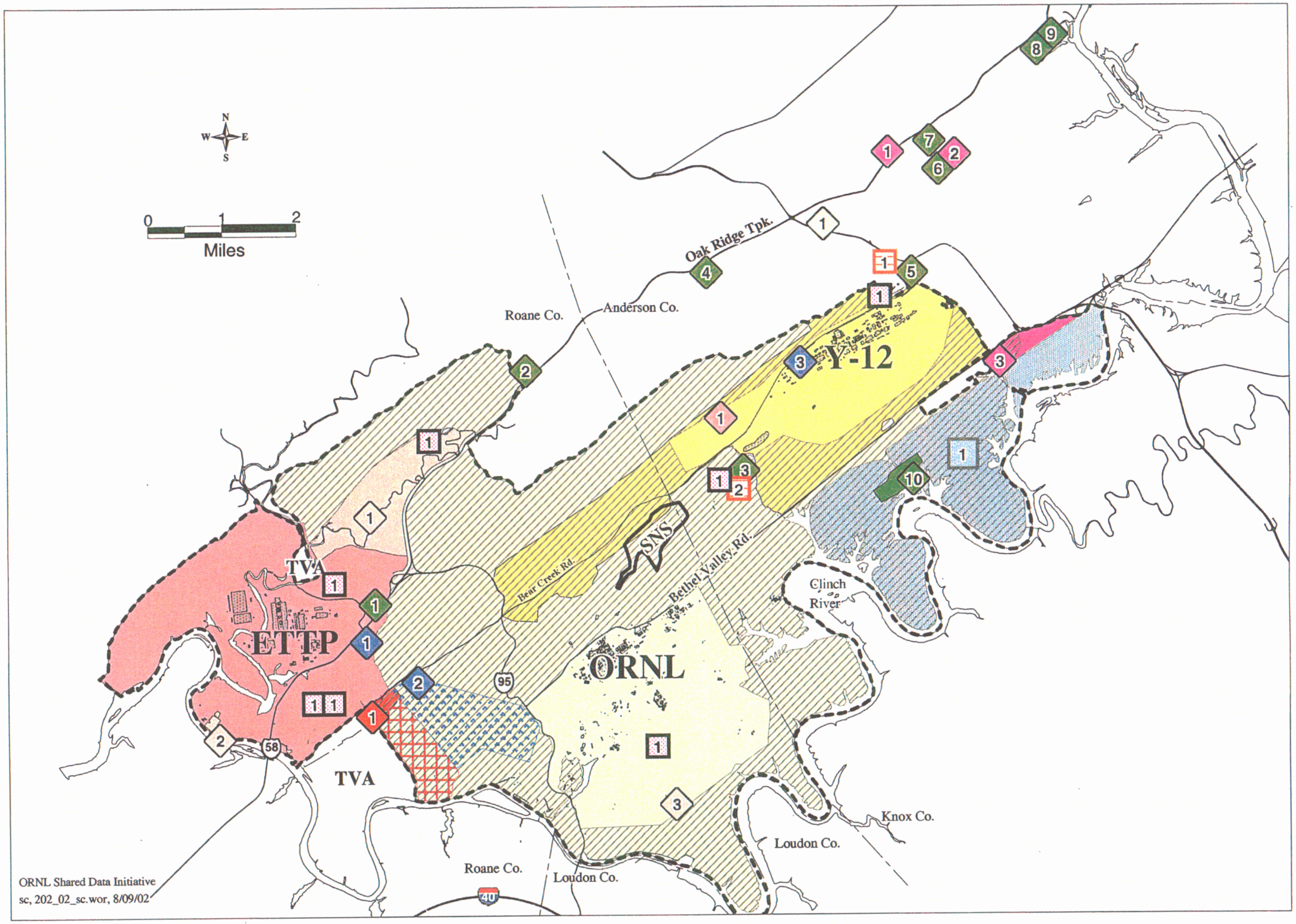


Fig. 2.2. Geographic areas of responsibility.

LEGEND

GEOGRAPHIC AREAS OF RESPONSIBILITY WITHIN THE U.S. DOE OAK RIDGE RESERVATION

- National Nuclear Security Administration (approximately 5,239 acres)
- Office of Science (approximately 17,887 acres)
- Environmental Management (approximately 5,942 acres)
  - 1 Environmental Management Waste Management Facility
- Community Reuse Organization of East Tennessee
  - 1 ED-1/Horizon Center (approximately 950 acres)
  - 2 ED-2
  - 3 BioNeutrics, Inc.

OTHER AREAS OF RESPONSIBILITY WITHIN AND OUTSIDE THE U.S. DOE OAK RIDGE RESERVATION

DOE (approximately 1,600 acres)

1. George Jones Memorial Church
2. Turnpike Checking Station (Gatehouse)
3. Chestnut Ridge Telecommunications Site
4. 55 Jefferson
5. Midway Checking Station (Scarboro Gatehouse)
6. 2714H, 2714J
7. Federal Office Building
8. 1916T-2
9. 1916T-1 (OSTI)
10. Clark Center Park

ORAU (approximately 247 acres)

1. Medical Research Facility
2. 2714F, 2714G, 2715
3. ORISE Scarboro Operations Site

TSD (DOE Albuquerque Operations Office)

1. Maintenance Facility
2. Firing Range
- Surface Danger Zone (Transportation and Safeguards Division)
3. Office and Storage Facility

NOAA

1. ATDD-NOAA
2. NOAA Meteorological Tower

ORNL

1. American Museum of Science and Energy
2. National Transportation Research Center (NTRC)

Wackenhut Services, Inc

1. Central Training Facility
- Surface Danger Zone (Central Training Facility)

Other

1. Mobile Service Sites

TWRA (approximately 3,000 acres)

1. Three Bend Scenic and Wildlife Refuge Area

National Environmental Research Park

Fig. 2.3. Topography with slope.

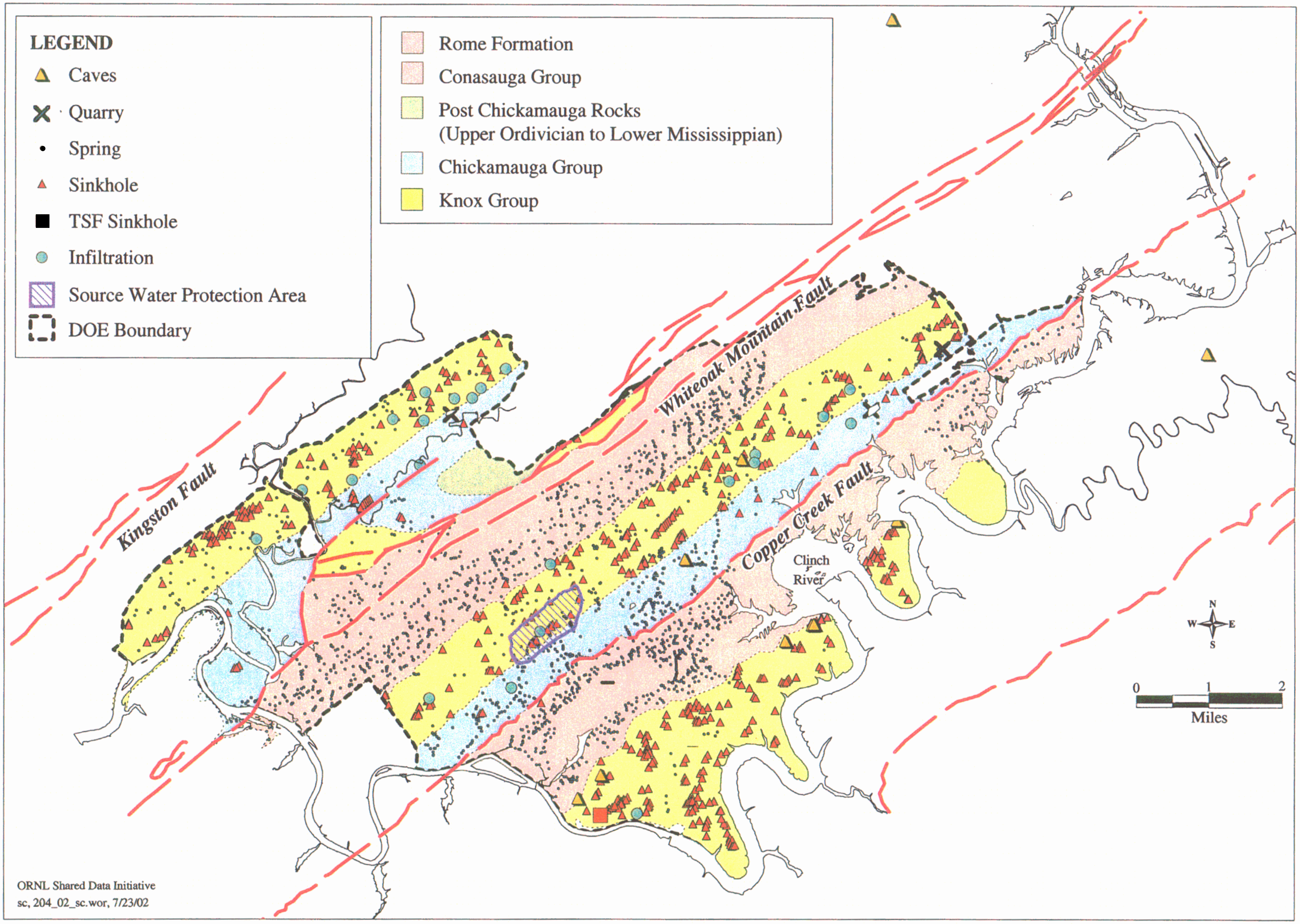


Fig 2.4. Geology with springs and karst features.

underlies Copper Ridge, Chestnut Ridge, McKinney Ridge at the ETTP, and Blackoak Ridge. It consists of a thick sequence of silica-rich carbonate rocks that weather to form silty clay soils rich in chert and resistant to erosion. Depth to bedrock is highly variable, but in many locations there is an extremely thick mantle of silty clay residual soil over solid rock. The Knox Group, together with the Maynardville Limestone in the Conasauga Group, is the principal aquifer (groundwater-bearing rock unit) on the ORR. The width of valleys and ridges is determined by geologic factors such as the dip angle and formation thickening due to thrust faulting of underlying geologic formations. Weathering and erosion processes, coupled with the general dipping attitude of bedrock underlying the area, result in rather steep (commonly steeper than 45°) northwest-facing slopes, while southeast-facing slopes are commonly gentler, with inclinations of 5 to 25% (Fig. 2.3) (ORNL 1992).

The topographical features of the ORR reflect geological structures and processes beneath the surface. While groundwater flow in bedrock and, to some degree, surface water flow are controlled by widespread fractures in all bedrock formations on the ORR, the carbonate bedrock also displays dissolutional features and landforms collectively referred to as karst. Karst features represent a spectrum ranging from minor solutional enlargement of fractures to conduit flowpaths to enterable caves. All of these are evidenced on the ORR, associated with the carbonate strike belts along ridge lines and valley bottoms.

All three ORR facilities are situated on carbonate bedrock to some extent such that groundwater flow and contaminant transport are at least in part controlled by solution conduits in the bedrock.

A recent inventory of karst features on the reservation has identified numerous indications of karst development which vary from site to site. Karst features are displayed on Fig. 2.4. Surface evidence of karst development includes sinking streams (swallets) and overflow swallets, karst springs and overflow springs, enterable caves, and numerous sinkholes of varying size. Additional karst-related topographic features may once have been present on the sites of the ORR facilities but were obscured or obliterated by construction activities. Not all springs on the ORR are associated with karst.

In general terms, karst appears most developed in association with the Knox Group carbonate bedrock. The highest density of sinkholes occurs in the Knox Group, and drilling data suggest the largest solution cavities are associated with these formations, ranging up to 22 feet in height at the ETTP. Enterable caves on the reservation are almost exclusively restricted to the Knox Group bedrock. Large springs in the Knox typically occur along the base of the ridges underlain by the Knox. Many appear to have been used for water supply purposes prior to DOE presence.

In contrast with the Knox, karst is less developed in the Chickamauga Group carbonates that underlie the ORNL facilities area and much of the ETTP facilities area in a valley-bottom topographic position. Cavities encountered in drilling are typically smaller and often clay-filled. Caves developed in the Chickamauga regionally, as well as on the ORR, are sparse and typically small.

Problems in recent years related to property damage to residential homes on neighboring properties due to settlement have highlighted the potential for collapse in areas underlain by cavernous limestone. While it is not possible to quantify the risk of collapse on the ORR, it should be considered a potential condition but not necessarily an imminent one. Considering that the karst features are best developed in the Knox Group carbonates, it stands to reason that collapse potential would be greatest in areas underlain by these formations.

The Clinch River is believed to represent the base level to which all groundwater in carbonate bedrock on the ORR would ultimately discharge, if not to surface water features on the ORR. The Tennessee Valley Authority (TVA) has performed probable maximum flood (PMF) studies along the Clinch River, which is the southern boundary of the ORR. PMF is the flood that can be expected from the most severe combination of critical hydrometeorological conditions that are reasonably possible over the entire watershed (ORNL 1992). The PMF level along the Clinch River at the mouth of Bearden Creek occurred at elevation 814.7 feet, while the PMF level at the mouth of White Oak Creek occurred at elevation 779.3 feet (ORNL 1992). Most of the ORR is located above the PMF elevation along the Clinch River.

Surface water hydrology on the ORR is characterized by a network of small streams that are tributary to the Clinch River (Fig. 2.5). Water levels in the Clinch River are regulated by TVA, and fluctuations in the river have an effect on tributary creeks and streams draining the ORR. The three DOE facilities on the ORR affect different subbasins of the Clinch River. Drainage from the ETTP enters Poplar Creek, which has a total drainage area of 136 square miles. Drainage from ORNL has its greatest effect on White Oak Creek, which has a total drainage area of 6.0 to 6.4 square miles. Drainage from the Y-12 National Security Complex enters both Bear Creek and East Fork Poplar Creek, which have total drainage areas of 7.4 and 30 square miles, respectively (DOE 1989).

2.4.3.2 Vegetation and Wildlife

The ORR is mostly contiguous native eastern deciduous forest. Prior to government acquisition as a security buffer for military activities, the ORR's approximately 1000 individual farmsteads consisted of forest, woodlots, open grazed woodlands, and fields. Results of remote-sensing analyses show that in 1994 about 70% of the ORR was in forest cover and about 20% was transitional, consisting of old fields, agricultural areas, cutover forest lands, roadsides, and utility corridors (Washington-Allen et al. 1995). Forested (hardwood and pine) areas (many in blocks greater than 100 acres) are found throughout the reservation. Cutover forest land includes about 1100 acres of pine plantations killed in 1994 by southern pine beetles (now regenerating or replanted). Additional areas are being cut to salvage timber as a result of the 1999-2000 pine beetle outbreak. Less than 2% of the reservation remains as open agricultural fields (Mann et al. 1996). The forests are mostly oak-hickory, pine-hardwood, or pine. Minor areas of other hardwood forest cover types are found throughout the ORR, including northern hardwoods, a few small natural stands of hemlock or white pine, and floodplain forests.

This large, relatively unfragmented area of mature eastern deciduous hardwood forest provides habitat for numerous wildlife species. Such blocks of forested area are increasingly uncommon in the Ridge and Valley Province and nationwide. In addition to the forested habitats and pine plantations, the ORR contains seminatural grasslands (hay) and forest edge (e. g., transmission line corridors through forest) which provide diversity of habitats suitable for a great variety of wildlife. Other wildlife habitats on the ORR include, but are not limited to, the following: old-field successional areas; unique or important vegetational communities; seminatural corridors; planted hardwoods and pines; bottomlands and wetlands, including an increasing number of beaver ponds; caves; and developed and semideveloped areas and roads.

The resulting diversity of wildlife species ranges from common species found in urban and suburban areas of eastern Tennessee to species with more restrictive requirements, such as interior forest bird species. The ORR hosts about 63 species of fish; 59 species of reptiles and amphibians; up to 260 species of migratory, transient, and resident birds; and 38 species of mammals, as well as innumerable invertebrate species. Among these, 20 species of federal- or state-protected vertebrate species have been confirmed in recent surveys (Mitchell et al. 1996). Furthermore, appropriate habitat for approximately 20 additional species has been identified.

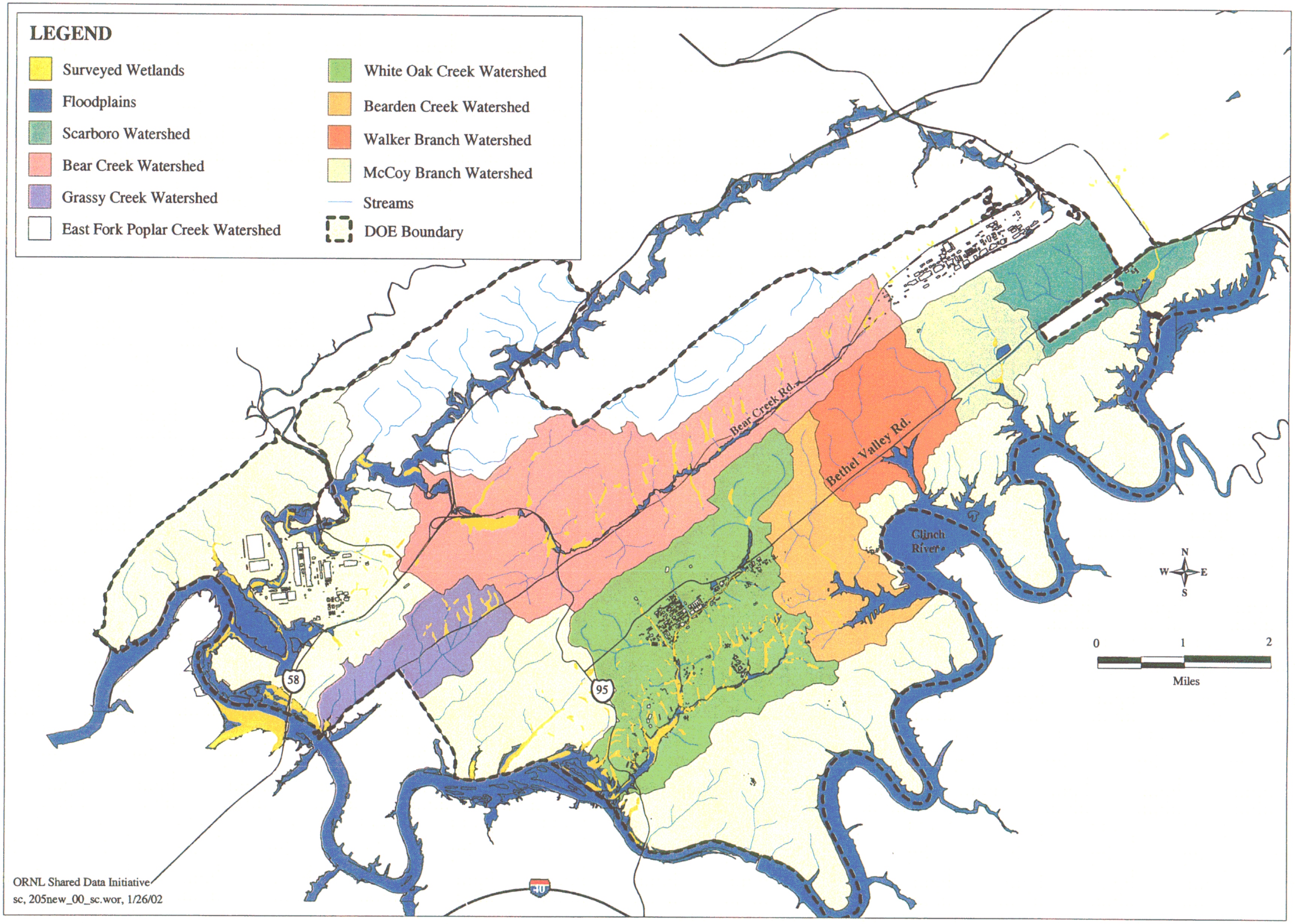


Fig. 2.5. Water, wetlands, floodplains, and watersheds.

Most of the ORR is relatively pristine when compared with the surrounding region, especially in the Ridge and Valley Province (Mann et al. 1996). Viewed from the air, the ORR is clearly a large and nearly continuous island of forest within a landscape fragmented by urban development and agriculture. Many ecological communities (e.g., cedar barrens, river bluffs, and wetlands) with unique biota, often including rare species, are known to exist within the larger framework of mixed hardwood and pine forest on the ORR (Pounds et al. 1993).

2.4.3.3 Caves, Open Sinkholes, and Quarries

Caves, sinkholes, and quarries are found on the ORR. In addition to providing important habitat for some plants and animals, including sensitive species, these features are often attractive to people, yet can be hazardous. The numerous caves on the reservation are not open to the public, and access has been restricted to research and monitoring uses (Fig. 2.4). A large, open sinkhole is located near the Tower Shielding Facility Highway 95 entrance in an area maintained by periodic mowing. The sinkhole is fenced, and access is restricted. The area is not open to the public (Fig. 2.4).The three inactive quarries (Lambert, Kerr Hollow, and Rogers) are all in restricted areas and are not open to the public (Fig. 2.4).

2.4.4 Cultural Resources

Cultural resources on the ORR include (1) surface and buried archeological materials (artifacts) and sites dating to the Prehistoric, Historic, and Ethnohistoric periods; (2) standing structures that are over 50 years of age or are important because they represent a major historical theme or era; (3) cultural and natural places, selected natural resources, and objects with importance for Native Americans; and (4) American folk life traditions and arts. Figure 2.6 shows general locations of cemeteries, churches, national historic landmarks, and old home structures. Six properties on the ORR are included in the National Register of Historic Places: New Bethel Baptist Church and Cemetery (includes church and two grave houses), George Jones Memorial Baptist Church, and Freels Cabin (includes dwelling and one outbuilding). Thirty-five other properties were identified in a 1996 evaluation (DuVall and Souza 1996). Additional information that may be considered sensitive is available in the cultural resource database for planning and evaluation purposes. A resource management plan for the ORR has been prepared (Souza et al. 2001).

2.4.5 Environmental Designations

The ORR has evolved into a biologically rich resource over the last 60 years. When acquired in 1942, aerial photos indicate that about half of the land was cleared. These cleared and cultivated areas have returned to forest through planted seedlings and natural succession, with about 70% of the ORR now in mature or maturing native forest. Ecological communities found within the larger framework of mixed hardwood and pine forests on the ORR include cedar barrens, river bluffs, and wetlands. As a result of urbanization, these communities are now absent or uncommon in areas surrounding the reservation.

Over 1100 vascular plant species are found on the ORR (compare this to The Great Smoky Mountains National Park, the most biologically diverse with respect to vascular plants of all the national parks in the contiguous U.S., which lists approximately 1650 species). Twenty-one plants listed by the State as rare (endangered, threatened, or special concern) are found on the ORR (Awl et al. 1996). The

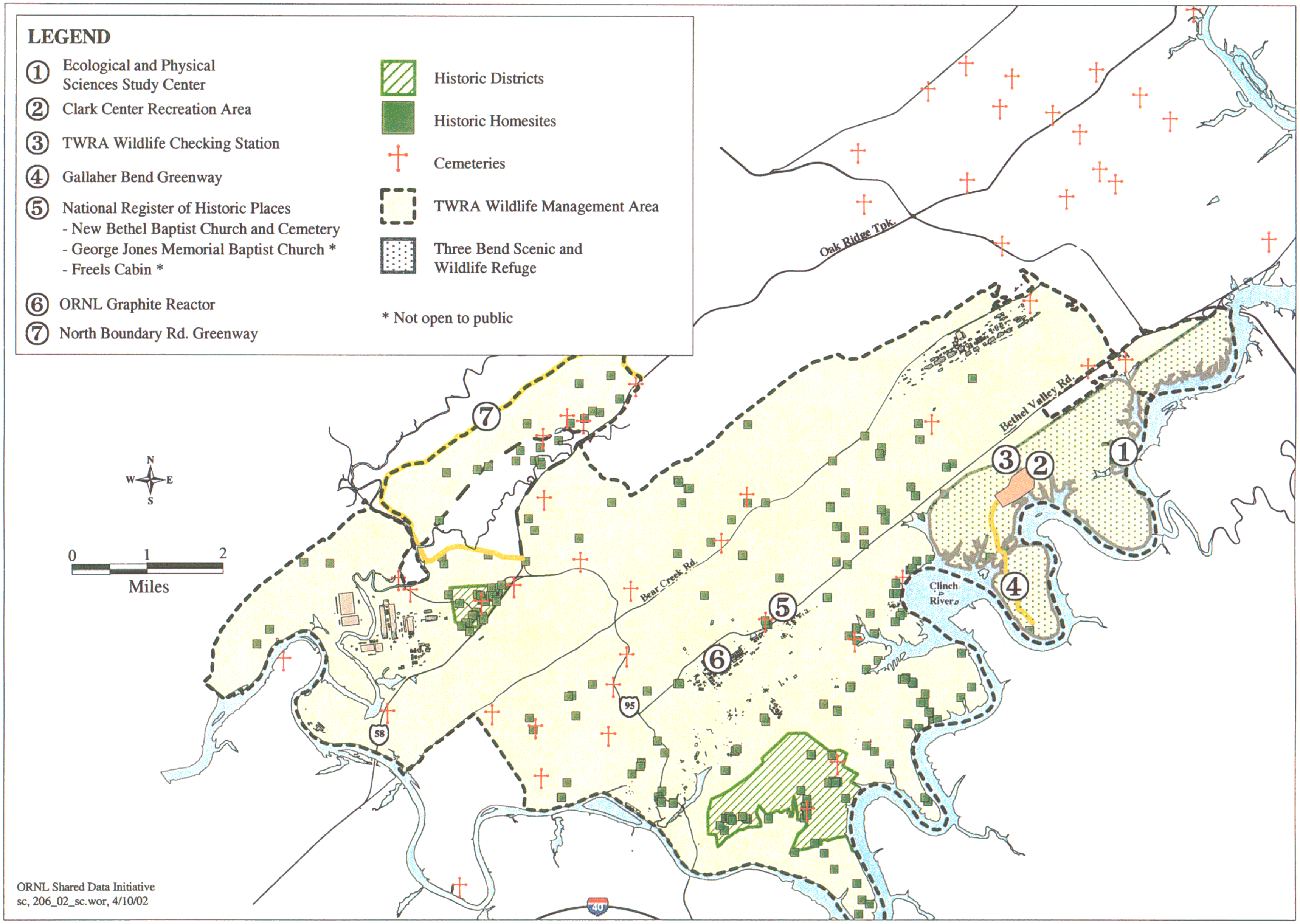


Fig. 2.6. Public, educational, and recreational opportunities.

population of tall larkspur on the ORR is one of the largest populations known to occur anywhere in the world. The species is listed as "globally rare" by The Nature Conservancy and as "endangered" by the State of Tennessee.

Over 315 wildlife species are known to occur on the ORR. Twenty of the species listed as rare by the State have been verified as occurring on the ORR, with an additional 20 that may be here because the habitat is appropriate (Mitchell et al. 1996). The Tennessee Dace (listed by the State as in need of management) is found in numerous streams and tributaries on the reservation in contrast to declining or absent populations in streams outside the ORR. Listed rare species occur across the ORR in over 50 different locations which are protected as Research Park Natural Areas. Seven of these special areas are also registered State Natural Areas.

The combination of long-term protection for the land area and the biological richness of the ORR with the available research capability and proximity of diverse scientific expertise has resulted in the following state, regional, national, and international associations:

- DOE National Environmental Research Park
- member of ParkNet (network of seven DOE National Environmental Research Parks)
- National Environmental Research Park Biosphere Reserve
- unit of the Southern Appalachian Biosphere (with Great Smoky Mountains National Park, Coweeta Hydrologic Laboratory, and others)
- member of Southern Appalachian Man and the Biosphere Cooperative [with U.S. Department of Agriculture (USDA), Forest Service, TVA, Economic Development Administration, U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service, U.S. Geological Survey, National Park Service, U.S. Forest Service, Appalachian Regional Commission, and others]
- Oak Ridge Wildlife Management Area managed by the Tennessee Wildlife Resources Agency (TWRA)
- Three Bend Scenic and Wildlife Management Refuge Area
- State Natural Areas (registered)
- ORNL User Facility

2.4.5.1 State Natural Areas

Seven State Natural Areas were noted on the ORR in 1985 through a letter agreement between DOE and the Tennessee Department of Environment and Conservation (TDEC) (see Fig. 2.7). These areas qualified as State Natural Areas because of rare plant or animal species or community types. In June 2001, TDEC submitted a request to DOE for expanded areas of designation. This request is being considered in the overall approach to comprehensive land-use management and the mission objectives of DOE.

2.4.5.2 Oak Ridge Wildlife Management Area

The ORR is a Tennessee Wildlife Management Area through an agreement between DOE and TWRA. The agreement provides for protection of wildlife habitat and species (including several threatened and endangered species) and restoration of other wildlife habitat and species. Management of the ORR for wildlife is also a type of land use (see Sect. 2.5.7).

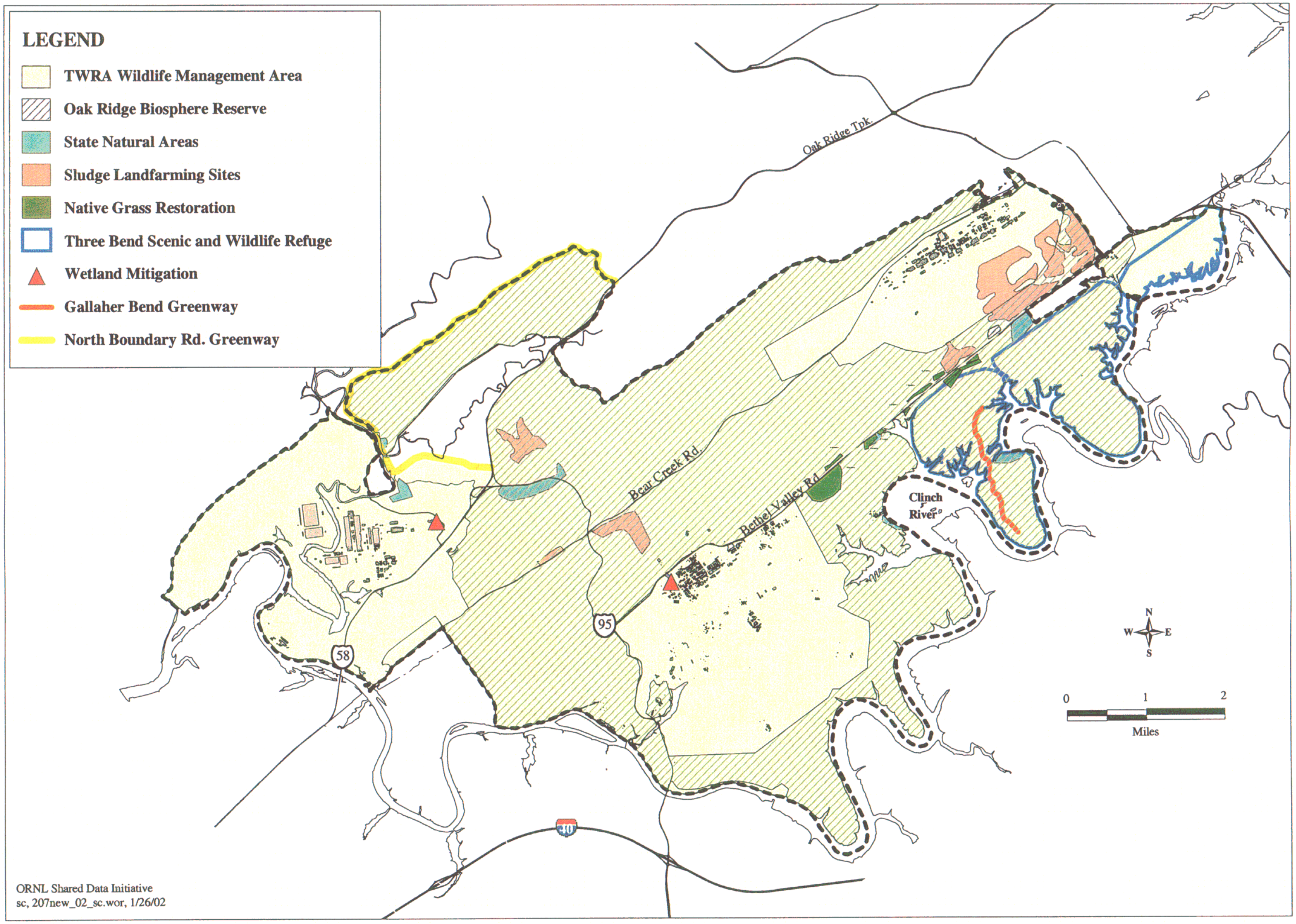


Fig. 2.7. Partnership areas.

About 2920 acres of the Wildlife Management Area are specifically managed by TWRA under a separate agreement with DOE. This area is known as the Three Bend Scenic and Wildlife Management Refuge Area and includes most of Solway, Freels, and Gallaher bends along the Clinch River on the southern boundary of the ORR.

2.4.5.3 Wetlands

The ecological functioning of approximately 580 acres of wetlands known to date on the ORR provides water quality benefits, stormwater control, wildlife habitat, rare species habitat, and landscape and biological diversity (Fig. 2.5).

Wetlands occur across the ORR in low-elevation positions primarily in the riparian zones of headwater streams and their receiving streams, as well as in Clinch River embayments. Most of the wetlands on the ORR are classified as palustrine forested, scrub-shrub, and emergent wetlands (Cowardin et al. 1979). Wetlands identified to date range in size from several square yards at small seeps and springs to approximately 25 acres at White Oak Lake. A high percentage of the wetlands on the ORR are less than one acre in size and occur in headwater areas. Wetlands greater than one acre are typically associated with river embayments, other areas affected by the fluctuating water levels of the Clinch River reservoirs (e.g., Poplar Creek), areas in which water has been artificially impounded (e.g., White Oak Lake), and beaver ponds.

Activities that affect wetlands are regulated under federal law [Sect. 404 of the Clean Water Act (CWA), Federal Water Pollution Control Act, 33 USC1251] and State law (Tennessee Water Quality Control Act, TN Code Annotated 70-324). Federal and State permits are required to conduct dredge and fill activities in a jurisdictional wetland. Impacts to wetlands are avoided whenever possible. However, if impacts are unavoidable, they are minimized through steps such as project design changes or the implementation of Best Management Practices. Compensatory mitigation in the form of wetland restoration, creation, or enhancement is a required permit condition under certain circumstances. Potential pre-impacted wetland mitigation areas are discussed in Sect. 2.6.2.3.2, "Wetland Mitigation Areas."

2.4.5.4 Nature Conservancy Biodiversity Ranked Areas

Over 270 occurrences of significant plant and animal species were recognized by The Nature Conservancy in its preliminary report of biodiversity on the ORR as part of Common Ground, the DOE Future Land Use Initiative (The Nature Conservancy 1995).

In addition, using a national ranking system, over 69 preliminary conservation sites were identified with occurrences of rare species and communities and other important features (e.g., caves, springs). These sites generally had clusters of important species or communities, with special emphasis placed on those species and elements designated as globally imperiled, rare, or uncommon in The Nature Conservancy and Natural Heritage Network ranking system. The sites also include the landscape features and ecological processes (i.e., watersheds) believed to be important for sustaining the occurrences of important species and communities. The sites were evaluated and given a biological significance ranking (BSR) based on their conservation significance. Sites on the ORR were rated BSR-2 (very high significance), BSR-3 (high significance), and BSR-4 (moderate significance). The BSR-5 category (of general biodiversity interest) was not used in The Nature Conservancy's report, although it notes that "forested land on ORR would fit in this or an above category." The Nature Conservancy areas of biological significance are identified in Fig. 2.8. The Nature Conservancy maintains ORR records of rare plant and animal species in the Biological and Conservation Database.

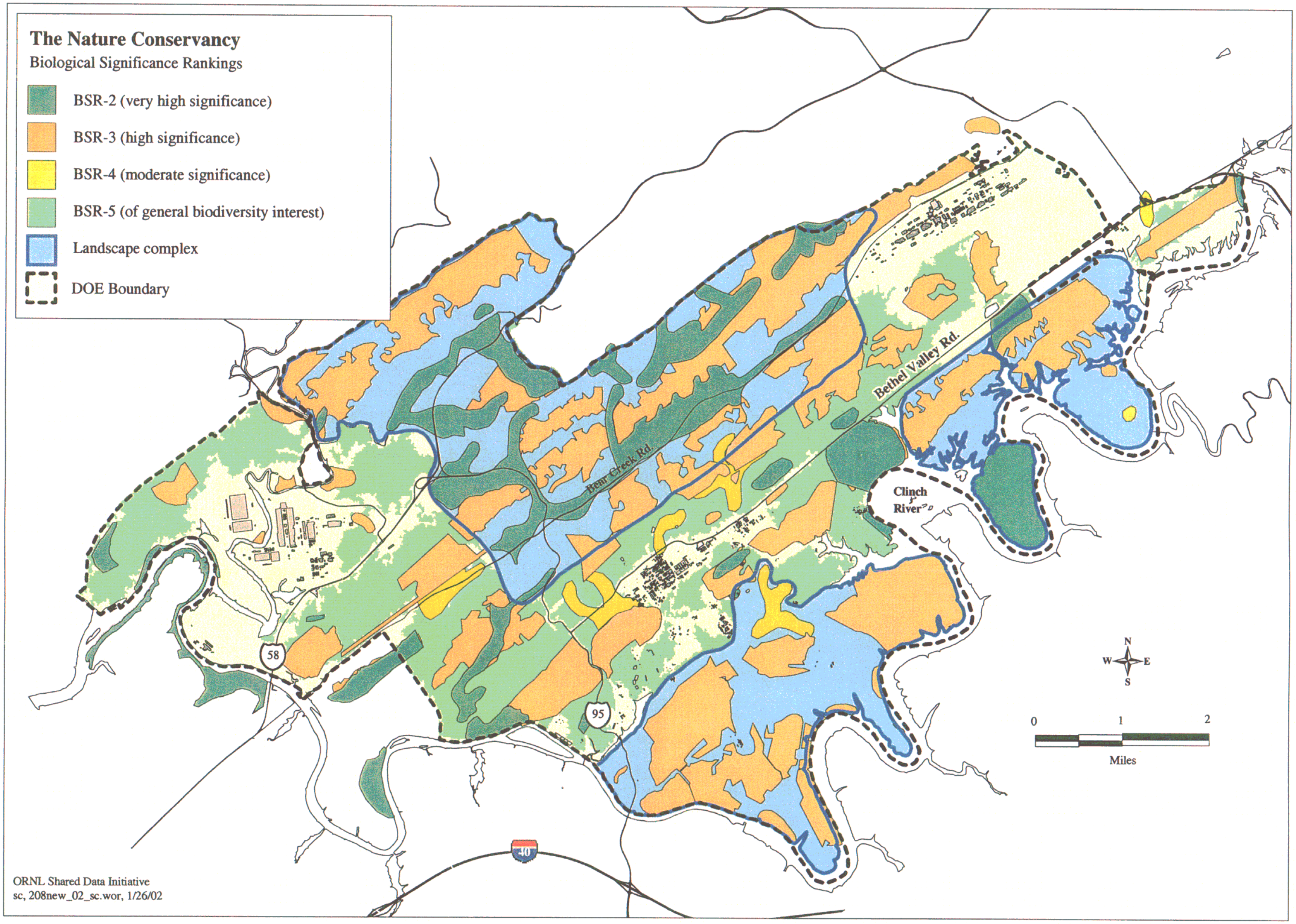


Fig. 2.8. The Nature Conservancy biodiversity rankings and landscape complexes.

2.4.5.5 Nature Conservancy Landscape Complexes

The Nature Conservancy report also recommended protection of three large land areas on which are found many highly ranked conservation sites [i.e., those with rare communities and rare species, hardwood forests greater than 100 acres, and critical watersheds (The Nature Conservancy 1995) (Fig. 2.8)].

2.4.5.6 Research Park Endangered Species Habitats (Natural Areas)

Rare plant and animal species (State and/or federal candidate, and/or listed) are provided protection through preservation of the habitat that is required for their survival. Such critical habitat is established on the best available information about the need of the rare species and is protected through Research Park Natural Area designations. Figure 2.9 shows the ORR areas designated as habitat for rare species.

2.4.5.7 Research Park Endangered Species Potential Habitats (Reference Areas)

Reference areas serve two functions. They provide protection to habitat with high potential for rare plant or animal species, and they provide protection for common or representative plant or animal communities that can serve as baseline areas for research and monitoring. Many of the areas originally designated as Research Park Reference Areas have been found to contain rare plant or animal species and have been changed to a Research Park Natural Area designation. Figure 2.9 shows these areas as potential habitat for rare species.

2.4.5.8 Biosphere Reserve

In 1988, the Oak Ridge National Environmental Research Park Biosphere Reserve (Fig. 2.7) was designated (Soles, letter to Van Hook, 1988). Biosphere reserves are areas of terrestrial and coastal ecosystems that are internationally recognized within the framework of the United Nations Educational, Scientific, and Cultural Organization Man and the Biosphere (MAB) Program. Collectively, they constitute a World Network. Each Biosphere Reserve is encouraged to fulfill three functions as appropriate within their management framework: a conservation function (contributing to the conservation of landscapes, ecosystems, species, and genetic variation); a development function (fostering economic and human development which is socioculturally and ecologically sustainable); and a logistic function (providing support for research, monitoring, education, and information exchange related to local, national, and global issues of conservation and development). The Oak Ridge Biosphere Reserve is managed by ORNL for DOE.

In addition, the Oak Ridge National Environmental Research Park Biosphere Reserve is a core protected area within the regional zone of the Southern Appalachian Biosphere Reserve. The MAB World Network now comprises 368 biosphere reserves. The Southern Appalachian Man and the Biosphere (SAMAB) is one of the most active of 47 biosphere reserves in the U.S. and is regarded as an international model.

2.4.6 Maps - Physical Characteristics and Natural Resources of the Oak Ridge Reservation

Maps included in this document were prepared on MapInfo software using data from the ORNL Shared Data Initiative (SDI). The SDI database is updated as data are available from ORNL projects as well as other ORR projects. Table 2.1 lists maps showing physical characteristics and natural resources on the ORR.

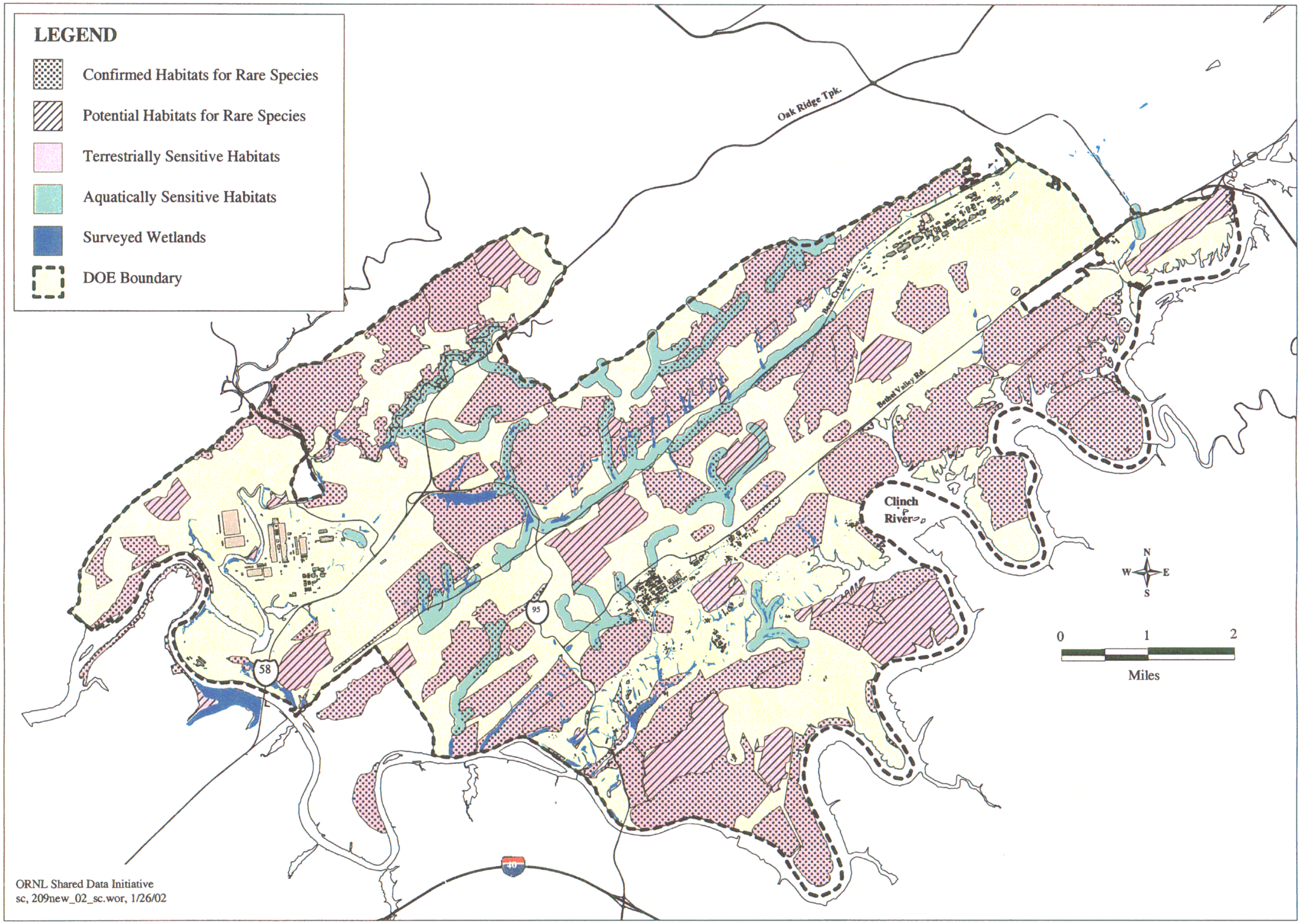


Fig. 2.9. Research park confirmed and potential habitats for rare species.

Table 2.1. Physical characteristics and natural resources of the ORR

Fig. no.	Map type	Main components
	Physical	
2.1		Location of Oak Ridge Reservation
2.2		Geographic areas of responsibility
2.3		Topography with slope
2.4		Geology with karst features including sinks, springs, caves, source water protection area, and quarries
2.5		Hydrologic features including water, wetlands, floodplains, and watersheds
	Environmental	
2.8		The Nature Conservancy Biodiversity Rankings and Landscape Complexes
2.9		Research Park confirmed and potential habitats for rare species
2.10		Research areas
2.11		Use of DOE land for specific types of research
2.12		ORR research uses

2.5 CURRENT LAND USE ON THE OAK RIDGE RESERVATION

2.5.1 National Environmental Research Park

Major DOE Office of Science (DOE-SC) scientific research programs use the ORR land base to meet mission objectives. The Office of Science considers the research and science values of the ORR to be critical. In 1980, DOE established the Oak Ridge National Environmental Research Park. Consisting of approximately 20,000 acres, the Research Park serves as an outdoor laboratory for studying the nature of present and future environmental consequences from energy-related issues such as global and regional change, environmental stresses, and resource use (Fig. 1.1). It provides a protected land area for research and education in environmental sciences and is used to demonstrate that environmental quality can be compatible with energy technology development. Furthermore, the ORR is one of the few sites in the nation where large-scale ecological research, environmental technology, and measurement science intersect against a backdrop of 30 years of environmental monitoring and research. The Research Park boundaries also form those of the Biosphere Reserve (Soles, letter to Van Hook, 1988).

The availability of the ORR protected lands and field research sites allows DOE [and its predecessor agencies, the U.S. Atomic Energy Commission (AEC) and the Energy Research and Development Administration] to support major field experiments that could not be done if the lands and associated ecological systems had not been protected and secured for such long-term studies. This research addresses fundamental questions about the effects of energy-related activities on ecological systems and compares such effects to the natural variation of ecological systems.

In addition, the Environmental Management (EM) Program supports a variety of monitoring programs on the ORR to assess the effectiveness of remedial actions for reducing the release and transport of radiological and chemical contaminants from waste disposal sites. Remote-sensing information, current and historical aerial photography, and natural resource inventories developed in the EM Program provide broad-scale information needed to characterize ecosystem status and dynamics over time. In the mid-1980s, long-term ecological monitoring programs were implemented for five ORR watersheds to comply with the Clean Water Act and/or CERCLA by assessing the health and monitoring the recovery of streams. Conventional monitoring approaches (laboratory toxicity tests, biota contaminant analyses, and benthic invertebrate and fish surveys) are combined with innovative, state-of-the-art techniques (e.g., biochemical indicators of fish health, in situ bioassays with endemic mollusks).

The National Environmental Research Park is an ORNL User Facility with more than 700 users from colleges, universities, industries, ORNL, and other State and federal government agencies over the past five years. The National Environmental Research Park also serves as the umbrella for coordinating natural resource management on the entire ORR.

Environmental Field Research Areas. Lands of the ORR are used for research to meet the mission goals and objectives of DOE in many substantive ways. The research addresses major national issues and contributes to national and international collaborative initiatives on global climate change, tropospheric air quality, sustainable development, and biodiversity. These uses require protected blocks of land ranging from a few acres to more than 250 acres. Use of the land area for research is shown in Fig. 2.10. Areas with active research have been identified. Many of these active areas also include sites where research has been proposed (identified for specific projects for proposal submittals or pending actions) or is planned (areas with high potential for studying research issues of interest to DOE and other Research Park users).

The Oak Ridge National Environmental Research Park contains intensive, long-term ecological research areas, most notably Walker Branch Watershed, which is a gauged, 250-acre deciduous forest catchment with a 30-year record of forest and stream ecosystem experiments and monitoring. This research includes studies of hydrology, atmospheric chemical deposition, forest biogeochemical cycling, plant physiology and community dynamics, and stream ecology and nutrient cycling. Ongoing research includes (1) the Throughfall Displacement Experiment, a large-scale ecosystem-level manipulation designed to assess the effects of climate-related changes in precipitation on forest growth and productivity; (2) continuous measurements of trace gas fluxes between the forest and the atmosphere; (3) an experimental study of the rates and pathways of nitrogen cycling in the stream; and (4) National Oceanic and Atmospheric Administration/Atmospheric Turbulence Diffusion Division (NOAA/ATDD) air pollutant dry deposition monitoring. (NOAA has the longest record of air pollutant dry deposition measurements in the world at Walker Branch Watershed.) NOAA/ATDD has a similar long record of measuring solar radiation in various wavelengths, and the Walker Branch Solar Station is part of the Integrated Surface Irradiance Study, NOAA's national solar radiation observing network. Walker Branch is also a site in several national research networks, including the National Atmospheric Deposition Program. Several other streams on the ORR have been used for manipulative experiments to investigate the limitation of primary productivity and the ecological effects of ultraviolet-B radiation.

Three field facilities located at Source Area A in Waste Area Group 5 (WAG 5), West Bear Creek Valley, and Melton Branch Subwatershed are extensively instrumented to monitor storm-driven unsaturated flow and saturated groundwater flow. The hydrologic and geochemical processes have been well characterized at each site, and instrumentation is available for performing sustained tracer injection studies. Investigations at the various sites have focused on quantifying the mechanisms of preferential flow and matrix diffusion in fractured saprolites and shale bedrock. Research findings have significantly improved decision-making strategies with regard to contaminant remediation in complex heterogeneous subsurface media.

In addition, several large lysimeters located west of the Y-12 National Security Complex in Bear Creek Valley are the site of manipulative, ecosystem-level experiments that use Genetically Engineered Microorganisms to investigate contaminant biodegradation in soil. While currently not in active use, these lysimeters provide a unique facility for safely evaluating the efficacy of such organisms.

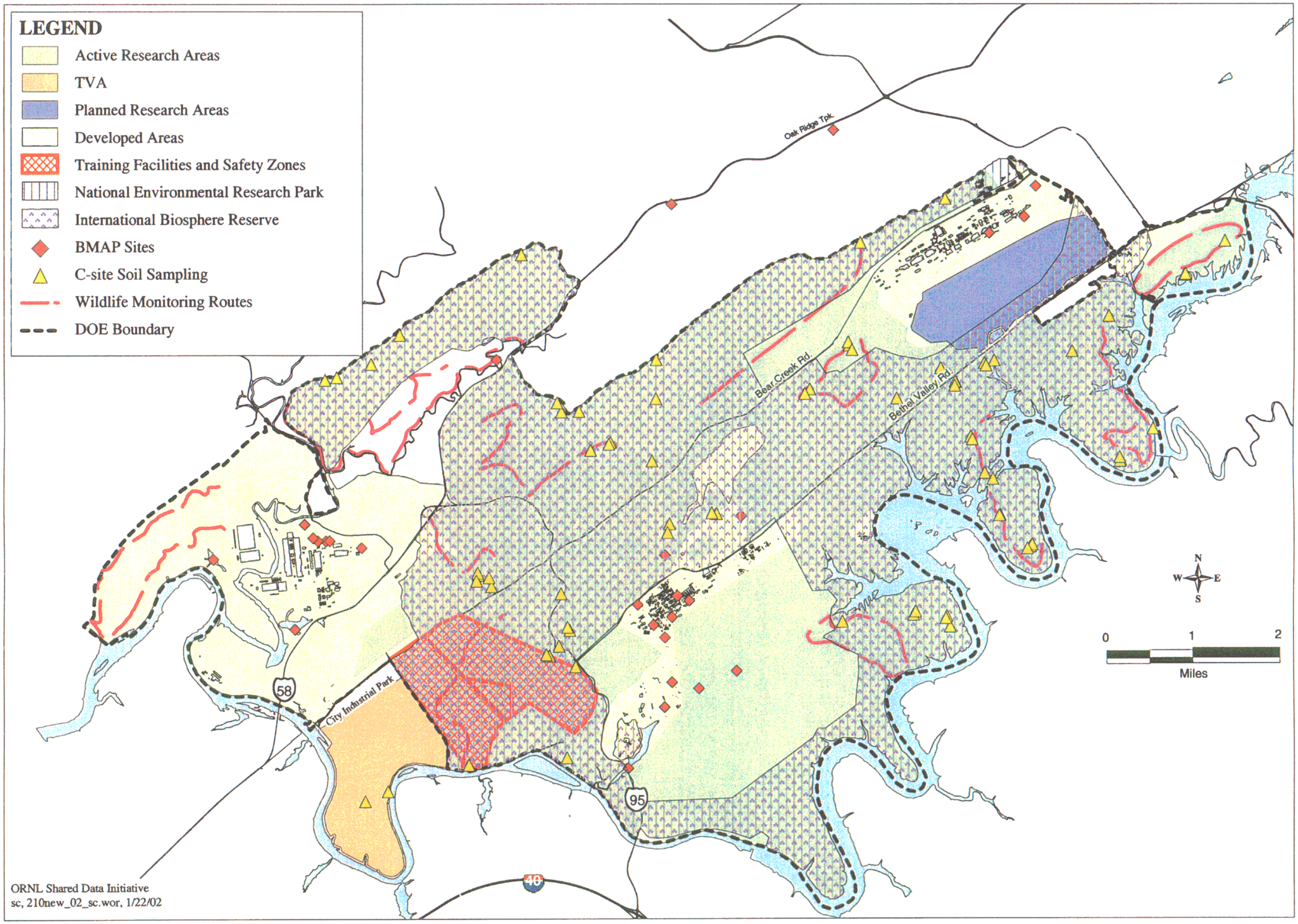


Fig. 2.10. Use of DOE land for research.

One of the major facets of the ORR Bioenergy and Carbon Sequestration Initiative regards the forests and their ability to sequester carbon. A description is included in the *ORNL Institutional Plan* (ORNL 2002).

The thousands of acres of eastern hardwood forests on the ORR also support several large-scale ecological manipulation experiments that have established ORNL's national leadership role in global change impacts research. Diverse, complex, and large-scale experimental approaches are used to understand how forest ecosystems respond to the changes in temperature, precipitation, and atmospheric carbon dioxide (CO_2) concentrations expected from global climate change. For example, the Free Air CO_2 Enrichment (FACE) Facility in the 0800 Area was completed in 1997 to investigate the response of a forest ecosystem to increased CO_2 concentrations. This unique global change research facility is providing an opportunity for researchers from all over the U.S. to increase collaborative research on the effects that changes in precipitation or CO_2 may have on the long-term development of these forest communities.

Research use on the reservation has been categorized under four main research types. Figure 2.11 shows the areas with active, proposed, and planned research for carbon cycling and management research, ecosystem dynamics research, global climate change research, and remediation research and monitoring. Specific research within these categories is described below and numbered corresponding to the research compartments shown in Fig. 2.12.

Carbon Cycling and Management Research. Carbon cycling research investigates the flows of carbon through ecosystems and the factors that control that flow, while carbon management research examines the mechanisms by which carbon is stored in ecosystems. Primary production and decomposition and soil carbon are key components of these studies. This work encompasses both terrestrial (forests and agriculture) and aquatic systems. Information garnered from this work will lead to better approaches for enhancing carbon uptake thereby slowing the buildup of carbon dioxide in the atmosphere or conversely reducing the loss of fixed carbon to the atmosphere.

- Control Area for Walker Branch Watershed and Chestnut Ridge Experimental Catchments - 14, proposed
- Bethel Valley Agricultural Land Use Impacts and Carbon Sequestration Research Area - 21, 22, planned (currently active in 19, 29)
- Bethel Valley Agricultural Land Use Impacts and Carbon Sequestration Research Area - 19, 29, active (also planned for 21, 22)
- Carbon Biogeochemistry in High-Fertility, Hydric Environments - 4, 7, 14, 21, planned
- Carbon Experimental Site - planned
    - Bethel Valley Replicated Limestone - 19, 22
    - Blackoak Ridge Replicated Dolomite - 2
    - Bottomland Forest Communities - 4
    - East Fork Poplar Creek - 5
    - Pine Ridge Replicate Experimental Catchments - 9
    - Replicated Controls for Chestnut Ridge - 25
    - Valley Bottom - 21
    - Wetland - 7
- Carbon Experimental Site - 37, active
- Pine Ridge Replicate Experimental Catchments - 37
- Carbon Sequestration Research - 30, planned
- Control Areas for Research on Impacts of Urban Fragmentation with Respect to (a) Plant and Soil Carbon Sequestration Rates, (b) Forest Successional Dynamics on Biodiversity, (c) Wildlife and Neotropical Migrants, (d) Invasive Exotic Species, and (e) Geneflow and Genetic Isolation - 2, planned

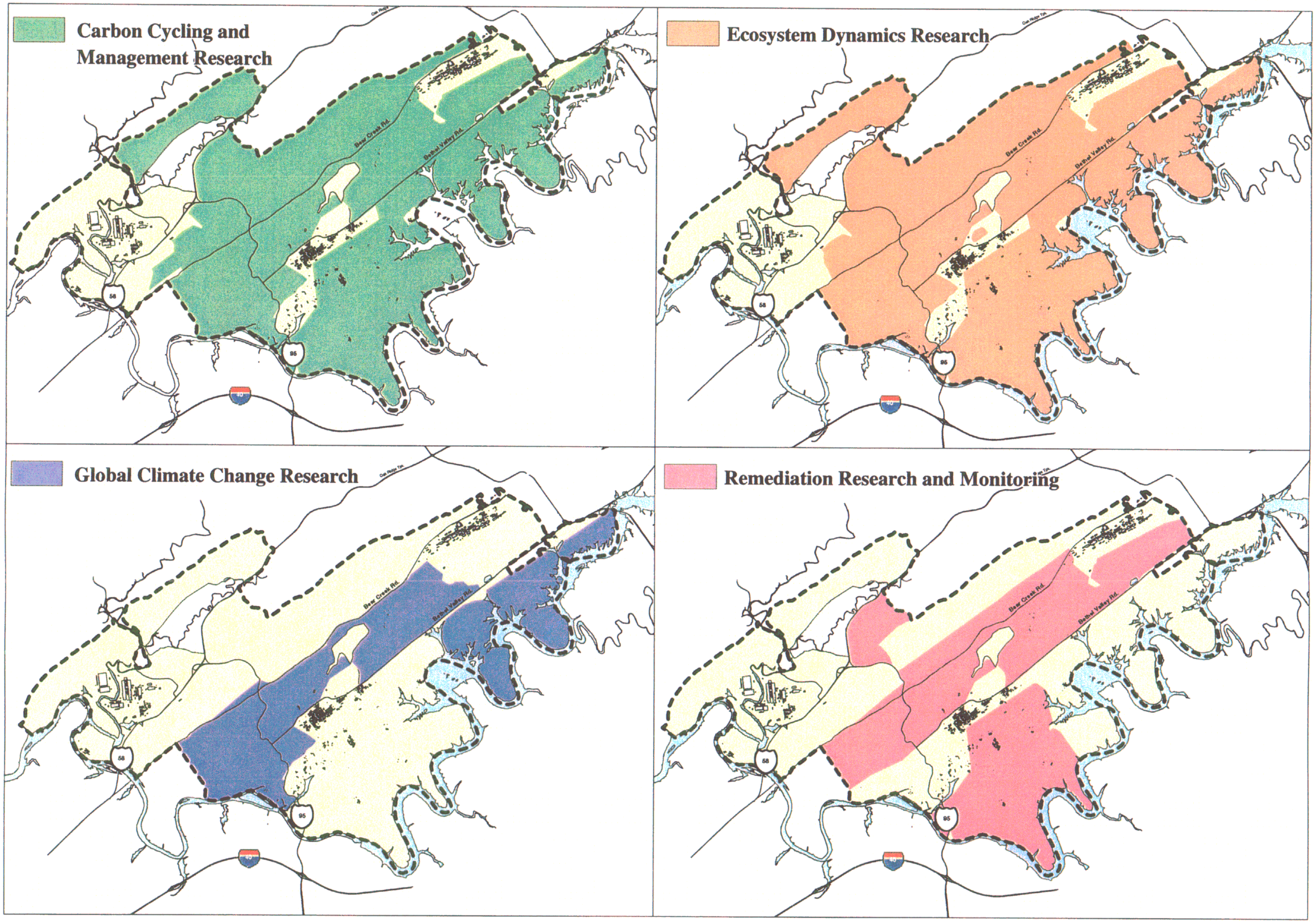


Fig. 2.11. Use of DOE land for specific types of research.

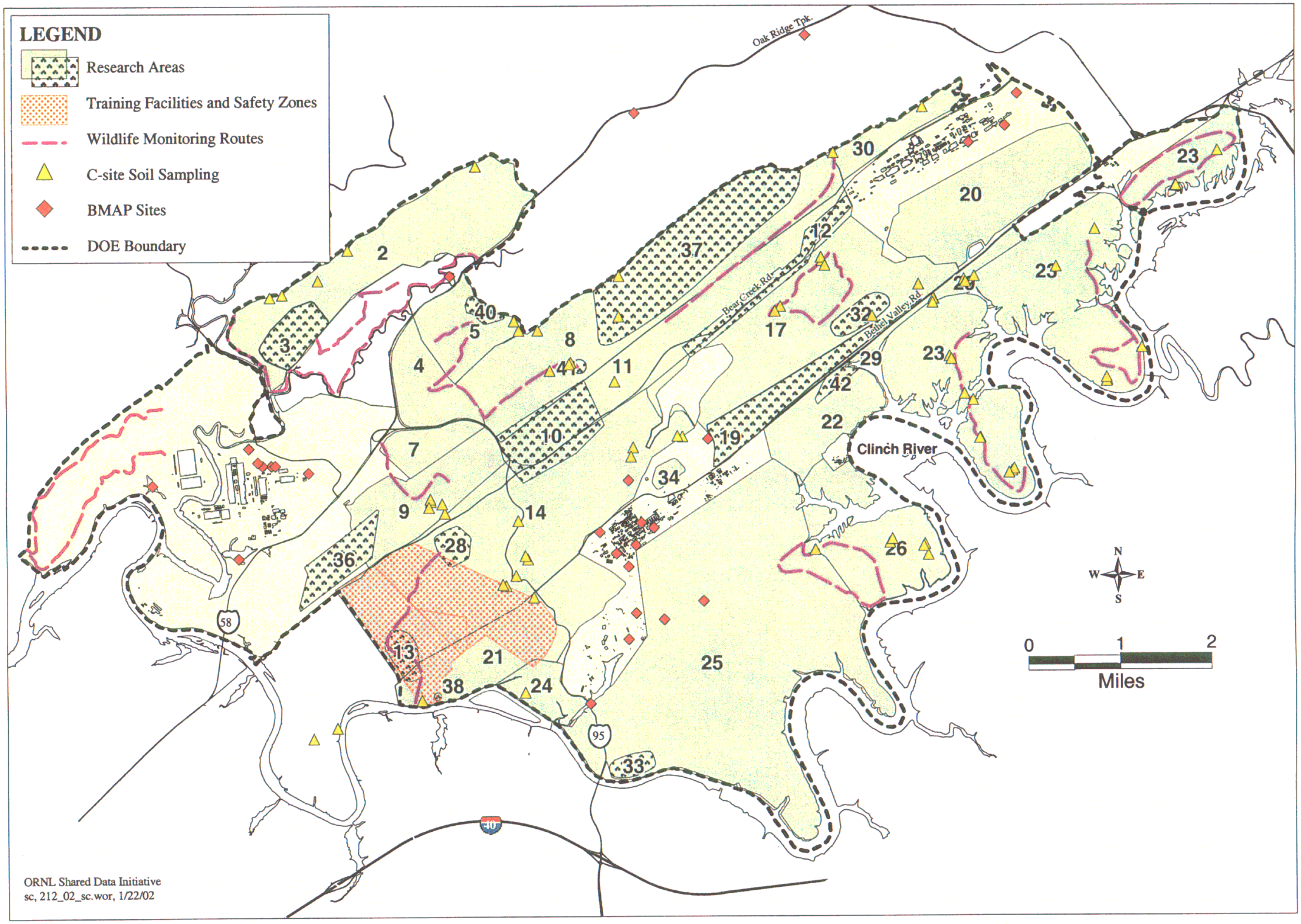


Fig. 2.12. Description of ORR research uses.

- C Site for Ecosystem and Landscape Studies - 2, 5, 8, 9, 10, 11, 14, 17, 19, 21, 23, 24, 26, 28, 30, 36, active
- Ecosystem Processes (Carbon Sequestration, Biodiversity, Wildlife, Non-Native Invasive Species) in High-Contrast Landscapes (Dry Ridges, Wet Valley Bottoms) - 8, 9, planned
- Effects of Current Land Management Practices on Soil and Plant Carbon Storage - 23, planned
- Enriched Background Isotope Study, C-14 - 3, 9, 17, 22, active
- Forest Succession Experimental Sites for Wildlife, Carbon Sequestration, Invasive Species, Biodiversity - 19, 21, 22, planned
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research - 4, 5, 14, 17, 20, planned
- Partnership with the Y-12 National Security Complex, Carbon Sequestration Demonstration Site, Biomass and Soil Carbon Experimental Facility - 20, planned
- Recovery of Soil Carbon and Biodiversity on Ash Fields - 20, planned
- Walker Branch Watershed Nitrogen and Carbon Transect Study - 17, active
- Walker Branch Watershed Long-Term Research Area and Buffer - 17, active

Ecosystem Dynamics Research. These studies focus on an improved understanding of ecosystem function and dynamics. Much of the work addresses the complex response of ecosystems to natural and human perturbations such as drought, elevated ozone, forest fragmentation and isolation, and exotic invasive species. Included among these field studies is the world's largest multiyear ecosystem manipulation experiment to examine the response of mature forest to rainfall shifts. The factors which control biodiversity of ecosystems are also a topic of several studies. These studies will improve the ability to predict ecosystem responses to change and to better manage ecosystems to safeguard the resources they provide.

- Biofuels Research and Demonstration Site - 24, active (planned for 14, 19, 21, 23)
- Carbon Experimental Site - 37, active
- Pine Ridge Replicate Experimental Catchments - 37
- Enriched Background Isotope Study, C-14 - 3, 17, 22, 36, active
- Forest Succession Experimental Sites for Invasive Species - 22, active
- Invasive Plant Control Research - Oriental Bittersweet - 8, active
- Exotic, Invasive Plant Research - 8, 17, 25, 26, 29, 30, active (13, 23, 25, 26, 29, 30, proposed)
- Long-Term Agricultural Impacts Research Plots - 32, 33, 34, active
- Long-Term Recovery from Agricultural Impacts - active
  - Complex Terrains - 17, 25, active (14, 26, planned)
  - Level Terrains - 19, active (22, planned)
- NOAA Partnership Area, NOAA Tower No. 2 and Footprint Area - 14, active
- NOAA Partnership Area, NOAA Tower No. 1 and Footprint Area - 17, active
- Partners in Flight Monitoring Route - 4, 5, 7, 8, 9, 11, 13, 14, 17, 21, 23, 25, 26, 30, area north of ETTP, ED-1, active
- Partnership with TWRA Wildlife Management Area on Wildlife Research, Monitoring, and Restoration - entire reservation, active
- Partnership with TWRA for biodiversity, educational, and research initiatives - 23, active
- Rare Plant Population Long-Term Monitoring - 29, active
- Throughfall Displacement Experiment - 17, active
- Tree Nutrition Study - 13, active
- Vascular Plant Monitoring Site - 28, 38, 39, 40, 41, 42, active
- Walker Branch Watershed Nitrogen and Carbon Transect Study - 17, active
- Walker Branch Watershed Long-Term Research Area and Buffer - 17, active
- Whole Tree Harvest Research - 28, active
- Biodiversity of Productive Riparian Areas - 4, 7, proposed
- Control Areas for Research on Impacts of Urban Fragmentation with Respect to Invasive Exotic Species - 2, proposed

- Control Area for Walker Branch Watershed and Chestnut Ridge Experimental Catchments - 14, proposed
- Forest Succession Experimental Sites for Invasive Species - 22, proposed
- Exotic, Invasive Plant Research - 13, 23, 25, 26, 29, 30, proposed (8, 17, 25, 26, 29, 30, active)
- Ecosystem Processes of Exotic, Invasive Plants in High-Contrast Landscapes - 9, proposed
- Large-Scale Catchment Study Area - 22, proposed
- Terrestrial Ecosystem Research Facility (TERF) - entire Research Park, proposed
- Biodiversity of Productive Riparian Areas - 14, 21, planned
- Biofuels Research and Demonstration Site - 14, 19, 21, 23, planned (active in 24)
- Biomass Recovery Plots - 9, planned
- Carbon Biogeochemistry in High-Fertility, Hydric Environments - 4, 7, 14, 21, planned
- Carbon Experimental Site - planned
  - Bethel Valley Replicated Limestone - 19, 22
  - Blackoak Ridge Replicated Dolomite - 2
  - Bottomland Forest Communities - 4
  - East Fork Poplar Creek - 5
  - Pine Ridge Replicate Experimental Catchments - 9
  - Replicated Controls for Chestnut Ridge - 25
  - Valley Bottom - 21
  - Wetland - 7
- Control Areas for Research on Impacts of Urban Fragmentation with Respect to (a) Plant and Soil Carbon Sequestration Rates, (b) Forest Successional Dynamics on Biodiversity, (c) Wildlife and Neotropical Migrants, (d) Invasive Exotic Species, and (e) Geneflow and Genetic Isolation - 1, 2, planned
- Ecosystem Processes (Carbon Sequestration, Biodiversity, Wildlife, Non-Native Invasive Species) in High-Contrast Landscapes (Dry Ridges, Wet Valley Bottoms) - 8, 9, planned
- Ecosystem Consequences of High Geological Complexity - 5, planned
- Effects of Current Land Management Practices on Soil and Plant Carbon Storage - 23, planned
- Forest Succession Experimental Sites for Wildlife, Carbon Sequestration, Invasive Species, Biodiversity - 19, 21, 22, planned
- High-Complexity Shoreline Effects on Wildlife, Biodiversity, Biogeochemical Flux Rates - 26, planned
- Long-Term Recovery from Agricultural Impacts - planned
  - Complex Terrains - 14, 26, planned (17, 25, active)
  - Level Terrains - 22, planned
- National Ecological Observation Network (NEON) - entire Research Park, planned
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research - 4, 5, 14, 17, 20, planned
- Experimental Facility - 20, planned
- Pine Bark Beetle Recovery Area Research - 19, 21, 22, 29, planned
- Recovery of Soil Carbon and Biodiversity on Ash Fields - 20, planned
- Replicated Controls for Chestnut Ridge - 14, 17, 26, planned
- Role of High-Productivity Habitats in Wildlife Conservation - 4, 7, 14, 21, planned
- Urban/Industrial Impacts on Isolated Natural Areas - 30, planned

Global Climate Change Research. These studies examine the response of ecosystems to atmospheric and climatic changes and the ability to monitor those changes. Joint studies with NOAA evaluate the ability to measure gas fluxes (e.g., CO_2, H_2O) over whole watersheds and thereby infer watershed productivity and water flux. The Free Air CO_2 Enrichment (FACE) experiment, in which a closed-canopy sweetgum plantation is exposed to elevated carbon dioxide, examines long-term forest ecosystem response to elevated carbon dioxide. This study builds upon open-topped chamber experiments on the reservation in which tree seedlings are grown for multiple years under natural rainfall and light but altered carbon dioxide. Tree and grass crops for energy production are also the subject of field studies.

These crops could provide an alternative energy source to fossil fuels. This suite of studies is aimed towards improving (1) the understanding of the impact of climate and the atmosphere on ecosystems and (2) the ability to manipulate ecosystems to mitigate negative effects of those changes.

- Biofuels Research and Demonstration Site - 24, active (planned for 14, 19, 21, 23)
- Free Air CO_2 Enrichment (FACE) - 24, active
- Global Carbon Cycle Studies - 24, active
- Global Climate Change Field Research Facility - 24, active
- NOAA Partnership Area, NOAA Tower No. 2 and Footprint Area - 14, active
- NOAA Partnership Area, NOAA Tower No. 1 and Footprint Area - 17, active
- Throughfall Displacement Experiment - 17, active
- Walker Branch Watershed Long-Term Research Area and Buffer - 17, active
- Control Area for Walker Branch Watershed and Chestnut Ridge Experimental Catchments - 14, proposed
- Large-Scale Catchment Study Area - 22, proposed
- Terrestrial Ecosystem Research Facility (TERF) - entire Research Park, proposed
- Biofuels Research and Demonstration Site - 14, 19, 21, 23, planned (active in 24)

Remediation Research and Monitoring. Like many other locations, production and research activities in the past have left the ORR with many sites contaminated with toxic chemicals and/or radionuclides. Scientists have taken advantage of on-site contamination to conduct in situ studies of the pathways by which contaminants move through the sites (soils, air, groundwater), the chemical and physical changes that occur to contaminants, and approaches that could be used to remediate or clean up such sites. Long-term monitoring of such sites is an important component of understanding the fate of contaminants. Site characterization of hydrologic flow (the chief means of contaminant movement) is key to many field remediation studies; consequently, such study sites are often heavily instrumented. Oak Ridge was recently selected by DOE to be the Field Research Center (FRC) for DOE's Natural Acceleration Bioremediation Investigation Research (NABIR) program. The FRC provides a site to conduct research and obtain samples related to in situ bioremediation of metals and radionuclides. The FRC includes a contaminated area for experiments on a plume of contaminated groundwater, a background area that provides for comparison studies in an uncontaminated area, and ancillary structures located within a 3.2-mile radius of each other on the ORR. These studies will lead to an improved understanding of the fate of contaminated sites at Oak Ridge and elsewhere and the most effective approaches to their cleanup.

- Biological Monitoring and Abatement Site - 14, 19, 25, Upper Mitchell Branch east of ETTP, ED-1, active
- Hydrology Field Sites - 10, 11, active
- Natural Acceleration Bioremediation Investigation Research (NABIR) Field Research Center - 11, active
- Natural Acceleration Bioremediation Investigation Research Reference Area - 10, active
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research - 4, 5, 14, 17, 20, planned

Compartment identifications for research areas are shown in Fig. 2.12. Many research projects include most of the reservation land area, excluding facilities.

Entire Research Park and Other Land Areas Outside of Facilities.

- Center for Bioenergy Research
- Partnership with TWRA Wildlife Management Area on Wildlife Research, Monitoring, and Restoration
- C Site for Ecosystem and Landscape Studies
- Partners in Flight Cooperative Study Site
- ORR Bioenergy and Carbon Sequestration Initiative

Specific active research projects within each compartment or area are described below. Proposed and planned research within these areas is described in Sect. 2.6.1, "Ecosystem Research."

Area 2
- C Site for Ecosystem and Landscape Scale Studies

Proposed research areas:
- Control Area for Impacts of Urban Fragmentation on Invasive Exotic Species

Area 3
- Enriched Background Isotope Study, C-14

Area 4
- Partners in Flight Monitoring Route

Area 5
- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route

Area 7
- Partners in Flight Monitoring Route

Proposed research areas:
- Biodiversity of Productive Riparian Areas, Invasive Plant Species

Area 8
- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route
- Invasive Exotic Plant Species Research
- Invasive Plant Control Research - Oriental Bittersweet

Area 9
- C Site for Ecosystem and Landscape Scale Studies
- Enriched Background Isotope Enrichment Site
- Partners in Flight Monitoring Route

Area 10
- C Site for Ecosystem and Landscape Scale Studies
- Hydrology Field Sites
- Natural Acceleration Bioremediation Investigation Research Reference Area

Area 11
- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route

Area 12
- Natural Acceleration Bioremediation Investigation Research (NABIR) Field Research Center

Area 13
- Tree Nutrition Study Partners in Flight Monitoring Route

Area 14
- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route

- NOAA Partnership Area, NOAA Tower No. 2 Footprint Area
- Control Area for Walker Branch Watershed and Chestnut Ridge Experimental Catchments
- NOAA Partnership Area, NOAA Tower No. 2
- Biological Monitoring and Abatement Site
- Invasive Exotic Plant Species Research

Area 17
- C Site for Ecosystem and Landscape Scale Studies
- Walker Branch Watershed Long-Term Research Area and Buffer
- Enriched Background Isotope Study, C-14
- Invasive Exotic Plant Species Research
- Partners in Flight Monitoring Route
- NOAA Partnership Area, NOAA Tower No. 1 and Footprint
- Walker Branch Watershed Nitrogen and Carbon Transect Study
- Long-Term Recovery from Agricultural Impacts in Complex Terrains

Area 19
- C Site for Ecosystem and Landscape Scale Studies
- Biological Monitoring and Abatement Site
- Long-Term Recovery from Agricultural Impacts in Level Terrains
- Bethel Valley Agricultural Land Use Impacts and Carbon Sequestration Research Area

Area 21
- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route

Area 22
- Enriched Background Isotope Study, C-14
- Forest Succession Experimental Sites for Invasive Plant Species

Area 23
- C Site for Ecosystem and Landscape Scale Studies
- Partnership with TWRA, Ecological and Physical Sciences Study Center
- Partners in Flight Monitoring Route

Area 24
- C Site for Ecosystem and Landscape Scale Studies
- Global Climate Change Field Research Facility
- Invasive Exotic Plant Species Research
- Free Air CO_2 Enrichment (FACE)
- Global Carbon Cycle Studies
- Biofuels Research and Demonstration Site

Area 25
- Biological Monitoring and Abatement Site
- Partners in Flight Monitoring Route
- Long-Term Recovery from Agricultural Impacts in Complex Terrain

Area 26
- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route

Area 28

- C Site for Ecosystem and Landscape Scale Studies
- Whole Tree Harvest Research
- Vascular Plant Monitoring Site - experimental

Area 29

- Rare Plant Population Long-Term Monitoring
- Invasive Exotic Plant Species Research

Area 30

- C Site for Ecosystem and Landscape Scale Studies
- Partners in Flight Monitoring Route

Area 32

- Ongoing Long-Term Agricultural Impacts Research Plots

Area 33

- Ongoing Long-Term Agricultural Impacts Research Plots

Area 34

- Ongoing Long-Term Agricultural Impacts Research Plots

Area 36

- Enriched Isotope Background Study Area

Area 37

- Carbon Experimental Site, Pine Ridge Replicate Experimental Catchments

Area 38

- Vascular Plant Monitoring - Reference Site

Area 39

- Vascular Plant Monitoring - Reference Site

Area 40

- Vascular Plant Monitoring - Reference Site

Area 41

- Vascular Plant Monitoring - Reference Site

Area 42

- Vascular Plant Monitoring - Reference Site

ED-1 Area

- Partners in Flight Monitoring Routes
- Biological Monitoring and Abatement site

ETTP Area

- Partners in Flight Monitoring Route
- Biological Monitoring and Abatement sites

More detailed information on environmental research is found in *Environmental Sciences: Research, Assessment, and Technology to Understand and Meet the Challenges of the Future* (Environmental Sciences Division 1998) and on the Environmental Sciences Division (ESD) World Wide Web site at http://www.esd.ornl.gov/. In addition to DOE, past and present sponsors of research on the site include the National Science Foundation, the Department of Defense, the EPA, the USDA, the Forest Service, the Nuclear Regulatory Commission, and the Electric Power Research Institute. Ongoing research collaborations also exist with NOAA and TVA.

2.5.2 Safety

ORNL systematically and fully integrates safety into management and work practices at all levels so that the mission of the Laboratory is successfully accomplished while protecting the public, the worker, and the environment. Operations are conducted in compliance with regulations and in a manner consistent with the hazards associated with the work. Work processes are systematically evaluated by ORNL through an ongoing self-assessment program designed to ensure that the mission of the Laboratory is carried out in a safe and effective manner. ORNL has adopted Integrated Safety Management (ISM) by Contract (DEAR Clause 970.5204-2) and carries out the requirements of ISM by way of an integrated set of management systems that apply controls tailored to all the work being performed.

To ensure employee and guest safety, buffer areas around training facilities and other hazard areas are identified with highly visible signage. Employees and guests are expected to comply with signage and are encouraged to report unsafe conditions observed in the field.

2.5.2.1 Security

A 5-mile stretch of Bethel Valley Road was closed to the public in December 2001 for safety and security reasons. Bethel Valley Road access is limited to those with official business as part of security upgrades at ORNL. East Bear Creek Road at Y-12 continues to be restricted to access for official business only.

2.5.2.2 Training Facilities with Surface Danger Zones

Two contiguous major firing ranges are located within the ORNL area of responsibility: the Southeastern Couriers Transportation and Safeguards Training Facility operated by DOE Albuquerque and the Central Training Facility (CTF) operated by Wackenhut Services, Inc. (Fig. 2.13). The ranges and their surface danger zones or buffer areas encompass about 2500 acres. Public entry into these areas is prohibited and strictly controlled. The two range areas, which are located on the south side of Bear Creek Road about 5 miles west of the Y-12 Plant, extend from the DOE ORR boundary on the west to Highway 95 on the east and from Bear Creek Road on the north to the Clinch River on the south. The eastern portion of the site is operated by DOE's Transportation and Safeguards Division Southeastern Courier Section and consists of four individual live-fire ranges and associated support facilities. The western portion of the range site is operated for DOE by Wackenhut Services, Inc., as a CTF and consists of an indoor range, five outdoor ranges, a shooting tower, three live-fire facilities, and assorted tactical facilities. Fire is directed to the south and southeast into an approximately 200-foot-high ridge. Safety analyses for the firing range activities were based on the absence of a permanent population in the downrange areas. Any change in land use in the vicinity of the firing ranges would entail a change in the safety analyses.

2.5.2.3 Emergency Planning Zones

Federal statutes [40 *Code of Federal Regulations* (*CFR*), Parts 301, 302, 304, and 355] require each state, tribal, or local government to protect its citizens from releases of hazardous materials. The

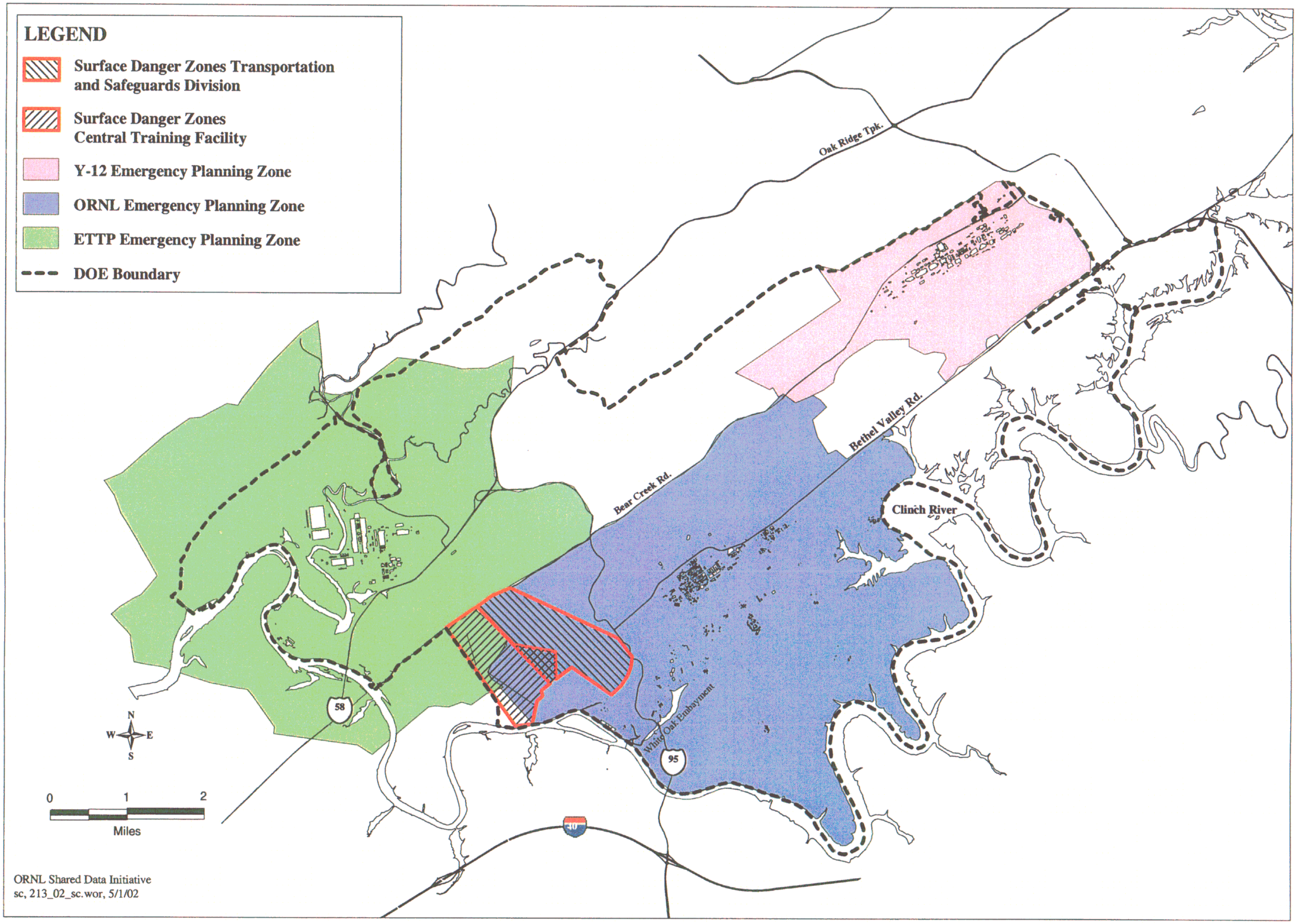


Fig. 2.13. Safety.

emergency planning zone around each ORO site (ETTP, ORNL, and the Y-12 National Security Complex) extends out 5 miles and is subdivided into emergency planning sectors that are defined by easily recognizable terrain features (*Oak Ridge Reservation Emergency Plan* 1998). Hazard assessments support the designation of emergency planning zones in which special planning is required to ensure that prompt and effective protective actions can be taken to minimize the risk to on-site personnel, the general public, and the environment in the event of an emergency.

2.5.3 Compliance and Monitoring

Operations at all facilities on the ORR must comply with environmental requirements established by federal and state statutes and regulations, executive orders, some DOE orders, and legal compliance and settlement agreements. The TDEC and EPA are principal among the regulatory agencies that issue permits, inspect operations, and oversee environmental compliance on the ORR. Changes in land use have the potential for impacting not only widespread ongoing compliance activities, but also operations at the EPA- and TDEC-regulated facilities. The facilities were intentionally located away from population centers with unpopulated land area between the facilities and local residents. Changes in the unpopulated land area could alter dose calculations required for meeting radiological requirements, such as those in the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 *CFR* 61, Subpart H), and thereby impact facility operations.

As regulatory agencies transition to watershed-based load-allocation permitting for wastewater discharges, the presence of additional new facilities on the ORR that need to discharge wastewaters to ORR streams under the National Pollutant Discharge Elimination System (NPDES) could cause DOE to reduce constituent concentrations in DOE-facility wastewater effluents in order to control watershed loading to an acceptable standard. An annual summary, prepared for the ORR environmental activities (Hughes et al. 2001), can be found on the World Wide Web at http://www.ornl.gov/aser. Figure 2.14 shows environmental compliance and monitoring locations on the reservation.

2.5.3.1 Environmental Monitoring

Environmental monitoring on the ORR consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring consists of the collection and analysis of liquid, gaseous, or airborne effluents at their sources. Environmental surveillance consists of the collection and analysis of samples of air, surface water, groundwater, foodstuffs, biota, and other environmental media from areas that have the potential to be affected by activities on the ORR. Data from the analyses are used to assess chemical and radiation exposures to members of the public and to demonstrate compliance with environmental permits and regulations.

2.5.3.2 Air Monitoring

Numerous activities conducted in facilities on the ORR emit, or have the potential to emit, pollutants to the atmosphere. In general, these activities are regulated and monitored as nonradiological sources or radiological sources. The most environmentally significant nonradiological sources include steam production plants located at each plant site (ETTP, Y-12, and ORNL) fired with coal, fuel oil, and/or natural gas. Radiological sources include emissions from production areas, research activities, and decontamination work. All sources are in compliance with emission standards, reporting requirements, and monitoring requirements.

Meteorological conditions on the ORR are provided by seven widely spaced meteorological towers. The data are used in dispersion modeling to predict impacts of facility operations. In addition, these data

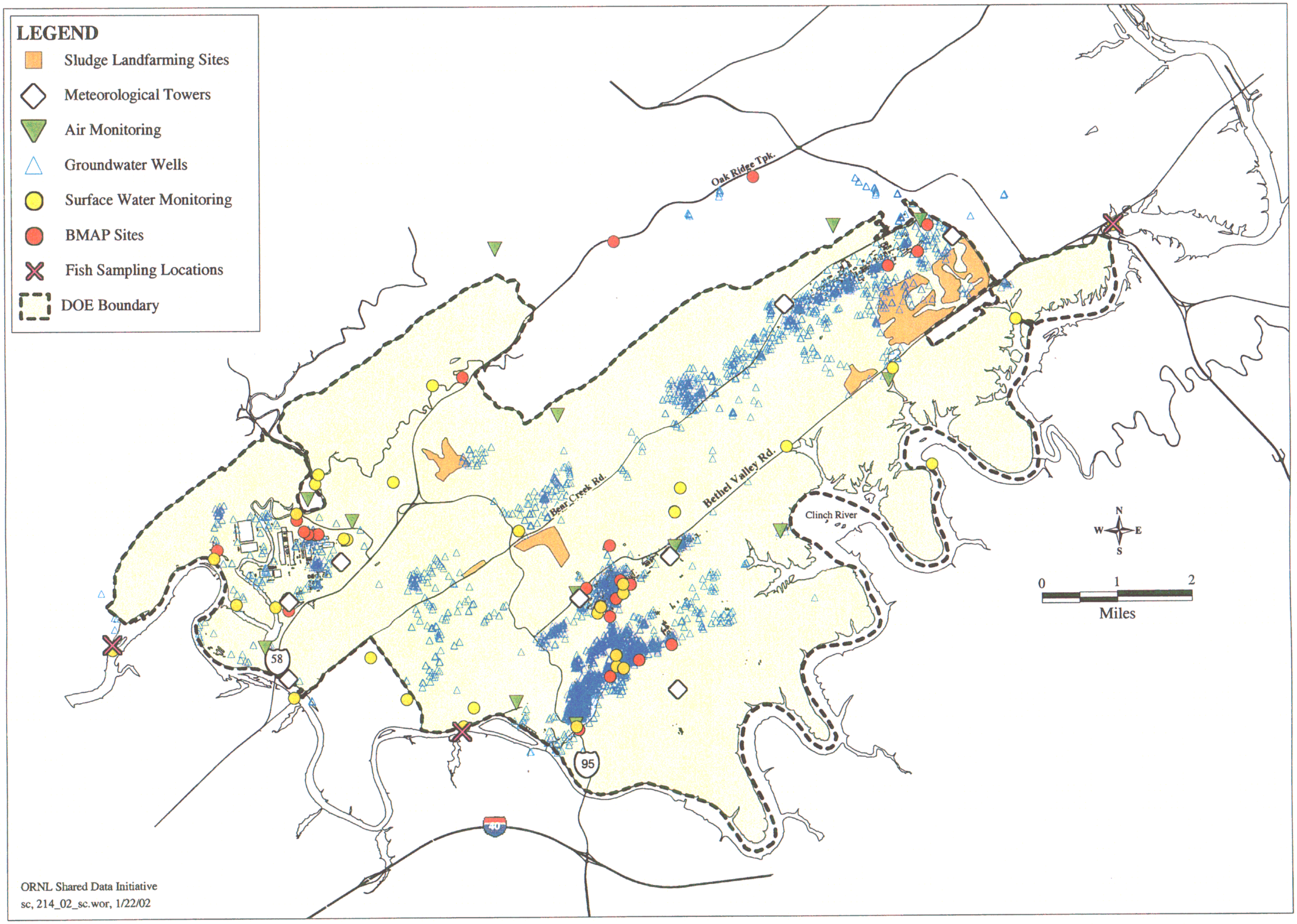


Fig. 2.14. Compliance and monitoring.

are essential as input to emergency response atmospheric models used in the event of accidental releases from a facility. The towers range from 100 to 330 feet in height, and data are collected at two to three levels above ground.

In addition to monitoring the sources of effluent release (e.g., stacks), ambient air is monitored at various locations on the ORR to determine whether effluents from the facilities are increasing levels of radiation or air contaminants. The ambient air monitoring program, which assesses the impact to air quality of operations on the entire ORR, includes operation of a network of perimeter air monitoring stations. These stations incorporate gamma radiation detectors as well as instrumentation for quantifying alpha-, beta-, and gamma-emitting radionuclides, uranium, tritium, and beryllium. NOAA/ATDD operates 16 meteorological towers for collection of routine observations throughout East Tennessee, including one at Walker Branch Watershed. Local climatological data for the Oak Ridge area includes records back to 1950.

2.5.3.3 Surface Water Monitoring

The primary statute governing the monitoring of effluent discharges to surface waters on the ORR is the CWA, which requires the issuance of NPDES permits. The ORNL NPDES permit lists 161 point-source discharges that require compliance monitoring, the Y-12 permit lists 100 sources, and the K-25 permit lists about 150, for a total of approximately 400 CWA discharge points for the ORR.

To assess the impact of ongoing, as well as past, discharges to receiving streams, surface water samples are collected from 22 stream locations on and around the ORR. Water quality measurements serve as guides to the health of the environment, and measurements therefore include sampling of reference streams upstream of operations on the ORR. Reference data are used to establish the baseline against which the health of ORR streams is assessed for regulatory purposes. These reference streams, which are located in undeveloped portions of the ORR, have been sampled for years and provide a long-term baseline against which current data can be evaluated. The sites were carefully selected, have been approved by the regulatory agencies, and must remain undisturbed for the indefinite future.

2.5.3.4 Groundwater Monitoring

The ORR is underlain by complexly deformed bedrock (folded and faulted sedimentary rock) that includes clastic rock types such as shales, siltstones, sandstones and pure carbonate rocks comprised of dolostone and limestone. The clastic bedrock types make up approximately 30 to 50% of the outcrop area, while the pure carbonate rock types make up the remainder. The clastic rock units (Rome Formation, Conasauga Group, and the Chickamauga Group) are generally categorized as "aquitard" units, while the massive pure carbonate rock units (Maynardville limestone and the Knox Group) are categorized as "aquifer" units on the ORR. Groundwater flow in the aquitards is dominated by flow through fractures of variable length and connectivity and discharge may be visible at "seeps" or may occur invisibly in stream channels. In fracture-dominated groundwater flow systems, groundwater movement depends on the length and connectivity of the fractures, and contaminants may move relatively rapidly (meters/day). Porosity of the rock matrix between fractures often functions as a sponge to retain contaminants in inaccessible pores. Groundwater flow in the carbonate aquifer units is dominated by the presence of solution conduits. In conduit-dominated groundwater flow systems, such as the Knox Aquifer, large volumes of water move rapidly (hundreds of meters to kilometers per day) through discrete channels that discharge at springs that may be visible near streams or may occur in the base of stream channels.

Depth of active groundwater circulation in the ORR aquitards is on the order of 100 meters below ground surface. Ancient brines (highly saline waters) are present in the aquitards at depths of 200 to 300 meters below ground surface. Yields of wells in the aquitards are quite variable but are generally low (<1 to 10 gpm). Fresh water is known to circulate to depths greater than 200 meters in the Knox Aquifer, and brines have not been encountered in Knox Aquifer monitoring wells. Yields of wells in the Knox Aquifer are often high, and wells in the intersect conduits can produce hundreds to more than 1000 gpm.

In fracture- and conduit-dominated groundwater flow systems such as those at the ORR, the direction and rate of groundwater movement are determined by the orientation and aperture (minimum cross sectional area) of the interconnected fractures or conduits and occurrence of precipitation. Fractures and conduits at the ORR tend to be oriented parallel to geologic outcrop trends because of the regional and local geologic structure (dipping strata) and differential weathering of interbedded rock types (carbonate vs. clastic). The geographic scale (basin area) and discharge volume of fracture and conduit flow systems at the ORR vary depending on the rock types. In the aquitard outcrop areas, groundwater basins tend to conform to surface watershed areas, although some exceptions are known to occur. In the Knox Aquifer outcrop area, groundwater basin delineation is difficult because the extensive conduit development and depth of groundwater flow promote flow beneath topographic divides. Although carbonate basins are less discrete than those formed in the clastic rock types, the influence of geologic structure (strike and dip) is apparent in observed groundwater flow patterns in the Knox Aquifer. Groundwater discharge volumes in fracture and conduit flow systems vary with seasonal and rainfall patterns. During the growing season (May – October), much of the rainfall is transpired back to the atmosphere by trees and other plants. This evapotranspiration reduces the amount of recharge to the groundwater system with the result that base flows in springs and streams diminish. During the late autumn, winter, and early spring seasons, rainfall is more effective at recharging the groundwater system because of much-reduced evapotranspiration and spring and stream base flows increase. In conduit-dominated groundwater systems, the response to individual storm events can cause orders of magnitude increases in spring discharge volumes, depending on the groundwater basin area.

Since contamination follows groundwater movement, information regarding the direction and rates of groundwater flow is needed for assessing the potential for contamination exposure. However, the geohydrology of the ORR is sufficiently complex that contaminant transport is difficult to predict on a local scale. For example, the leading edge of a contaminant mass such as tritium may migrate along fractures at a typical rate of 1 m/d, whereas the center of mass of the contaminant plume migrates at less than 0.06 m/d. The presence of dense non-aqueous phase liquids (DNAPLs) contaminants in the ORR hydrogeologic setting also exemplifies the site complexity. DNAPLs discharged on the land surface or in shallow pits at the ORR tend to seep downward through fractures and bedding planes to depths at which either the openings terminate or pore pressures equilibrate with the DNAPL density. This results in infiltration of contaminant masses to depths of several hundred feet in the fractured rock. Plumes of contaminated groundwater at these depths are fed by the gradual dissolution of the DNAPL masses.

Because of the geohydrologic complexity of the ORR and the many different regulations governing groundwater monitoring requirements [e.g., the Resource Conservation and Recovery Act (RCRA), CERCLA, TDEC Solid Waste Management regulations, and regulatory requirements for groundwater monitoring for petroleum underground storage tanks], an integrated groundwater monitoring program has been established.

To fully comply with regulatory requirements, to delineate and predict the extent of groundwater contamination on the ORR, and to protect the public and the environment, a groundwater surveillance monitoring program is in effect. The program includes groundwater monitoring wells on the ORR. Although most wells are located at the facility sites where contamination is greatest, the areas on the ORR containing groundwater monitoring wells are essential for providing regulatory compliance data and supporting monitoring program objectives.

Source Water Protection Area. The First Creek headwaters have been identified as a sensitive water source for the Aquatics Research Laboratory, Building 1504. Figure 2.4 shows the First Creek Source Water Protection Area. The area is based on a combination of surface topography and geology. The southern boundary of the area was confirmed in June 1999 by groundwater tracing from disappearing streams to springs in the First Creek headwater. Extensive terrain modification or contamination of groundwater or surface water within this area will have adverse impacts on the water quality of First Creek and consequently impact the Aquatics Research Laboratory.

2.5.3.5 Terrestrial Vegetation Monitoring

Contaminants released from facilities on the ORR can accumulate in food crops and in terrestrial animals that feed on vegetation on the ORR. Because the primary exposure pathway for contaminants in humans is the ingestion of crops, meat (e.g., deer, geese, and wild turkey), and milk, both hay and food crops grown on or near the ORR are collected and analyzed to evaluate potential radiation doses.

Vegetables, such as tomatoes, lettuce, and turnips, are collected from local gardens which have been identified as potential deposition areas. Samples from each plot are analyzed for gross alpha and beta radiation, gamma emitters, and uranium. The results are compared to crops grown at a reference site outside the influence of ORR activities.

Because radionuclides can be transferred to humans from the environment through the food chain (e.g., grass to cow to milk to human), milk is considered a significant potential exposure source. Even small amounts of radionuclides deposited from airborne emissions can be significant because of the large surface area that can be grazed by a cow, the rapid transfer of milk from producer to consumer, and the importance of milk in the human diet. Milk is collected bimonthly from local producers and analyzed for radioactive iodine, radioactive strontium, and tritium.

2.5.3.6 Biological Monitoring and Abatement Program

Biological monitoring of streams on the ORR has been conducted for more than 15 years. The Biological Monitoring and Abatement Programs (BMAPs) at the three DOE facilities on the ORR were developed to meet NPDES permit requirements and include tasks on (1) toxicity monitoring; (2) bioaccumulation in aquatic biota; (3) bioindicators of fish health; and (4) fish, macroinvertebrate, and periphyton community surveys. Additional BMAP tasks are required by the individual facility-specific NPDES permit. Each of these tasks utilizes water or fauna from streams near the ETTP (Mitchell Branch and Poplar Creek), ORNL (White Oak Creek and its tributaries), and the Y-12 National Security Complex (East Fork Poplar Creek). In addition, reference streams used for comparison with contaminated sites include Scarboro Creek, Ish Creek, and Mill Branch (Peterson 2000; Smith 2000).

2.5.4 Contaminated Areas

Since 1942, the three plants on the ORR have had significantly different operations and missions, but all have generated various types of wastes that were disposed of on-site in waste management areas. On-site disposal of RCRA and/or polychlorinated biphenyl (PCB) wastes ceased in the early 1980s. However, the early waste disposal practices have resulted in contaminated streams, groundwater, and soil on the reservation. Spills, piping leaks, and other inadvertent releases (historic use of lead-based paint or PCB-contaminated paint) have contributed to environmental contamination. Most of the contamination occurs within the waste management areas and the developed and fenced areas of the Y-12 National Security Complex, ETTP, and ORNL (Fig. 2.15). Waste management at ORNL included such activities as the disposal of radioactive waste materials by shallow land burial from 1951 to 1993,

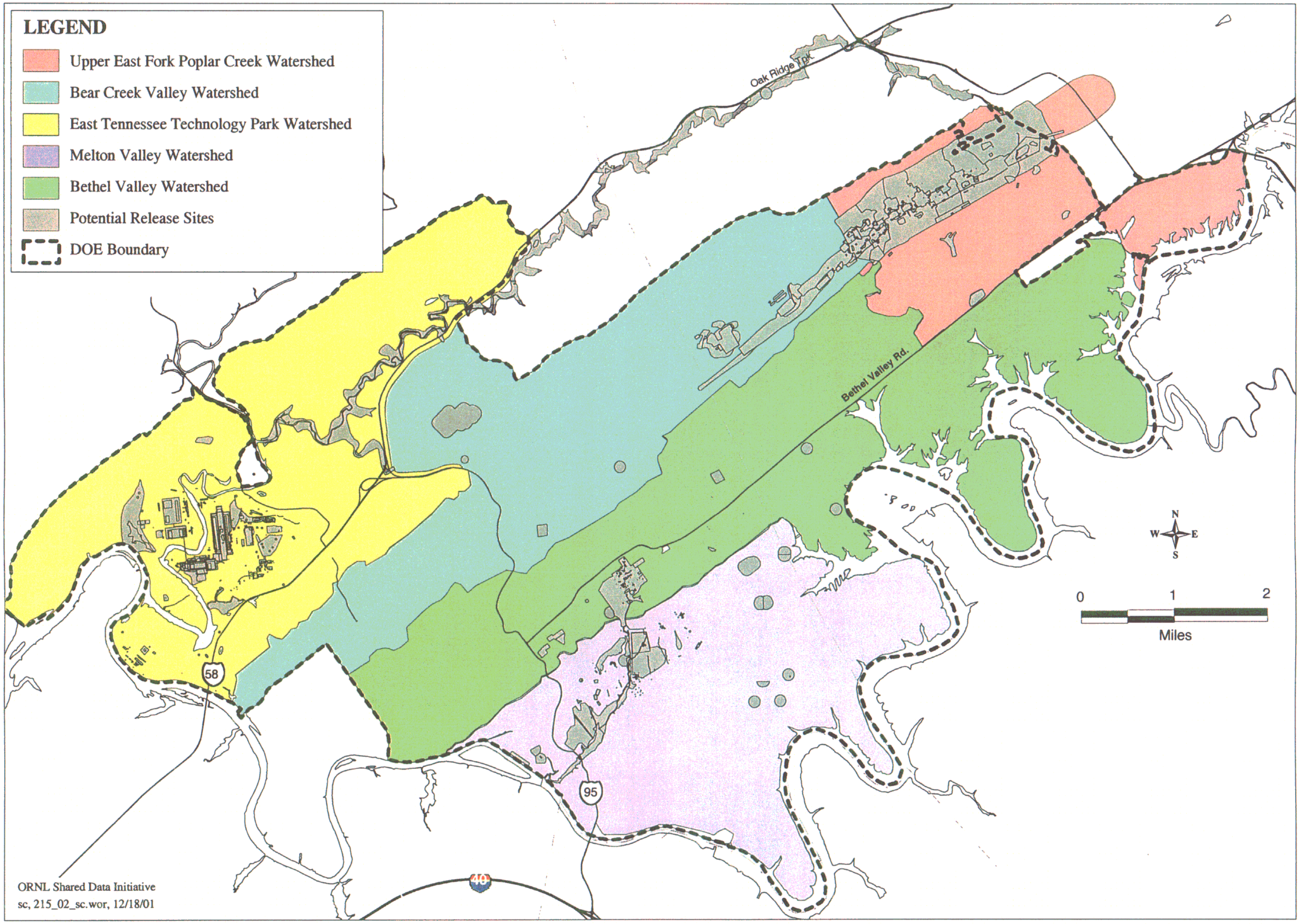


Fig. 2.15. Watershed areas with potential release sites.

the disposal of liquids in shallow seepage pits and trenches from 1951 to 1981, and the injection of waste liquids and sludges mixed with cement grout into deep rock formations using the hydrofracture process from 1959 to 1984. During the period from 1955 to 1963, ORNL was designated by the AEC as the Southern Regional Burial Ground and received a wide variety of poorly characterized waste from approximately 50 different sources. These wastes were included in the shallow land burial sites in use by ORNL.

Remediation of the contaminated areas at ORNL is conducted under CERCLA. A Federal Facilities Agreement (FFA) was signed by DOE, EPA, and the State of Tennessee to coordinate environmental remediation activities on the ORR. Cleanup goals for the contaminated areas are negotiated through the CERCLA process and are documented in Records of Decision (RODs). A variety of issues must be addressed as cleanup goals are developed: anticipated future land and groundwater use, availability of waste treatment and disposal facilities, federal and state requirements that the remedy will attain, long-term stewardship/institutional controls, and risk to human and ecological receptors. The ROD for Interim Actions for the Melton Valley Watershed was signed by DOE, EPA, and the State of Tennessee in September 2000. This ROD documented the selected remedy for the remediation of waste sites and other contaminated sites in Melton Valley. The ROD also established land uses for the areas within Melton Valley. A similar ROD is expected to be signed in 2002 for Bethel Valley sites. The selected remedy for both watersheds leaves some hazardous substances in place which pose a future potential risk and which would require land use restrictions for hundreds of years or longer. Land use controls and monitoring, as appropriate, are included as part of the selected remedies to ensure protectiveness. Groundwater decisions have been deferred pending results of source removal and containment actions.

2.5.5 Land Application of Biosolids

The City of Oak Ridge has been applying sanitary sewage sludge to approved sites on the ORR since 1983 under agreements with DOE and the State of Tennessee. It is the policy of the federal government that DOE consider beneficial use of municipal sewage sludge for fertilizer, soil conditioner, or other uses, when such use enhances resources on federal lands and is cost effective (EPA, *Federal Register* July 91-30448). Locations are shown in Fig. 2.7.

ORNL is currently sending sanitary sewage sludge to the City of Oak Ridge for inclusion in the City's biosolids land application program. While not all sludge can be transferred because of low levels of residual radiological contamination, the portion that can be disposed of in this manner lessens the quantity of solid low-level contaminated waste generated at the ORNL facility. Efforts continue to determine possible sources of ground-based contamination that is leaching into the ORNL sewage collection system. Once identified, remedial actions will be undertaken to prevent this legacy contamination from entering the collection grid.

2.5.6 Reservation Infrastructure (Gas, Communication Lines, Power)

Since all major utilities cross the ORR, a number of companies have easements. ORR infrastructure is shown in Fig. 2.16. Details are not provided in this plan as they are described fully in the *Oak Ridge Reservation Management Plan*, February 1999. Section 3.3 of the plan, "Access Control," identifies companies with utility easements. Part of Sect. 3.4, "Surveillance and Maintenance," lists companies and organizations with operating and maintenance responsibilities. Appendix E, "ORR Roles and Responsibilities," explains in detail the activities of various governmental entities and companies, some of which involve utilities. Through permission granted by DOE realty licenses, mobile service towers have been erected in seven locations across the reservation. Additional towers are being considered to improve communication ability across the reservation.

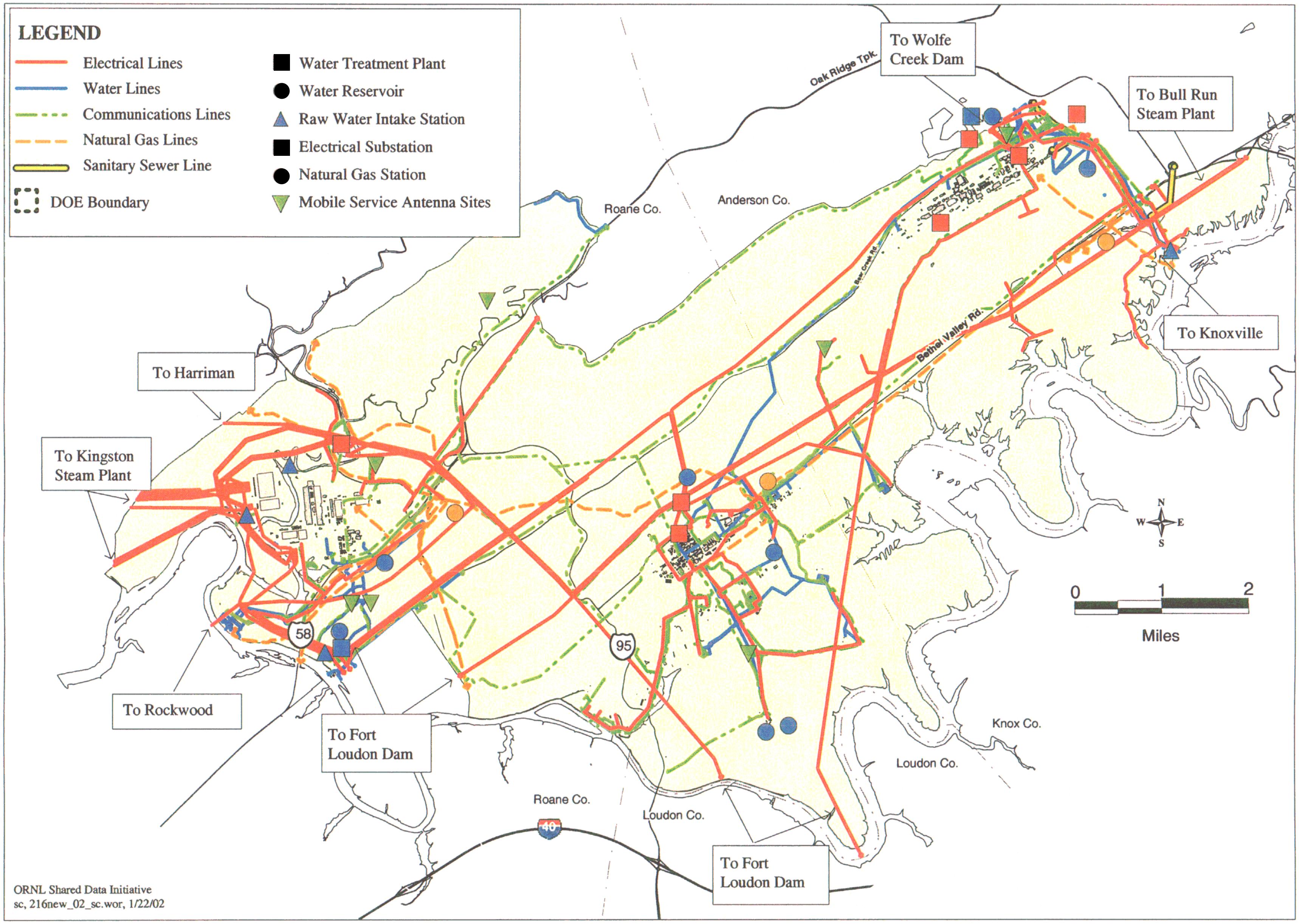


Fig. 2.16. Reservation infrastructure.

2.5.7 Oak Ridge Wildlife Management Area

Management of wildlife on an area as large as the ORR is necessary to ensure public safety and maximize wildlife health and diversity. Most of the ORR is within the Oak Ridge Wildlife Management Area. Wildlife management is carried out by TWRA in cooperation with ORNL's ESD under agreements between TWRA and DOE and between DOE and UT-Battelle. Management includes wildlife population control through hunting, trapping, and removal; wildlife damage control; restoration of wildlife species; preservation, management, and enhancement of wildlife habitats; coordination of wildlife studies; and law enforcement. Wildlife resources are placed in management categories, each with a specific set of objectives and procedures for achieving them. These resource management categories are (1) wildlife habitats/species-richness, to ensure that all resident wildlife species exist on the ORR in viable numbers; (2) featured species, to maintain selected species in desired numbers on designated land units; (3) game species, for research, education, recreation, and public safety; (4) sensitive species needing inventory, preservation, and protection of both the species and their habitats; and (5) wildlife pest problems. The Oak Ridge Wildlife Management Area is shown in Fig. 2.7.

Three Bend Scenic and Wildlife Management Refuge Area. Secretary of Energy Bill Richardson set aside 2920 acres of the DOE ORR as a conservation and wildlife management area on June 23, 1999, in an agreement between the Energy Department and TWRA. The proclamation, signed by Secretary Richardson and George Akans, Jr., of the Tennessee Wildlife Commission, calls for the land to be cooperatively managed for preservation purposes under a use permit.

The Three Bend Scenic and Wildlife Management Refuge Area consists of 2920 acres located in the ORR buffer zone on Freels, Gallaher, and Solway bends on the north shore of Melton Hill Lake in Anderson County.

TWRA has signed a cooperative agreement with DOE to serve as a natural resources management plan for the Three Bend Area. The agreement establishes general guidelines for managing the area to preserve and enhance its natural attributes.

2.5.8 Public Opportunities

Most of the reservation is not freely accessible to the public, although parts are open at various times for recreation and educational activities (Fig. 2.6).

2.5.8.1 Public Greenways

Gallaher Bend Greenway, an experimental public greenway in the Oak Ridge National Environmental Research Park, was opened in December 1997. North Boundary Road Greenway, which follows East Ridge Road and Poplar Creek Road, was opened in 1999. The greenways are shown in Fig. 2.6.

2.5.8.2 Tennessee Wildlife Resources Agency Wildlife Management Area

Wildlife on the ORR is managed by TWRA under an agreement with the DOE Oak Ridge Operations Office (DOE-ORO). This management includes annual public managed quota deer and turkey hunts (special permits are required). Public deer hunts were initiated to reduce the rapidly growing deer population and as a safety measure to address the increasing number of deer/vehicle collisions. Each animal taken during deer and turkey hunts is monitored for radiation contamination. Since the hunts began in 1985, 2.2% of the 7842 deer taken (through 2000) have been retained due to radiological contamination. One turkey was retained due to radiological contamination during the first hunt in 1997;

another was retained in 2001. Deer hunts were canceled in the fall of 2001 but are planned for 2002. Turkey hunts were held in 2002. Deer and turkey hunt maps are available at http://www.ornl.gov/rmal/huntinfo.htm. Additionally, TWRA has led public bird walks during the spring and coordinated bird counts for input to the Partners In Flight interagency program.

2.5.8.3 New Bethel Baptist Church and Interpretive Center

New Bethel Baptist Church is one of the few remaining original structures of pre-Manhattan Project days and is listed on the National Register of Historic Places. This facility is open to the public, and its interpretive center contains displays and artifacts relating to the building's use before and after government occupancy.

2.5.8.4 Walks/Tours

ORNL sponsors annual activities on the ORR (e.g., bird walks, wild flower hikes, and trips to field research sites) that are open for public participation. These are advertised in local media. In addition, ORNL participates in Community Day, which offers the public an opportunity to visit Laboratory facilities. A DOE Oak Ridge facilities public bus tour is available at the American Museum of Science and Energy.

2.5.8.5 Ecological and Physical Sciences Study Center

This educational program offers hands-on experiences in outdoor environmental and physical sciences for kindergarten through high school students, as well as programs to familiarize teachers with new concepts. The programs are primarily centered at historic Freels Cabin and require preregistration through the ORNL Office of University and Science Education.

2.5.8.6 ORNL Graphite Reactor

A registered National Historic Landmark, the Graphite Reactor's primary wartime mission was to produce the first gram quantities of plutonium for experiments at the University of Chicago. Afterwards, it was dedicated to the peace-time development of atomic energy and operated until 1963.

2.5.8.7 Other Public Facilities and Educational Programs

Facilities on the reservation operated by others and open to the public include the Clark Center Recreation Area, the Wheat Community African Burial Ground near ETTP, the ETTP Visitors Overlook, and the Y-12 Visitors Center.

2.5.9 Facilities

A number of ORNL facilities, as well as facilities managed by ETTP, the Y-12 National Security Complex, and others, are located outside the ORNL developed area. ORNL facilities are identified in the "ORNL Integrated Facilities Plan" in Sect. 3 of this land use plan.

2.5.10 Other

Some land uses within the National Environmental Research Park are the responsibility of others as designated by DOE-ORO. These uses are identified in the *Oak Ridge Reservation Management Plan* (1999) and the *ORR Comprehensive Integrated Plan* (September 1999).

2.5.11 Maps - Current Land Use on the Oak Ridge Reservation

Maps included in this document were prepared on MapInfo software using data from the ORNL SDI. The SDI database is updated as data are available from ORNL projects as well as other ORR projects. Table 2.2 is a list of maps pertaining to current ORNL land usage.

Table 2.2. Current land use on the ORR

Fig. no.	Maps	Main components
2.6	Public, educational, and recreational opportunities	Ecological and Physical Sciences Study Center New Bethel Church Interpretive Center ORNL Graphite Reactor Gallaher Bend Greenway TWRA Wildlife Management Area Cemeteries, historic districts, churches, and home sites Clark Center Recreation Area North Boundary Road Greenway
2.7	Partnership areas	Sludge landfarming sites State Natural Areas TWRA Wildlife Management Area Oak Ridge Biosphere Reserve Gallaher Bend Greenway Wetland Mitigation Areas North Boundary Road Greenway
2.10 2.11 2.12	Research areas	National Environmental Research Park Active research areas Proposed research areas Planned research areas
2.13	Safety	Emergency planning zones Surface danger zones
2.14	Compliance and monitoring	Air monitoring sites Groundwater wells Surface water monitoring BMAP sites Meteorological towers Fish sampling locations Sludge landfarming site
2.15	Contamination areas	Potential release sites EM watershed project boundaries
2.16	Reservation infrastructure	Electrical lines Water lines Communications lines Natural gas lines Sanitary sewer lines Water treatment plants Water reservoirs Electrical substations Natural gas stations Main roads Mobile service antenna sites

2.6 FUTURE LAND USE ON THE OAK RIDGE RESERVATION

The Secretary of Energy's Land and Facility Use Management Policy states that DOE will exercise stewardship over its assets based on ecosystem management principles (DOE 1994). Management of the ORR as a viable and healthy ecosystem provides the foundation required for environmental research and for pursuing future scientific initiatives. Planning for future land use requires management of the ORR as an ecosystem unit. Ecosystem management is not a land use objective in itself. It is, however, a method for achieving the land use objectives. Additionally, it provides a mechanism for preservation of the land area needed to pursue future scientific research opportunities such as neutron science. Future land uses will, in most cases, expand and build on current land uses, not replace them.

2.6.1 Ecosystem Research

Ecosystem management has been defined as ". . . a collaborative process that strives to reconcile the promotion of economic opportunities and livable communities with the conservation of ecological integrity and biodiversity" (Keystone National Policy Dialogue 1996). Ecosystem management must be based on an understanding of the factors governing the limits on ecosystem sustainability and the controls on ecosystem response to environmental change. Such an understanding requires comprehensive, multidisciplinary research on a variety of ecosystems under different levels of human influence. Research approaches that combine ecosystem monitoring and experimental studies are most valuable for developing a mechanistic understanding of ecosystem sustainability and factors controlling ecosystem change.

Within this context of ecosystem management, the ORR provides a combination of complex geology and hydrology; ecological diversity; fundamental ecosystem process research, modeling, and long-term data records; a historical record of land use change; and dynamic pressures on its ecosystems resulting from its suburban/industrial setting. Future research will capitalize on the wealth of historical and ongoing ecological research and monitoring on the ORR to address the fundamental sciences underlying the structure and function of ecosystems, response of ecosystems to stress, and sustainability of ecosystems. The focus of future experimental research and monitoring activities is identified in greater detail in Appendix C.

2.6.2 Identified New Future Land Uses

Maps for future land use reflect identified new future needs; current land uses do not preclude different future uses. Land planning, however, will need to incorporate current land use with identified new future land uses.

New future land uses include

- research facilities,
- environmental research areas,
- environmental partnership areas,
- waste management facilities,
- future initiatives,
- transportation improvements,
- education and recreation, and
- land transfers/lease areas.

2.6.2.1 Research Facilities

Proposed locations of future research facilities are shown in Fig. 2.17 and are described in the following sections.

2.6.2.1.1 Spallation Neutron Source

The Spallation Neutron Source (SNS) will serve as a world-class facility for neutron research. The SNS is being constructed on approximately 90 acres on Chestnut Ridge, approximately 2 miles from the ORNL main entrance. The SNS consists of a front-end system (including ion source), linear accelerator, accumulator ring, target facility, and experimental areas. Within the site, support laboratories and shops, a central laboratory and office building, conference areas, user facilities, and a central utility building will be provided. A large water reservoir, an electric service switchyard, and a stormwater retention pond are also being constructed to serve the facility. After reviewing the analysis presented in the "Final Environmental Impact Statement for the Construction and Operation of the Spallation Neutron Source" (SNS FEIS, DOE/EIS-0247, April 23, 1999), DOE issued a ROD for the Construction and Operation of the Spallation Neutron Source on June 18, 1999, whereby the ORR (Chestnut Ridge) was selected as the site for the SNS.

The Joint Institute for Neutron Sciences is a proposed joint venture with The University of Tennessee, the State of Tennessee, and DOE for a user facility which will serve both the existing High Flux Isotope Reactor (HFIR) and the proposed new SNS. This project is funded by the State. A facility of approximately 25,000 square feet is proposed to provide short-term accommodations for visiting scientists and serve other user needs. Potential sites, integrated into the SNS campus, are being investigated.

2.6.2.1.2 Center for Nanophase Materials Science

The Center for Nanophase Materials Science (CNMS) will consist of a new multistory, multipurpose building of approximately 80,000 square feet. It will be located near the SNS Complex and will house the core support facilities, offices, and laboratories necessary to ensure the mission of the CNMS. The location and synergy of the functions planned for this facility will provide valuable support and services to a broad user base of educational, industrial, and research organizations.

2.6.2.1.3 West Campus

The West Campus will be centered around the new Laboratory for Comparative and Functional Genomics, a DOE Line Item now in the design stage that will house the ORNL mouse colony critical to ORNL's future genomics research. This 35,000-square-foot facility will allow the mouse colony to be moved from its historical (but now deteriorated) home at the Y-12 National Security Complex and open the availability of that important DOE resource to a broader research community.

That enhanced research community will be better able to utilize this resource through the Joint Institute for Biological Sciences (JIBS), a State of Tennessee funded research laboratory and office facility to be co-located in the West Campus during Phase I.

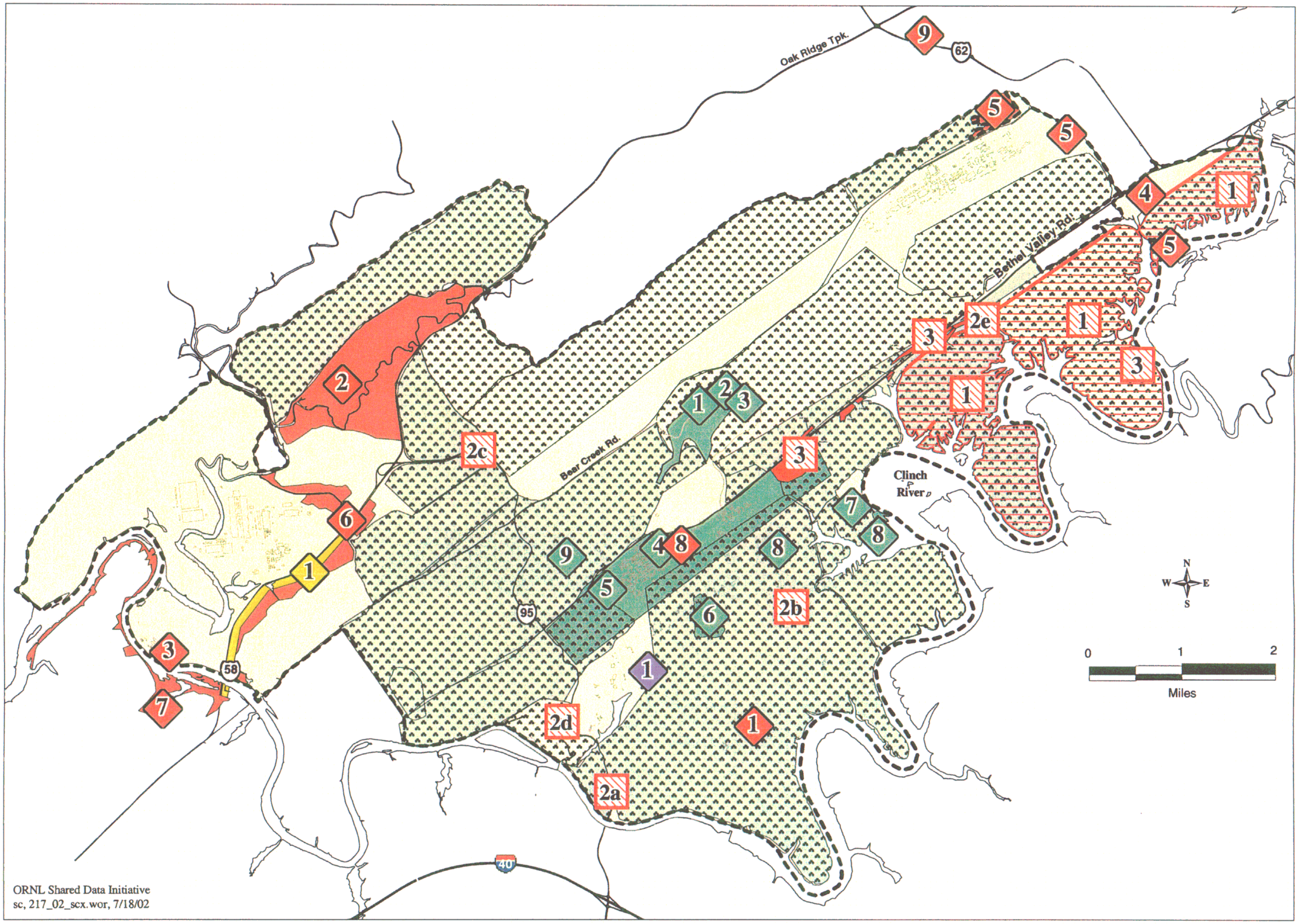


Fig. 2.17. New future uses.

LEGEND

PROPOSED RESEARCH AREAS

PLANNED RESEARCH AREAS

NEW RESEARCH FACILITIES

1. Spallation Neutron Source
2. Center for Nanophase Materials Sciences
3. Joint Institute for Neutron Sciences
4. East Campus
5. West Campus
6. 7900 Area
7. 7600 Area
8. Future Reseach and Development Facilities
9. NOAA Meteorological Research Tower

TRANSPORTATION IMPROVEMENTS

1. Highway 58 Widening

WASTE MANAGEMENT AREAS

1. Transuranic Waste Processing Facility

LAND TRANSFERS/LEASE AREAS

1. BioNeutrics, Inc.
2. Parcel ED-1 (Horizon Center)
3. Parcel ED-2
4. Parcel G
5. Water Treatment Plant and Associated Facilities - Oak Ridge City
6. Parcel ED-3 (proposed)
7. DOE Shoreline (sold)
8. Private Sector and State of Tennessee Facilities
9. American Museum of Science and Energy

ENVIRONMENTAL PARTNERSHIP AREAS

1 Wildlife Refuge

2 Pre-Impact Wetland Mitigation Areas:

- 2a Vanden Bulck Bridge Terrace
- 2b Melton Branch
- 2c Hembree Marsh
- 2d Jones Island Terrace
- 2e McCoy Branch

3 Native Grass Restoration

2.6.2.1.4 East Campus

The East Campus of the Laboratory will feature the planned construction of the Research Support Center, three private-sector research buildings, two State of Tennessee Joint Institutes, a general purpose support office building, and the infrastructure that integrates the new facilities with the existing Laboratory and provides a new face to the public and visiting scientists. In addition to the new construction, renovations will begin to take place on existing research and support buildings to accommodate staff consolidation and new science initiatives, the most notable of those being the upgrades to 4500N/S, the High Temperature Materials Laboratory (HTML), and Building 5500 (for ESH&Q consolidation). Research wings of the 4500N/S complex will be prioritized for upgrade, and staff will be temporarily relocated in a phased approach to allow the existing 1950s laboratories to be updated to current technology. At the HTML, a new special-foundation-designed facility will be constructed adjacent to the current laboratory to allow consolidation of the primary ORNL electron microscopes into a single, unique, and highly stable facility to support long-term use of these supersensitive instruments.

2.6.2.1.5 Development in the 7600 and 7900 Areas

While not within the main ORNL campus boundaries, critical activities are occurring in the HFIR/ Radiochemical Engineering Development Center (REDC) complex (7900 Area) and the Robotics and Process Systems Complex (7600 Area) that are important to the overall ORNL revitalization initiative. The improvements to HFIR operations and research capabilities occurring during their ongoing upgrade program will make the reactor and adjacent facilities more user-friendly and available. To support that increase in mission, several DOE general plant project (GPP)-level projects will be undertaken to eliminate multiple trailers housing research and support staff, provide much-needed highbay operations and storage areas, and improve the user-facility status of the complex. The 7600 Area has been selected to be the location for consolidation of Fusion Energy Division staff and facilities that have been historically located at Y-12. A new DOE GPP facility will be constructed (for offices and for highbay process space needs).

2.6.2.1.6 Research and Development Facilities

Space for future Melton Valley research and development (R&D) facilities has been identified bordering Melton Hill Lake (known as the Ramsey Drive Site). Approximately 39 acres of land adjoining the proposed Fusion Materials Irradiation Facility have been identified for future use. No specific facility designations have been identified for the site.

2.6.2.2 Environmental Field Research Areas

Environmental field research is proposed and/or planned across the entire reservation (except for the ETTP area) in addition to areas where it is already being done (Fig. 2.17).

- Proposed Research Areas – areas identified for specific projects for proposal submittals or pending actions
- Planned Research Areas – areas with high potential for studying research issues of interest to DOE and other Research Park users

For both types of areas, proposed changes in land use that could affect the ability to use the land for research must be considered.

Four projects, the National Ecological Observation Network (NEON), the Terrestrial Ecosystem Research Facility (TERF), the Bioenergy and Carbon Sequestration Initiative, and the Global Water Cycle Test Bed, encompass the entire Research Park. Proposed and planned research projects corresponding to the compartments shown in Fig. 2.12 are listed as follows.

Area 2

Planned research areas:

- Carbon Experimental Site, Blackoak Ridge Replicated Dolomite
- Control Area for Impacts of Urban Fragmentation on (a) Plant and Soil Carbon Sequestration Rates, (b) Forest Successional Dynamics on Biodiversity, (c) Wildlife and Neotropical Migrants, and (d) Geneflow and Genetic Isolation

Area 4

Proposed research areas:

- Biodiversity of Productive Riparian Areas, Invasive Plant Species

Planned research areas:

- Carbon Experimental Site, Bottomland Forest Communities
- Carbon Biogeochemistry in High-Fertility, Hydric Environments
- Role of High-Productivity Habitats in Wildlife Conservation
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research

Area 5

Planned research areas:

- Carbon Experimental Site, East Fork Poplar Creek
- Ecosystem Consequences of High Geological Complexity
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research

Area 7

Planned research areas:

- Carbon Experimental Site, Wetland
- Carbon Biogeochemistry in High-Fertility, Hydric Environments
- Role of High-Productivity Habitats in Wildlife Conservation

Area 8

Proposed research areas:

- Ecosystem Processes (Carbon Sequestration, Biodiversity, Wildlife, Non-Native Invasive Species) in High-Contrast Landscapes (Dry Ridges, Wet Valley Bottoms)

Planned research areas:

- Ecosystem Processes (Carbon Sequestration, Biodiversity, Wildlife) in High-Contrast Landscapes (Dry Ridges, Wet Valley Bottoms)

Area 9

Planned research areas:

- Carbon Experimental Site, Pine Ridge Replicate Experimental Catchments
- Ecosystem Processes (Carbon Sequestration, Biodiversity, Wildlife, Non-Native Invasive Species) in High-Contrast Landscapes (Dry Ridges, Wet Valley Bottoms)
- Biomass Recovery Plots

Area 13

Proposed research areas:

- Invasive Exotic Plant Species Research

Area 14

Proposed research areas:

- Invasive Exotic Plant Species Research

Planned research areas:

- Long-Term Recovery from Agricultural Impacts in Complex Terrains
- Biofuels Research and Demonstration Site
- Replicated Controls for Chestnut Ridge
- Control Area for Walker Branch Watershed and Chestnut Ridge Experimental Catchments
- Carbon Biogeochemistry in High-Fertility, Hydric Environments
- Biodiversity of Productive Riparian Areas
- Role of High-Productivity Habitats in Wildlife Conservation
- Control Area for Pine Ridge Experimental Catchments (Sandstone and Shale Soils Similar to Pine Ridge)
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research

Area 17

Planned research areas:

- Replicated Controls for Chestnut Ridge
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming for Carbon Research

Area 19

Planned research areas:

- Pine Bark Beetle Recovery Area Research
- Biofuels Research and Demonstration Site
- Forest Succession Experimental Sites for Wildlife, Carbon Sequestration, Invasive Species, Biodiversity
- Carbon Experimental Site, Bethel Valley Replicated Limestone

Area 20

Planned research areas:

- Y-12 Partnership Area, Carbon Sequestration Demonstration Site, Biomass and Soil Carbon Experimental Facility
- Recovery of Soil Carbon and Biodiversity on Ash Fields
- Partnership with City of Oak Ridge, Bechtel Jacobs Company, LLC, and DOE on Biosolid Landfarming Sites for Carbon Research

Area 21

Planned research areas:

- Carbon Experimental Site, Valley Bottom
- Biofuels Research and Demonstration Site
- Carbon Biogeochemistry in High-Fertility, Hydric Environments
- Biodiversity of Productive Riparian Areas
- Role of High-Productivity Habitats in Wildlife Conservation
- Control Area for Pine Ridge Experimental Catchments (Sandstone and Shale Soils Similar to Pine Ridge)

- Bethel Valley Agricultural Land Use Impacts and Carbon Sequestration Research Area
- Pine Bark Beetle Recovery Area Research
- Forest Succession Experimental Sites for Wildlife, Carbon Sequestration, Invasive Species, Biodiversity

Area 22
Proposed research areas:
- Large-Scale Catchment Study Area
- Forest Succession Experimental Sites for Wildlife, Carbon Sequestration, Invasive Species, Biodiversity

Planned research areas:
- Carbon Experimental Site, Bethel Valley Replicated Limestone
- Long-Term Recovery from Agricultural Impacts in Level Terrains
- Control Area for Pine Ridge Experimental Catchments (Sandstone and Shale Soils Similar to Pine Ridge)
- Bethel Valley Agricultural Land Use Impacts and Carbon Sequestration Research Area
- Pine Bark Beetle Recovery Area Research

Area 23
Proposed research areas:
- Invasive Exotic Plant Species Research

Planned research areas:
- Biofuels Research and Demonstration Site
- Effects of Current Land Management Practices on Soil and Plant Carbon Storage
- Control Area for Pine Ridge Experimental Catchments (Sandstone and Shale Soils Similar to Pine Ridge)

Area 25
Planned research areas:
- Carbon Experimental Site, Replicated Controls for Chestnut Ridge

Area 26
Proposed research areas:
- Invasive Exotic Plant Species Research

Planned research areas:
- High-Complexity Shoreline Effects on Wildlife, Biodiversity, Biogeochemical Flux Rates
- Long-Term Recovery from Agricultural Impacts in Complex Terrain
- Replicated Controls for Chestnut Ridge

Area 29
Planned research areas:
- Bethel Valley Agricultural Land Use Impacts and Carbon Sequestration Research Area
- Invasive Exotic Plant Species Research

Area 30
Planned research areas:
- Urban/Industrial Impacts on Isolated Natural Areas, Invasive Exotic Plant Species Research
- Urban/Industrial Impacts on Isolated Natural Areas, Carbon Sequestration

2.6.2.3 Environmental Partnership Areas

"Environmental Partnership Areas" are sites of special environmental significance or sites with great potential for restoration and/or mitigation where state, federal, and educational agencies are working together, or can work together, to solve environmental problems. Some of these areas are shown in Fig. 2.7.

2.6.2.3.1 State Natural Areas

In June 2001, TDEC submitted a request to DOE for expanded areas of designation. This request is being considered in the overall approach to comprehensive land-use management and mission objectives of DOE. Seven State Natural Areas were noted on the ORR in 1985 through a letter agreement between DOE and TDEC. These areas qualified as State Natural Areas because of rare plant or animal species or community types. Additional threatened and endangered species data have been collected since 1985 when the original Natural Areas were registered (Awl et al. 1996; The Nature Conservancy 1995).

To register a State Natural Area, the site must meet TDEC qualifying criteria as determined by a natural heritage evaluation and review by the State Natural Areas Advisory Committee. Registration of a State Natural Area is by a written, nonbinding registry agreement signed by the landowner and the Commissioner. Protection of the natural area is a voluntary, nonbinding conservation tool which relies on the landowner's sense of pride and stewardship; the designation can be removed if DOE decides on an alternative land use and the designation is no longer appropriate.

2.6.2.3.2 Wetland Mitigation Areas

Over 580 acres in wetlands have been identified on the ORR (see Sect. 2.4.5.3, "Wetlands"). Some of these wetlands, including one of the single largest wetlands areas, are in locations where new program construction and waste management or remedial actions may occur, resulting in direct wetland impacts. Before any activities occur that will directly impact wetlands, it is necessary to obtain federal and/or state permits or to fulfill the substantive requirements of the law in those cases where permits are waived (e.g., CERCLA actions). Individual permits issued by the federal and state governments will, in most cases, require compensatory mitigation as a permit condition. Mitigation, in the wetland regulatory context, is a sequential process consisting of (1) avoidance of wetland impacts, (2) minimization of wetland impacts, and (3) if impacts are unavoidable, compensatory mitigation. Compensatory mitigation includes wetland restoration and wetland creation.

Bethel Valley Pre-Impact Wetland Mitigation Evaluation. In 1999, ten sites in the Bethel Valley area of the ORR were evaluated with respect to their potential for pre-impact wetland mitigation (Durr 1999). Of these ten areas, the potential for success was ranked as "high" for three areas, "medium" for two areas, and "low" for the other five areas. There are not extensive areas of high-quality wetland mitigation opportunities in the Bethel Valley portion of the reservation. Most reliable water sources are positioned within narrow, steep-sided hollows that offer little potential for lateral expansion with highly porous native soils that do not have the physical capacity to remain saturated for extended periods of time. However, at least 7.5 to 8 acres were determined to be suitable for small-scale wetland creation/ enhancement projects, most requiring a relatively minor amount of earth moving to convert them to jurisdictional wetlands. An additional 8 acres of bottomland were identified that are more marginal. With extensive work, these marginal areas might be manipulated to support a dominance of wetland plant species or even open water environments, making a nice addition to the diversity of habitat within forested portions of the reservation.

The areas ranked as "high" or "medium" are shown in Fig. 2.17. Areas included in the evaluation and the potential acreages are:

(1) McCoy Branch (high) in lower McCoy Branch watershed contains approximately 1.5 acres of moderate- to high-quality creation potential, plus approximately 0.5 acres of enhancement opportunity. The area includes young palustrine forested wetlands and emergent wetlands.

(2) Jones Island Terrace (high) includes a seasonal drainage with periodically inundated terraces, plus a number of small wet depressions. This site offers the potential for approximately 3 acres of creation and another 2 acres of enhancement of existing wetlands. Because of the site's close proximity to the Clinch River, small open-water areas that can be used as feeding stations by migratory waterfowl are possible as well.

(3) Hembree Cemetery wetland in upper McNew Hollow (high) is a small, but high-quality palustrine forested/palustrine scrub-shrub area with approximately 0.75 acres of combined creation and enhancement potential.

(4) Melton Branch area (medium) is approximately 1.8 miles upstream of the confluence with White Oak Lake, just downstream from a palustrine forested wetland. Approximately 1 acre of wetland creation is possible within the primary terrace of Melton Branch with enhancement of an additional 1.5 acres.

(5) Vanden Bulck Bridge Terrace (medium) is located along the east bank of the Clinch River about 2000 feet downstream of Vanden Bulck Bridge. Opportunities exist to create about 1 acre of wetland and enhance an additional 1 acre.

(6) Lower Raccoon Creek (low) is a tributary of the Clinch River entering the river about 6.2 km below Melton Hill Dam. The potential mitigation area lies within the flattened terraces of lower Raccoon Creek. The area contains an estimated 2 acres of low-quality mitigation opportunity.

(7) Lou Cagle Road (low) is in the upper watershed of an unnamed tributary to Clinch River. The area includes a mature palustrine forested wetland lying immediately adjacent to the unnamed tributary, but there is less than an acre of mitigation potential. There is little opportunity for lateral expansion due to relative steep topography.

(8) New Zion Cemetery (low) area currently supports a moderate high-quality palustrine forested wetland. The potential mitigation site is about 500 feet southwest of the New Zion Cemetery in the upper watershed of an unnamed tributary to the Clinch River below Melton Hill Dam. The only possibility for mitigation is immediately adjacent to existing wetland areas.

(9) Friendship Cemetery (low) is near the Bearden Creek Bridge on Melton Valley Drive. It includes an unnamed tributary to Bearden Creek. It presents a number of low-quality wetland creation opportunities that total less than 1 acre.

(10) Bearden Creek (low) area encompasses a large flat at the upper end of the Bearden Creek watershed. The location contains a limited number of small depressions that support a dominance of hydrophytic vegetation and wetland hydrology, but it is less than 1 acre.

One approach to compensatory mitigation is pre-impact wetland mitigation, which is undertaken to compensate for unavoidable wetland losses in advance of development actions. Among the advantages of pre-impact mitigation are (1) a greater potential for a successful mitigation project that effectively replaces wetland functions; (2) a reduction in permit processing times; and (3) the economies of scale relating to the planning, implementation, monitoring, and management of mitigation projects.

The U.S. Army Corps of Engineers, the EPA, the U.S. Fish and Wildlife Service, the Natural Resources Conservation Service, and the National Marine Fisheries Service issued final policy guidance regarding the establishment, use, and operation of mitigation banks (*Federal Register* 60, No. 228, November 28, 1995). The establishment of a pre-wetland mitigation on the ORR would require the involvement of several federal and state agencies, including the Corps of Engineers, EPA, Fish and Wildlife Service, and National Marine Fisheries Service, as well as the TDEC, TWRA, and TVA.

2.6.2.3.3 Wildlife Habitat Restoration

The TWRA has initiated a cooperative effort with TVA and Quail Unlimited to improve the wildlife habitat under TVA electrical distribution lines on the ORR by restoring native, warm season grasses. An approximately 70-acre demonstration plot was treated in 1998 with plans to convert additional acreage annually. Habitat improvement will enhance conditions for both resident wildlife and migratory birds, provide soil erosion control, and lower power line right-of-way maintenance needs. The habitat improvement will benefit quail, turkey, ground-nesting birds, rabbits, songbirds, snakes, mammalian predators, and other mammals. Some neotropical migratory birds are especially in need of this native grass habitat. Additionally, TWRA has plans to continue restoration of wildlife species and habitats such as Freels Bend.

The Environmental Sciences Division of ORNL has also initiated programs to improve the habitat on the ORR. One program is aimed at the restoration of some of the disturbed areas on the ORR (e.g., decimated pine plantation areas that resulted from recent outbreaks of the southern pine beetle). These areas will be prepared for restoration (e.g., removing fallen pine tree debris) and, in some cases, tilling the soil. Following the site preparations, a variety of grass communities will be planted that are designed to emphasize different management goals. These goals include improved wildlife habitat, erosion control, aesthetic beauty, and biomass production. Some areas that are prepared will also be left to naturally re-vegetate to promote native grass communities that currently exist on the ORR. These sites will serve as both test plots and demonstration areas and will be located along Bethel Valley Road (see Fig. 2.7). Supplementing this native grass restoration program will be an effort to target selected areas to remove invasive non-native plant species. The spread of these exotic species threatens rare native species that are currently protected on the ORR and are a threat to the overall diversity of the ORR. Such species as kudzu, privet, and nepal grass will be targeted with a combination of mechanical and herbicidal treatments, with an emphasis on the natural areas identified on the ORR. As part of this effort, a partnership of ESD, TVA, and TWRA has targeted some transmission line right-of-ways for treatment, with supplemental replacement planting using native low-growing shrubs.

2.6.2.4 Waste Management Facility

Reservation land is also needed for the EM Transuranic Waste Processing Facility (Fig.2.17), which is in progress.

2.6.2.5 Future Initiatives

Land for future initiatives may not have specific projects associated with it. Diverse physical characteristics and the evaluation of proposed sites for past projects are factors used to identify suitability of such lands for future initiatives. Some of the general land areas identified for future needs are shown in Fig. 2.17.

Associated with reservation management are a number of infrastructure needs which are identified in Table 2.3.

Table 2.3. Oak Ridge Reservation infrastructure needs ($ in 000s)

Project	Estimated cost	Funding year
ORR communications system	6,000	FY 2002
Wildland fire equipment trailer	15	FY 2002
Upgrades to road barricades/signs	165	FY 2002
Repair and maintenance of secondary roads	3,700	FY 2002–11
Bethel Valley Road upgrades	3,000	FY 2003–05
Lambert Quarry fencing	165	FY 2003
Dump/tow vehicle	62	FY 2003
4 x 4 3/4-Ton truck with fire tank	35	FY 2003
D7 Bulldozer	425	FY 2004
Boundary fence upgrades	500	FY 2004
Bethel Valley Road/Highway 95 intersection	3,000	FY 2005
Road grader	140	FY 2005
D4 Bulldozer	125	FY 2006
Trackhoe excavator	200	FY 2007
4 x 4 3/4-Ton truck with fire tank	35	FY 2007
Hydroseeder vehicle	115	FY 2008
Backhoe excavator	60	FY 2009
Total	17,742	

2.6.2.6 Transportation Improvements

The following projects on the ORR have been identified as proposed by the Tennessee Department of Transportation:

- Highway 58 widening from I-40 to the Highway 58/95 intersection (initiated)
- Highway 58 widening from the Highway 58/95 intersection east (proposal pending to DOE)

2.6.2.7 Education and Recreation

In 2001 DOE signed an agreement with the City of Oak Ridge for a greenway on Old Bethel Valley Road. Due to security upgrades, this greenway has been put on hold.

2.6.2.8 Land Transfers/Lease Areas

Areas identified by DOE that have recently been, or will soon be, leased or released are shown in Fig. 2.17. They include the following:

Private-Sector Research Facilities: As described in Sect. 3.4.1, up to 25 acres of DOE property at the ORNL site will be transferred to the private sector to allow for construction and space rental of research and office facilities for continuing the DOE mission at the site. Repurchase of this land by DOE at a specified time in the future will be provided for in the deed language.

Industrial Development: Areas that have been leased or may be leased, licensed, or transferred for industrial development have been identified. These do not include facilities within the ETTP developed area. Actions include

- Parcel ED-1 [leased April 1998 to the Community Reuse Organization of East Tennessee (CROET) for industrial development; DOE is currently considering a proposal to sell the parcel]
- Tower Shielding Facility (26 acres leased 1998 to BioNeutrics, Inc.)
- Parcel ED-2 (15 acres leased to CROET)
- Parcel ED-3 (450 acres currently under review for leasing to CROET)
- Parcel G
- Shoreline/floodplain along Boeing property (sold to the City of Oak Ridge, 2001)
- Water Treatment Plant and associated facilities (transferred to the City of Oak Ridge, 2000)
- American Museum of Science and Energy (currently under review for transfer to the City of Oak Ridge)

2.6.2.9 Oak Ridge Institute for Science and Education

The Oak Ridge Institute for Science and Education (ORISE), which is managed for DOE by ORAU, includes the 223-acre Scarboro Operations Site on the ORR. ORAU also manages several ORISE sites in downtown Oak Ridge, as shown in Fig. 2.2. DOE granted an easement to the Tennessee Department of Transportation for highway construction on the 24 acres east of Scarboro Creek, and it has been proposed to transfer about 20 acres immediately west of the creek to the City of Oak Ridge. The remaining 203 acres, and the structures located on them, will be adequate for ORISE's current operations in support of the DOE mission. Because no ORISE town site includes developable land, the Scarboro site is the only land now available to accommodate future growth.

2.6.3 Maps - Future Land Use on the Oak Ridge Reservation

Maps included in this document were prepared on MapInfo software using data from the ORNL SDI. The SDI database was updated with data from ORNL and other subcontractors, as available. Table 2.4 lists the categories contained on the future land use map.

2.7 STAKEHOLDER INPUT

2.7.1 Stakeholder Definition

Recognizing that ORNL, ETTP, and the Y-12 National Security Complex have differing missions and diverse stakeholders, DOE requested that each site establish and implement a tailored stakeholder involvement plan.

ORNL stakeholders include those who use the land for DOE mission activities, those who fund activities on the ORR, those with state or federal regulatory interest, neighbors who may be impacted by land use decisions, and those with a perspective on regional/national/international impacts of ORR land use decisions.

2.7.2 Process for Input

Earlier *ORNL Land and Facility Plans* incorporated stakeholder input from the DOE Environmental Management's Future Use Initiative or "Common Ground" process (The Nature Conservancy 1995), as appropriate, during the plan development. Comments were also received from individuals and

Table 2.4. ORNL future land use map

Fig. no.	Category	Main components
2.17	New research facilities	Spallation Neutron Source Center for Nanophase Materials Sciences Joint Institute for Neutron Sciences East Campus West Campus 7600 Area 7900 Area Future Research and Development Facilities NOAA Meteorological Research Tower
	Research areas	Proposed research areas Planned research areas
	Environmental partnership areas	Wildlife Refuge Pre-Impact Wetland Mitigation Areas Native grass restoration
	Waste management area	Transuranic Waste Processing Facility
	Transportation improvements	Highway 58 Widening
	Land transfers/lease areas	BioNeutrics, Inc. Parcel ED-1 (Horizon Center) Parcel ED-2 Parcel G Water Treatment Plant Parcel ED-3 (proposed) DOE shoreline (sold) Private Sector and State of Tennessee Facilities American Museum of Science and Energy

agencies on the draft plans and were incorporated, as possible. The DOE Land Use Planning Process, initiated in August 2001, is now providing a mechanism for updated input. Suggestions received as part of this process will reflect more current thoughts and ideas from ORNL stakeholders. Input for this update of the *ORNL Land and Facility Plan* has been and will be solicited as described in Appendix D. Additionally, a copy of the plan is located in the DOE Public Reading Room.

2.7.3 Use of Input

Recognizing that land and facilities planning is not a static process, solicitation of tailored ORNL stakeholder responses will be ongoing. Input received subsequent to publication will be incorporated in update documents.

All input is or will be evaluated for compatibility with the *ORNL Land and Facilities Plan*. Where appropriate and possible, these responses have been or will be incorporated into current and future land use planning.

Land use planning is an opportunistic and dynamic process. Through the ORNL Land and Facilities Use Committee, additional comments, ideas, and suggestions will be evaluated in a timely manner and will be reviewed through the RMO and DOE Reservation Management Team, as required.

3. ORNL INTEGRATED FACILITIES PLAN

3.1 PURPOSE

Excellence in Laboratory operations is one of the three key goals of the Oak Ridge National Laboratory (ORNL) Agenda. That goal will be met through a comprehensive upgrade of facility conditions and operational approaches over the next few years. This ORNL Integrated Facilities Plan is designed to provide a summary of the critical components of that upgrade process, outline the cost and schedule associated with implementing the plan, and document the basic facilities information necessary to properly manage the U.S. Department of Energy (DOE) assets at this site. The plan serves many planning functions for ORNL, as well as for multiple DOE and public stakeholders; therefore, it is an integrated document that represents input from a variety of data sources that can be consulted for more detail on any given technical topic. New information contained in this year's plan includes (1) specific plans for implementing activities associated with the just-completed Facility Environmental Vulnerability Assessment (FEVA) (Sect. 3.2.3.2.2), (2) a more detailed review of facilities operations and maintenance costs (Sect. 3.2.3.2.5.2), (3) an overview of the recently implemented Facility Management Model for ownership and operations of all ORNL facilities (Sect. 3.2.3.2.5.1), and (4) an overview of the Laboratory's energy efficiency and environmental sustainability goals (Sect. 3.2.3.2.5.6).

This Integrated Facilities Plan is structured to provide a current inventory and condition summary of all of the supporting ORNL facilities (Sects. 3.2.1 and 3.2.2), a brief review of the current ORNL program mission areas and needs (Sect. 3.2.3), and a brief overview of the ORNL site planning methodology used for infrastructure decision making (Sect. 3.3). Following this baseline information, future planning for ORNL facilities improvements is outlined in Sect. 3.4, with overall cost and schedule data provided in Sect. 3.5. Conclusions and recommendations are summarized in Sect. 4. Detailed data sets and project listings supporting the plan are provided in the appendices.

The plan references documents and other management systems whenever possible to assure a cogent, comprehensive presentation of appropriate information within the context of this plan. Users, therefore, should access the referenced documents for detailed information. Table 3.1 is a listing of key planning documents/databases that support this plan. Appendix F provides a description of the contents of each of the listings in Table 3.1. The *ORNL Land and Facilities Plan* will be updated periodically to assure the most current planning base; however, general plant project (GPP), Line Item (LI), and general-purpose equipment (GPE) projects, schedules, and funding are continually revised to meet the current needs of the Laboratory. The Infrastructure Planning Division Web Site (http://www.ornl.gov/camext/) will provide the most current planning base decisions and funding allocations.

3.2 SITE AND PROGRAM DESCRIPTION

UT-Battelle manages the site and programs both functionally and cost effectively in support of the Laboratory Agenda for excellence in science and technology; excellence in Laboratory operations and environment, safety, and health (ES&H); and excellence in community service. Each of these agenda initiatives at ORNL requires a variety of facility types, systems, and equipment to conduct research and support functions. ORNL currently has one of the oldest physical plants in the DOE laboratory system, which requires efforts to maintain, renovate, and rehabilitate general-purpose buildings and utility systems, as well as to provide new mission-related facilities for expanded scientific endeavors.

Table 3.1. List of organizational contacts for documents/databases

Document/Web Address	Organizational Contact	Bldg./MS	Phone	UID*
Comprehensive Integrated Planning Process for the Oak Ridge Operations Sites (September 1999) (http://www.ornl.gov/~dmsi/cip/)	P. D. (Pat) Parr UT-Battelle	Bldg. 1505/MS 6038	576-8123	par
ESHQ&I Management Plan Information System (http://svr1.cmo.ornl.gov/eshwc/wc.dll?eshweb~TopPage)	P. E. (Patty) Cox UT-Battelle	Bldg. 1000/MS 6302	576-4183	pcx
Environmental Management Program Life Cycle Baseline (http://www.bechteljacobs.org/busmgt/baseline/Baselines.html)	N. J. (Nancy) Montgomery Bechtel Jacobs Company, LLC	Bldg. K-1225/MS 7293	576-4010	njm
ESHQ&I Budget Formulation Submission for ORNL (http://www.ornl.gov/camext/CAMIndex.htm)	P. E. (Patty) Cox UT-Battelle	Bldg. 1000/MS 6302	576-4183	pcx
ESHQ&I Management Plan and Execution Plan for ORNL (http://www.ornl.gov/camext/CAMIndex.htm)	R. J. (Rick) Forbes UT-Battelle	Bldg. 1000/MS 6302	574-5490	rfs
ORNL Facility Index (http://home.ornl.gov/~q9t/facility/)	D. (Dave) Kennard UT-Battelle	Bldg. 1000/MS 6302	574-9282	k33
ORNL Institutional Plan (http://www.ornl.gov/inst_plan/IP_Outline.html)	D. P. (Debbie) Stevens UT-Battelle	Bldg. 4500N/MS 6251	574-4763	svn
ORNL Laboratory Agenda (http://home.ornl.gov/offices/strategic_planning/stratplan/labagenda/lab_agenda.htm)	M. B. (Bonnie) Nestor UT-Battelle	Bldg. 4500N/MS 6251	574-4173	mnj
ORNL Land and Facilities Plan (http://www.ornl.gov/~dmsi/landUse/)	A. R. (Tony) Medley, UT-Battelle P. D. (Pat) Parr, UT-Battelle	Bldg. 1000/MS 6302 Bldg. 1505/MS 6038	574-9156 576-8123	arm par
Oak Ridge Reservation Annual Site Environmental Report (http://www.ornl.gov/Env_Rpt/aser2000/aser2000.htm)	J. F. (Joan) Hughes UT-Battelle	Bldg. 4500S/MS 6137	574-6649	fhu
Oak Ridge Reservation Management Plan (http://home.ornl.gov/general/orrmp/)	P. D. (Pat) Parr UT-Battelle	Bldg. 1505/MS 6038	576-8123	par
ORNL Strategic Facilities Plan (http://www.ornl.gov/~dmsi/strategic_plan/index.html)	T. E. (Tim) Myrick UT-Battelle	Bldg. 1000/MS 6336	241-4597	uyt
ORNL Parking Lot and Traffic Flow Plan (http://www.ornl.gov/~dmsi/parking/)	F. S. (Faye) Brewer UT-Battelle	Bldg. 1000/MS 6302	241-4710	sni

*Users external to ORNL should add the extension @ornl.gov to all UIDs (e.g., par@ornl.gov).

Modernization of the Laboratory's infrastructure through support by DOE programs, the commitment of the State of Tennessee to build three new buildings, and the commitment of UT-Battelle to enable private-sector development of three new facilities is the focus of the ORNL Facilities Revitalization Project (FRP) documented in ORNL/TM-2000, *Oak Ridge National Laboratory Strategic Facilities Plan for Making ORNL a 21st Century Laboratory.*

3.2.1 Current Facilities and Uses

ORNL's main site encompasses approximately 1100 acres in the Bethel (Fig. 3.1) and Melton (Fig. 3.2) valleys, approximately 10 miles southwest of the center of the City of Oak Ridge, Tennessee, with additional facilities located on the adjacent Copper Ridge (Fig 3.3). ORNL also occupies space at the Oak Ridge Y-12 National Security Complex (Fig. 3.4), leases some space off-site, and manages some space for DOE functional activities (e.g., the American Museum of Science and Energy). An approximately 90-acre site on Chestnut Ridge north of the main ORNL site is currently being developed for the Spallation Neutron Source (SNS). ORNL has responsibility for management of a 21,076-acre portion of the approximately 34,235-acre ORR, including ORNL facilities and most of the 20,000-acre Oak Ridge National Environmental Research Park. The ORNL site has many functions and requirements similar to those of a small city. It is supported by a dedicated fire department, a medical center, a security force, and a steam plant. Amenities include 180 miles of roads, 34 miles of overhead power lines, 27,000 feet of steam lines, 100,000 feet of treated water piping, and about 225 acres of mowed grounds.

As indicated in Table 3.2, buildings at the main site in Melton Valley, Bethel Valley, and Copper Ridge comprise approximately 3.6 million gross square feet of building space. At the Y-12 National Security Complex, ORNL use accounts for 0.9 million square feet, with the remaining space leased or made available through operating contracts (approximately 0.3 million square feet). At the Y-12 National Security Complex, ORNL has responsibility for building maintenance and ES&H functions as approved by Memoranda of Understanding (MOUs) between ORNL and Y-12. ORNL is actively reducing the square footage of space used at Y-12 by transitioning operations to the ORNL main site and placing facilities in cheap-to-keep status or transferring facilities to the Y-12 operating contractor.

Table 3.2. ORNL space distribution

	Buildings		Trailers		
Location	**Number**	**Space, ft²**	**Number**	**Space, ft²**	**Total space, ft²**
ORNL main site					
UT-Battelle (DOE-SC)	329	2,991,676	48	44,096	3,035,772
UT-Battelle (DOE-DP)[a]	1	37,191	—	—	37,191
Bechtel Jacobs	130	445,482	34	30,118	475,600
Subtotal, ORNL main site	460	3,474,349	82	74,214	3,548,563
ORNL off-site:					
AMSE	3	56,583	1	552	57,135
ORNL at Y-12	16	1,137,738	1	680	1,138,418
Leased off-site	5	297,064	—	—	297,064
Total	**484**	**4,965,734**	**84**	**75,446**	**5,041,180**

[a]The National Nuclear Security Administration's Deputy Administrator for Defense Programs owns Building 3019A.

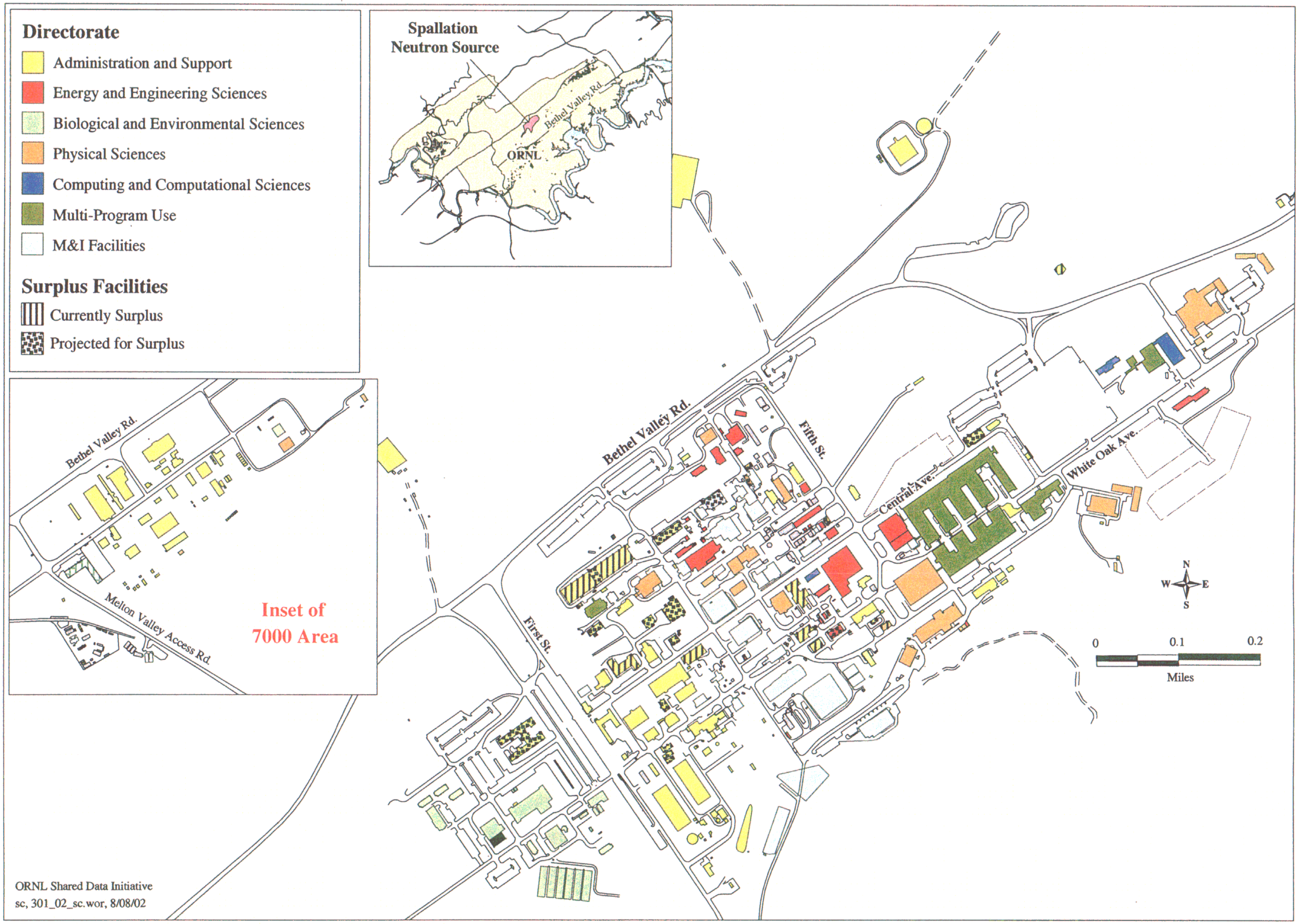


Fig. 3.1. ORNL Bethel Valley area facility uses.

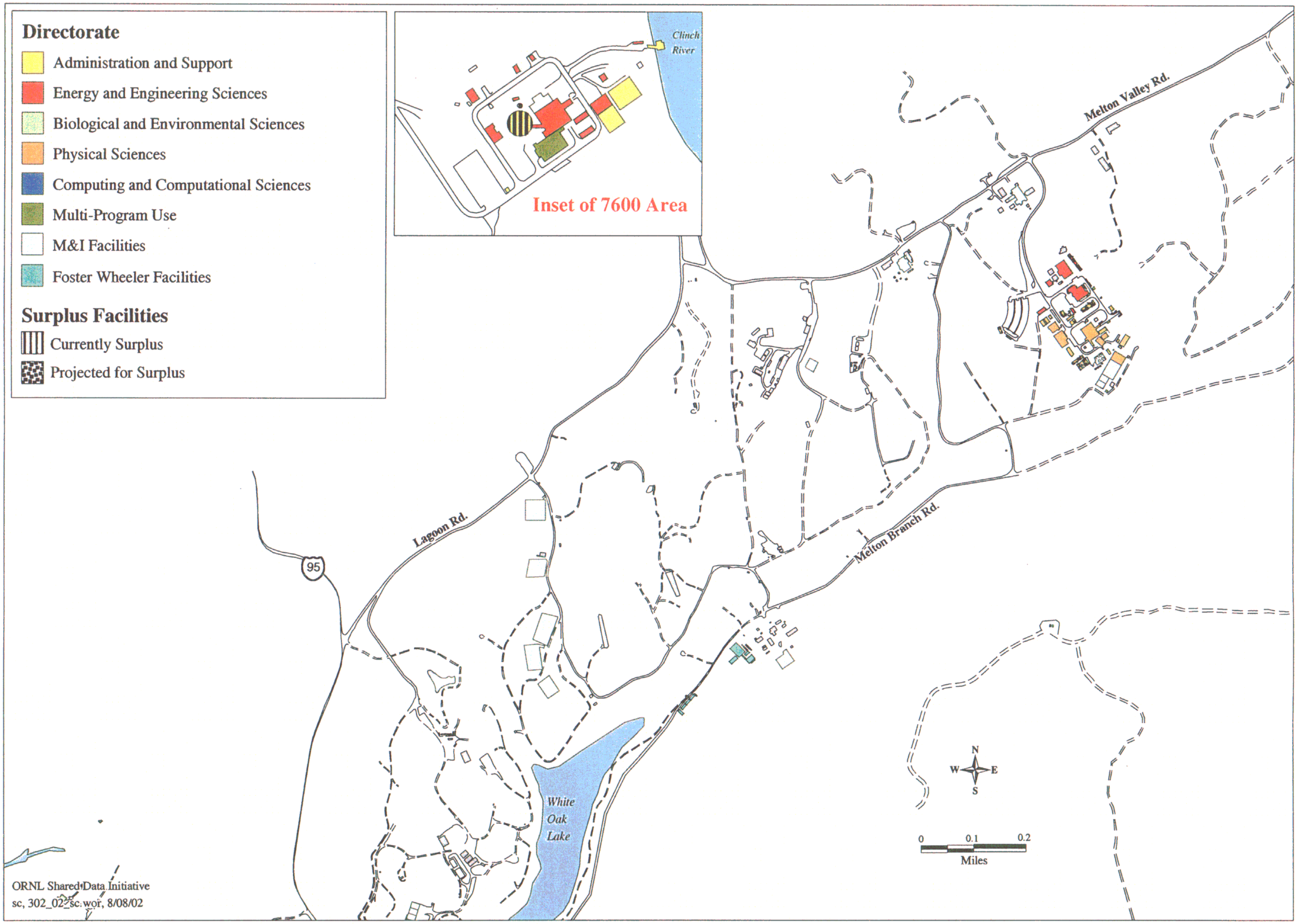


Fig. 3.2. ORNL Melton Valley area facility uses.

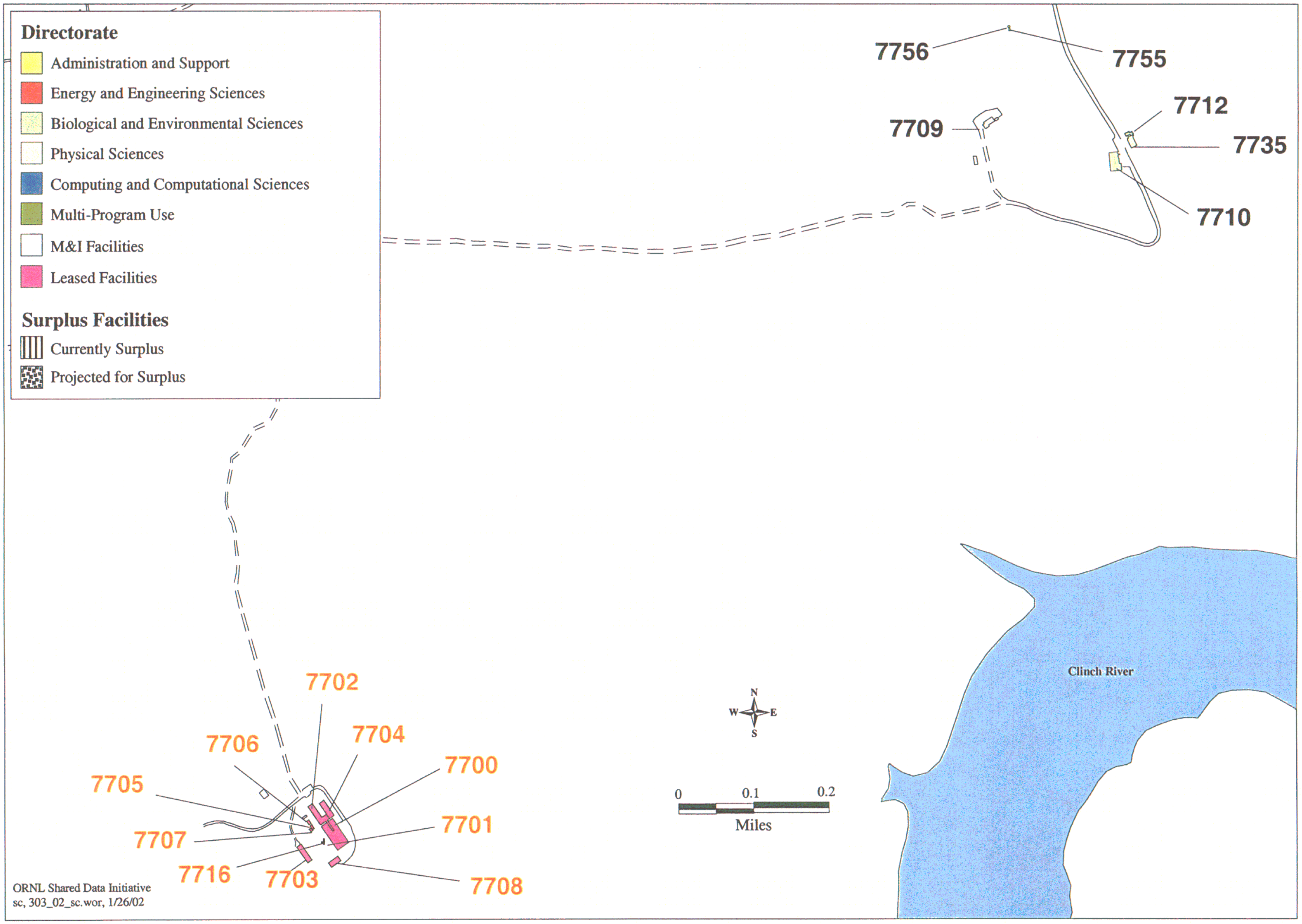


Fig. 3.3. ORNL Copper Ridge area facility uses.

Fig. 3.4. ORNL at Y-12 facility uses.

The National Transportation Research Center (NTRC), a partnership of DOE, ORNL, and UT, provides a mechanism for promoting and supporting research activities focused on major transportation research and development (R&D) issues related to energy, environment, and security for the nation and the world. It is located in a new facility in Knox County, between ORNL and UT's Knoxville campus, that was constructed through a collaborative effort involving DOE, ORNL, UT, and the Development Corporation of Knox County. The NTRC was formally designated a national user facility in FY 2001.

UT-Battelle is moving forward with implementation of a plan to ensure the financial stability of the American Museum of Science and Energy (AMSE). In response to the plan's recommendations, DOE has agreed to transfer the museum and the surrounding property to the City of Oak Ridge. DOE has also completed an environmental assessment associated with the museum's proposed transfer. Three of DOE's largest contractors have agreed to provide five-year bridge funding for the museum. The city has hired a consultant to determine the best means of managing the museum. UT-Battelle continues to work with DOE and the City of Oak Ridge to secure the museum's future for the community.

Of the 3.6 million gross square feet of building space at the main site, approximately 0.5 million square feet has been transferred to Bechtel Jacobs Company, LLC, under the management and integration (M&I) contract for Environmental Management (EM). Bechtel Jacobs Company, LLC, manages the EM Program and waste management systems at the ORNL main site.

Facility use designations are identified in Figs. 3.1– 3.4. Of the total square footage of ORNL facility space, 16% is for administration and support functions (including vacated facilities being dispositioned), 18% is designated as multiprogram support, 20% is for physical science programs, 6% is for biological and environmental sciences programs, 21% for energy and engineering sciences programs, 1% for computing and computational sciences programs, 2% for the Spallation Neutron Source program, and 16% for Bechtel Jacobs Company, LLC, programs for EM projects and waste services. Space usage within the facilities is shown in Fig. 3.5.

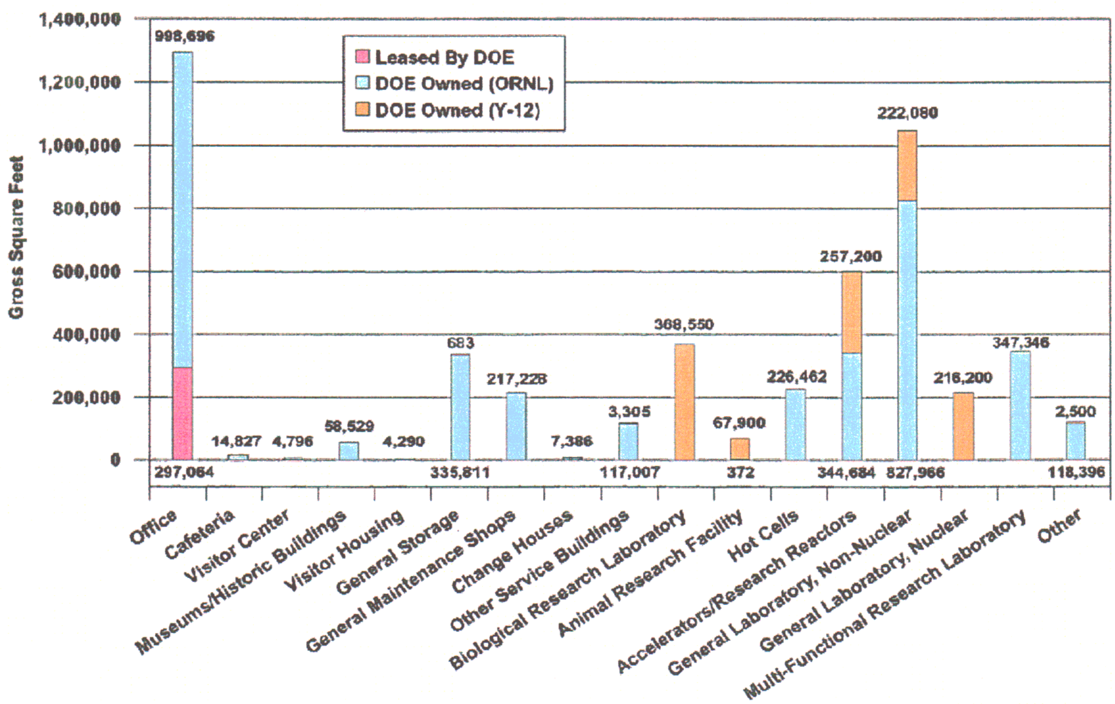


Fig. 3.5. Use of ORNL space.

3.2.2 General Infrastructure Conditions

UT-Battelle has the responsibility to ensure that scientists and engineers conduct first-rate scientific research in modern and efficient facilities with state-of-the-art equipment and instrumentation. The overall condition of the ORNL space is shown in Figs. 3.6 and 3.7. The condition assessment surveys provide data regarding adequacy of the facilities to meet intended uses. Approximately 33% (or 1.2 million square feet) of the ORNL site facilities is in good to excellent condition for intended uses, with the remaining in need of modernization or replacement. The Facilities Revitalization Project has scheduled the replacement and/or modernization of facilities to increase the amount of space in good to excellent condition to 70% (or 2.48 million square feet) by FY 2009. Photographs of some of the representative substandard facilities are provided in Figs. 3.8 – 3.11. A summary of building age is shown in Fig. 3.12 and indicates that the majority of buildings are over 30 years old.

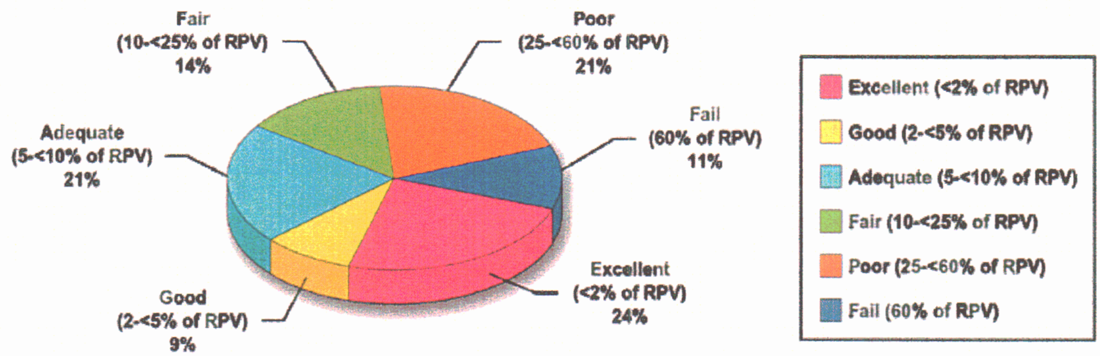


Fig. 3.6. Condition of space at ORNL.

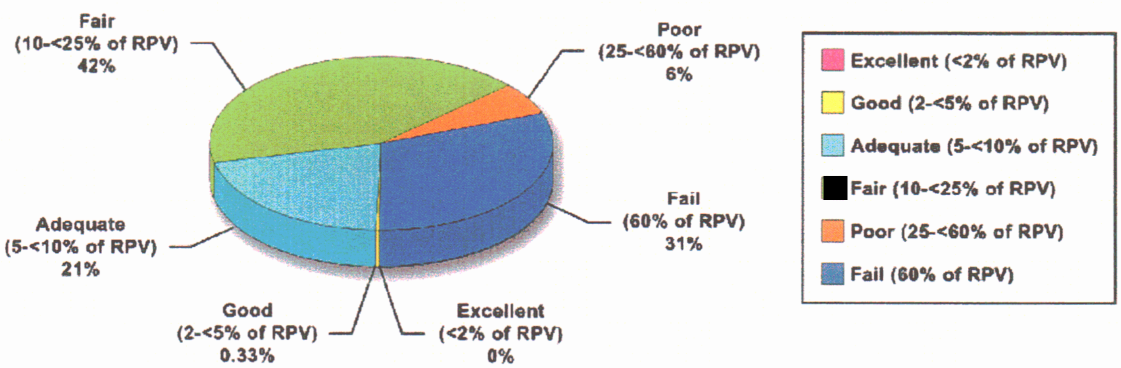


Fig. 3.7. Condition of ORNL space at Y-12.

Fig. 3.8. Building 2001 (constructed in 1948).

Fig. 3.9. Building 3550 (constructed in 1943).

Fig. 3.10. The "new" ORNL Cafeteria (constructed in 1951).

Fig. 3.11. Bricks falling off Building 9207 at Y-12.

ORNL actively uses the Condition Assessment Information System (CAIS) to document facility condition. Replacement plant value (RPV), defined as the cost for replacement of a building/facility to include fixed equipment, is presented in Table 3.3.

Table 3.3
Estimated replacement plant value (RPV) for ORNL main site (in millions of FY 1997 dollars)

Facility type	Replacement cost
Buildings and structures	3,550
Utility systems	650
All other	300
Total	**4,500**

To support research activities, a wide variety of infrastructure systems are in place across the Laboratory. Similar to the research facilities, they are in various stages of deterioration due to age. These systems include utilities (electrical, gas, compressed air, potable/process water, chilled water, steam, industrial gases, HVAC, stormwater collection, and telecommunications); transportation infrastructure (roads and parking areas); security (fencing, portals, building access controls); fire protection; and waste management (conventional and hazardous). Appendices G through K provide more detailed descriptions of the conditions and needs in each of these areas. It is important to understand that these infrastructure systems are critical to the mission of the Laboratory and must receive equal attention in revitalization planning.

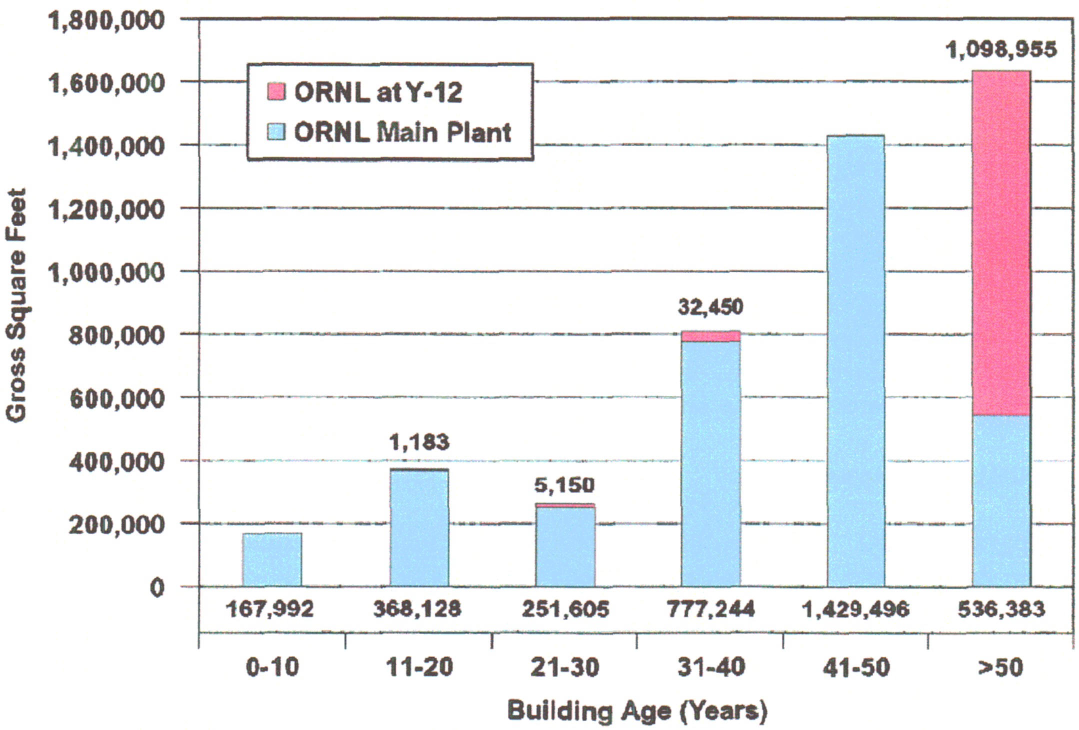


Fig. 3.12. Age of ORNL buildings.

The systems having the greatest need for refurbishment or replacement as part of the Laboratory's modernization initiatives are those related to facility conditions identified in the Facility Environmental Vulnerability Assessment and to other general upgrades of the electrical distribution system, process/chilled water systems, ventilation and exhaust systems, transportation infrastructure, and security. Many of the upgrades are driven by health and safety requirements that can no longer be met by 35- to 50-year-old electrical or heating, ventilating, and air-conditioning (HVAC) equipment, or for which reliability concerns cannot be tolerated (e.g., the primary potable water systems). Underground piping for water and waste systems is a primary health and safety concern being addressed by the Facility Environmental Vulnerability Assessment Recommendation Implementation (FEVARI) project. Roadways and parking are becoming an important issue as related to security improvements, safety improvements for entrances, and parking associated with new facility construction and the open campus initiatives. Similarly, site security upgrades are required due to changes in DOE's approach to operations, as well as UT-Battelle's desire for a more open campus environment as part of Laboratory revitalization efforts. Projects related to these initiatives are identified in Sect. 3.4 of this plan.

3.2.3 ORNL's Programmatic Direction and Needs

Trends in ORNL's site and facilities management and planning are driven by the need to develop an integrated research campus for the 21st century. To support the programmatic direction of research, the key issues include (1) relocation of ORNL organizations at Y-12 to the main ORNL site, (2) upgrades and modifications to existing laboratory and experimental space to better facilitate R&D activities, (3) upgrades and replacement of site and facility utility systems, and (4) disposition of inactive/surplus facilities. Traditional funding sources for infrastructure include GPP and GPE budgets, programmatic Line Items, and DOE's Multiprogram Energy Laboratory Facility Support (MEL-FS) Program. To assist ORNL's needs for programmatic facility modernization, innovative arrangements have been established to add funding sources from the State of Tennessee and the private sector. Sect. 3.4, the Master Plan planning description, provides a detailed listing of all projects supporting both programmatic and general landlord maintenance and upgrades.

3.2.3.1 Science Programs

To extend the nation's capabilities in key areas of science and technology, ORNL is pursuing major research initiatives in neutron sciences, complex biological systems, terascale computing and simulation science, energy and environmental systems of the future, and advanced materials. The University Partnerships Initiative is aimed at increasing the value of ORNL's science and technology through active involvement of university faculty and students in Laboratory programs. These initiatives are captured in the Laboratory Agenda and described in detail in the *ORNL Institutional Plan*. A brief overview of these initiatives is presented below, organized by Laboratory research directorates. Needs for new facilities to support research initiatives are summarized in Table 3.6 at the end of this section (p. 3-39).

3.2.3.1.1 Physical Sciences

HFIR Upgrade. ORNL is engaged in a Neutron Sciences Initiative to ensure that the Laboratory continues its stewardship of neutron science in support of DOE's missions. This initiative has two major elements: (1) design and construction of the SNS, a next-generation spallation neutron source facility, in collaboration with five other DOE national laboratories and (2) upgrades and refurbishment of the High Flux Isotope Reactor (HFIR), which will greatly enhance the neutron science capabilities of the world's highest-power research reactor and will extend its life well into the 21st century. An overview of the SNS follows in Sect. 3.2.3.1.2.

The HFIR is among the world's best research reactor facilities. Its flexible design allows it to serve multiple missions—neutron scattering, isotope production, materials irradiation, and neutron activation analysis—and, when operating at 85 MW, HFIR produces the world's highest peak thermal neutron flux, 2.3×10^{15} neutrons per square centimeter per second.

HFIR was shut down October 1, 2000, for a beryllium reflector replacement. The outage provided an outstanding opportunity to install larger beam tubes and new and improved instrumentation for neutron scattering. On November 30, 2001, ORNL received DOE approval to restart HFIR, and, currently, operations are resuming.

Improvements to HFIR's research capabilities will continue during FY 2002 and FY 2003. Basic Energy Sciences has provided $3 million for the construction of the Small-Angle Neutron Scattering (SANS) Guide Hall and is also supplying support for the installation of the cold-neutron source and instrumentation. These endeavors will be completed during FY 2002 and FY 2003. The SANS Guide Hall will provide the necessary space to support a new 20-m SANS instrument and a new 16-m biological SANS instrument, which will be dedicated to biological research. The cold neutron source will allow HFIR to support leading-edge cold-neutron research that could result in key new discoveries and applications involving polymers, plastics, alloys, and biochemical systems.

The performance of the upgraded HFIR will be comparable to the best in the world for cold and thermal neutron scattering. It will have 15 state-of-the-art neutron scattering instruments with thermal or cold-neutron beams with intensities equivalent to the world's best. Its neutron scattering capabilities will complement those of the SNS and will help restore U.S. leadership in neutron science. In addition, the upgraded HFIR will maintain its exceptional capabilities for isotope production, materials irradiation, and neutron activation analysis.

A large neutron guide hall that would extend the HB-2 beam line to as many as 15 instruments and would allow many more users to be accommodated has been proposed. This guide hall would provide more space for instruments in a low-background area outside the reactor building. It would also provide office and laboratory space for outside users and ORNL researchers. Other proposed changes would improve access for radioisotope production and would enhance the neutron activation analysis mission.

Advanced Materials Initiative. ORNL's Advanced Materials Initiative is aimed at sustaining ORNL's position as an excellent advanced materials R&D laboratory supporting DOE's missions. The initiative includes the development of a recognized capability in nanoscale science, engineering, and technology; the development of extraordinary tools for materials characterization and the extension of ORNL's capabilities for synthesis and processing; the establishment of the Center for Nanophase Materials Sciences; and the construction of a new Advanced Materials Characterization Laboratory (AMCL).

The Center for Nanophase Materials Sciences. The Center for Nanophase Materials Sciences (CNMS) will be a national facility for advancing the understanding of nanoscale phenomena in materials. It will leverage the unprecedented opportunity for new research on the structure and dynamics of nanoscale materials systems that will be afforded by the SNS and the upgraded HFIR. The focus will be on interdisciplinary research areas that benefit from access to neutron scattering, including soft materials, interfaces, nanoscale magnetism, and other nanophase systems. Research will provide the foundation for new nanotechnologies based on the systems of these materials and will optimize the use of the SNS and the upgraded HFIR for nanoscience-related research. Working through university and industry partnerships, CNMS will create an environment and provide facilities for rapid progress in interdisciplinary nanoscale science and engineering. It will also provide training for graduate students and postdoctoral associates in interdisciplinary nanoscale science, with particular emphasis on nanoscale materials synthesis and characterization, assembly of nanomaterials systems, and fundamental understanding of nanoscale phenomena. The CNMS was approved by Basic Energy Sciences (BES) in FY 2001 and has been funded as a Line Item construction project beginning in FY 2002 (see Table 3.4). It will be housed in an 80,000-square-foot laboratory/office complex to be constructed adjacent to the SNS and the Joint Institute for Neutron Sciences (JINS). This facility will include clean rooms and specialized equipment for nanoscience research that cannot be accommodated in existing space at ORNL. The CNMS responds to the recommendations of *Nanoscale Science, Engineering, and Technology Research Directions,* a 1999 report prepared by members of the Office of Basic Energy Sciences Nanoscience/Nanotechnology Group, and will provide a unique national resource in the nanosciences. Preliminary design activities for the facility have been initiated in FY 2002. A workshop to facilitate community involvement in the planning for the Center, held in October 2001, was attended by more than 270 participants from 67 institutions.

Table 3.4. Funding profile for the Center for Nanophase Materials Sciences
Project engineering and design and construction

FY 2002	FY 2003	FY 2004	FY 2005	Total
$1,500K	$25,000K	$20,000K	$17,250K	$63,750K

Advanced Materials Characterization Laboratory. As a leader in the development of techniques and instrumentation for analysis of materials at the atomic level, ORNL has one of the nation's strongest and broadest materials sciences programs. This area is the focus of collaborative research with universities and industries across the United States. Many of these collaborations involve characterization of materials at ORNL user facilities and participation in collaborative research centers. Appropriate housing for the Laboratory's advanced analytical electron microscopes, atom probe field ion microscopes, and similar instrumentation is a high priority. This equipment is now scattered across the ORNL campus in buildings that either do not meet the manufacturers' requirements for optimum operation or are only marginally adequate. These buildings will not allow ORNL to maintain state-of-the-art instrumentation for the next generation of this equipment. Therefore, ORNL will construct an Advanced Materials Characterization Laboratory (AMCL) to address this issue. A new structure with 12,000 square feet of space, the AMCL will provide the high-quality environment required to optimize the performance of sophisticated characterization equipment essential for the next generation of advanced materials R&D. The AMCL is included in ORNL's Facilities Modernization Initiative as a GPP budget item with a cost of $4.8 million. Architects have been selected and design is under way. Construction is expected to start in the late summer of 2002. The AMCL will foster state-of-the-art materials characterization that is essential for understanding materials and materials-related processes and phenomena that underpin energy technologies and industrial endeavors. Specifically, the facility will house equipment funded by several DOE offices, primarily the Office of Science (DOE-SC) and the Office of Energy Efficiency and Renewable Energy (DOE-EE). Two of ORNL's major user programs—the High Temperature Materials Laboratory, funded by DOE-EE, and the Shared Research Equipment Collaborative Research Center, funded by DOE-SC—include a strong emphasis on electron-beam characterization and related techniques that will be supported by this facility (Fig. 3.13).

3.2.3.1.2 Spallation Neutron Source

The SNS is an accelerator-based, next-generation neutron scattering facility that is under construction on the ORR. It will produce neutron beams that are 12 times as intense as any existing pulsed source, enabling researchers to "see" never-before-observed details of physical and biological materials, ranging

Fig. 3.13. Advanced Materials Characterization Laboratory.

from high-temperature superconductors to proteins. The SNS is the top-priority project of DOE-SC, which plays a key role in supporting DOE's goals and strategies in science (Fig. 3.14). At a total cost of $1.4 billion, construction began in FY 1999 and will be completed in FY 2006.

Other planned improvements are to develop innovative research programs that take advantage of the unique capabilities afforded by the HFIR, SNS, and other neutron facilities (including a new HFIR user support facility); to build a world-class user program that provides access to these capabilities; and to construct an $8 million facility, funded by the State of Tennessee, for the Joint Institute for Neutron Sciences (JINS).

3.2.3.1.3 Biological and Environmental Sciences

ORNL is developing a significant program in complex biological systems that builds on established programs and expertise in the life and environmental sciences. The Complex Biological Systems Initiative incorporates innovative applications of computational, physical, chemical, and engineering science, as well as special facilities and resources in analytical technologies, to advance the understanding of biological systems. This initiative engages organizations and disciplines across the Laboratory and draws on programs in comparative and functional genomics, structural biology, and computational biology and bioinformatics. It focuses ORNL's distinctive expertise and facilities in mammalian genetics, biochemistry, environmental microbiology, plant genetics, analytical technologies, computational science and applied mathematics, physical sciences, and engineering on the challenges of observing and understanding the functioning of complex biological systems. Five key areas will be pursued through the Complex Biological Systems Initiative: comparative and functional genomics, proteomics and structural biology, the microbial cell, biological systems analysis, and predictive toxicology.

A significant investment in a new Center for Systems Biology at ORNL is being initiated. The Center is planned as a modular complex of buildings, equipment, and infrastructure to house current and future research programs in functional genomics, structural biology, proteomics, and systems biology. The initial element of the Center for Systems Biology is the recently completed Environmental and Life Sciences Laboratory constructed with GPP funds. The next phase in the development of the Center is the construction of the William L. and Liane B. Russell Laboratory for Comparative and Functional Genomics (LCFG) to house the Mouse Genetics Research Facility. The LCFG, which will replace an aging building at the Oak Ridge Y-12 National Security Complex, will be constructed with DOE Line Item funding ($13.9 million). Construction completion for the LCFG is scheduled for August 2003. In addition to the mouse colony, the LCFG will include laboratories with special phenotype screening capabilities, thus supporting the ORNL Functional Genomics and Proteomics Program. In support of the mouse colony, laboratories for microinjection of mouse embryos and cryopreservation facilities will be constructed and attached to Building 1059 with GPP funding (approximately $1.2 million). The Center for Systems Biology will also encompass the Center for Structural Molecular Biology (CSMB) and the Joint Institute for Biological Sciences. The principal new capital resource needed to support the CSMB beyond 2003 is a beam line dedicated to structural biology on the SNS. Construction of a facility to house the Joint Institute for Biological Sciences will be funded by the State of Tennessee at a cost of $8 million. Figure 3.15 shows the West Campus facilities.

Building 1503 is scheduled for modification in FY 2003 at a cost of $1.5 million with GPP funding. The greenhouses and modernized laboratories to be renovated will enable researchers to develop quantitative characterizations of the structure and functional relationships among terrestrial and aquatic ecosystems, populations, and communities and a better understanding of processes affecting carbon management and carbon sequestration. Other anticipated research areas this facility will support include the toxicity evaluation of compounds to plant ecosystems and the evaluation of microbial and plant remediation

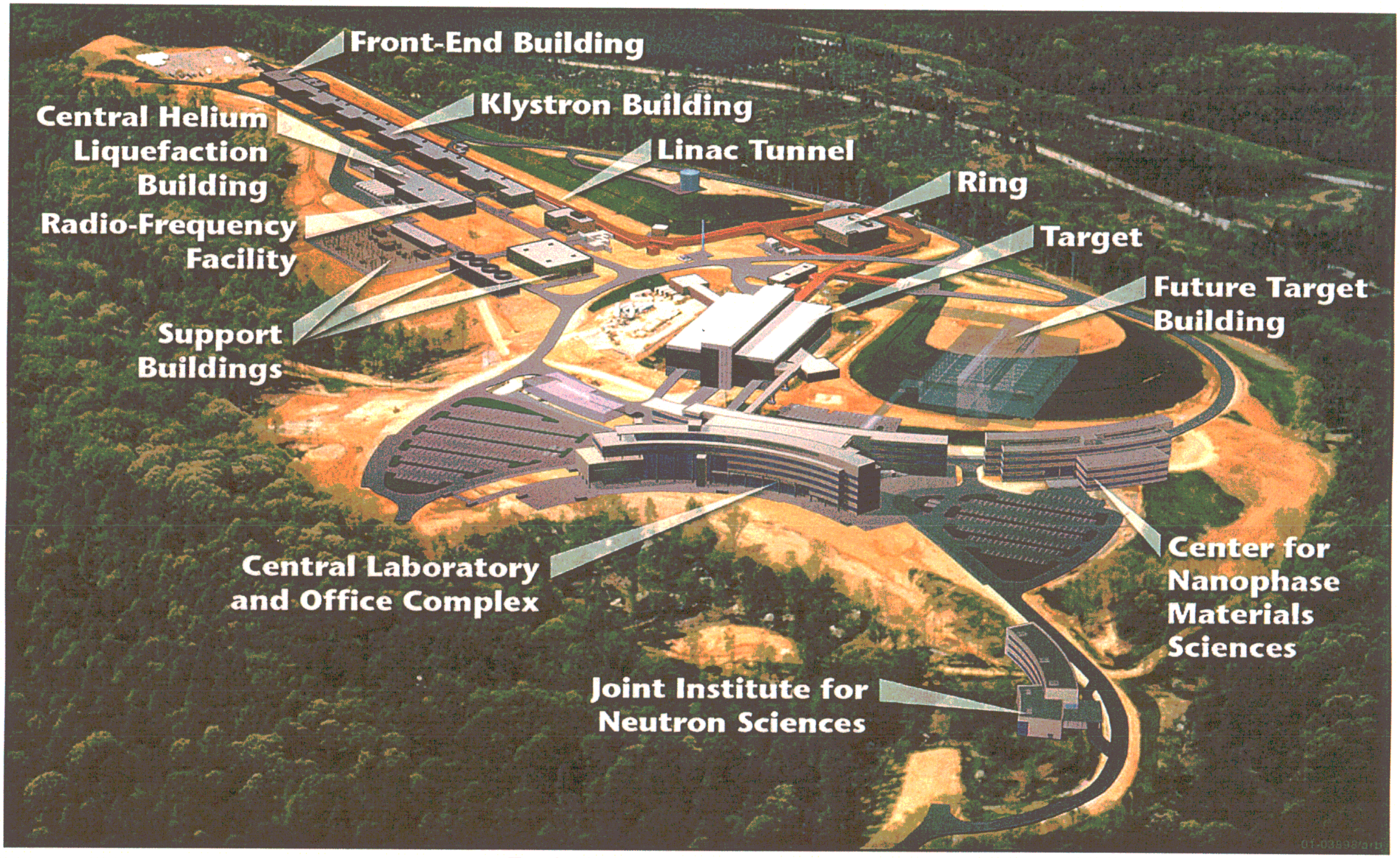


Fig. 3.14. Spallation Neutron Source.

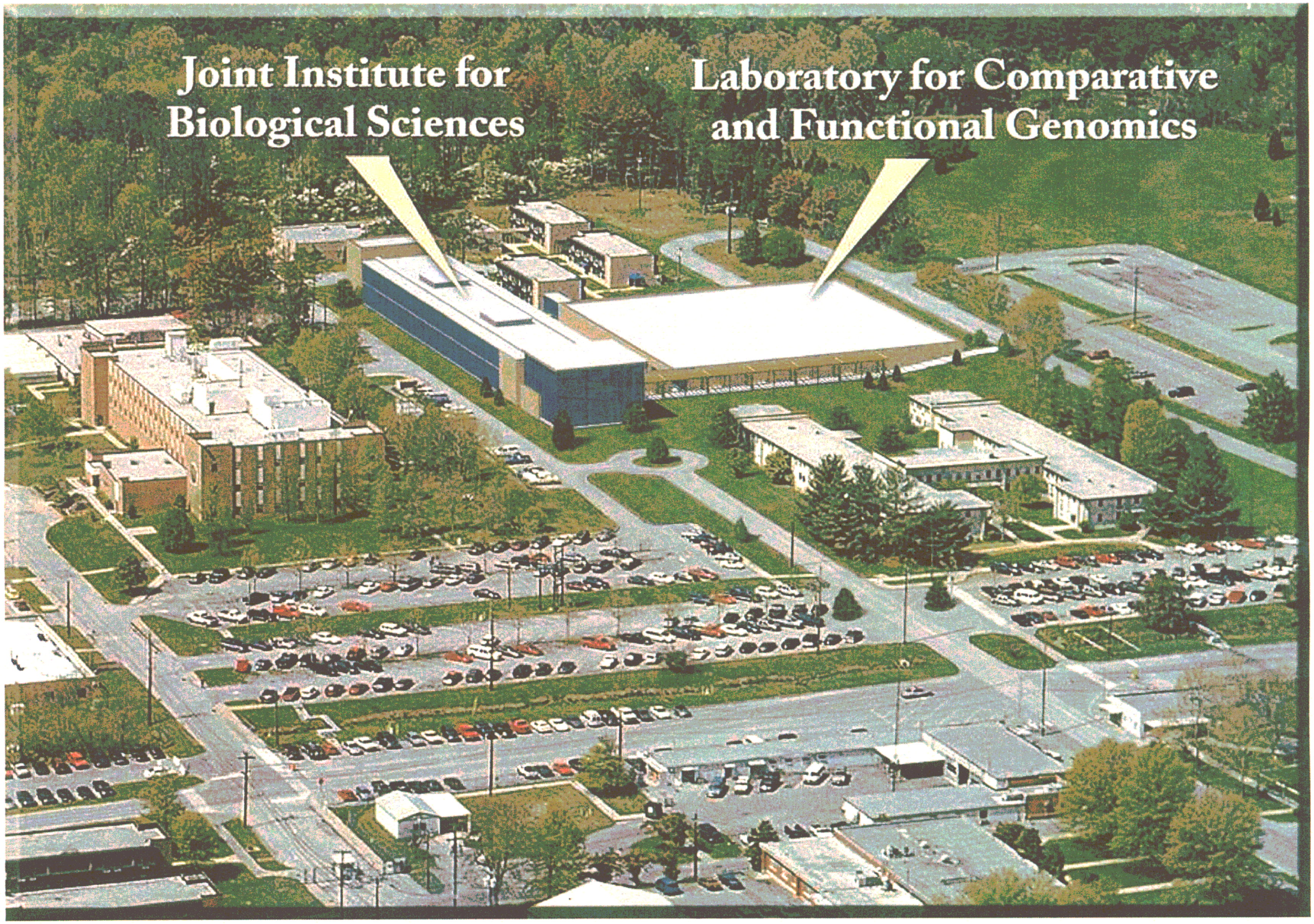


Fig. 3.15. West End Campus view.

techniques for purposes of environmental management. A particularly important area also to be supported is bioenergy research in which Environmental Sciences Division (ESD) researchers are developing and demonstrating environmentally beneficial, commercially viable biomass production systems.

3.2.3.1.4 Computing and Computational Sciences

DOE's Scientific Discovery through Advanced Computing (SciDAC) Program is being developed to take the nation into a new era of information and communications technology. It will rapidly deploy computing and communications capabilities that are at least ten times faster than today's fastest systems for government, academic, and industrial use.

This capability will revolutionize current approaches to solving complex problems in energy, the environment, fundamental research, and technology development, and it will stimulate the national system of innovation. Attaining the proposed capability will demand significant advances in computational resources. Fully exploiting the power of massively parallel machines requires the creation of new programming paradigms, languages, scheduling and partitioning techniques, and algorithms. All of these elements must be integrated into systems that are accessible and useful to a diverse user community.

ORNL has been selected as the primary site for SciDAC application development and deployment. With computational power of 5.5 teraflops, ORNL is among the nation's most powerful unclassified computing facilities. In order to support the growing mission-critical computational needs of DOE, ORNL must continue to maintain state-of-the-art supercomputing and networking infrastructure. ORNL has plans to increase the capacity of its computers to 10 teraflops in FY 2003 and is currently working on a cooperative R&D agreement (CRADA) that will lead to a 180 teraflops computer in FY 2004 or FY 2005. At the current rate of advance in computing capabilities, petascale computing will be required by FY 2008 or FY 2009 to support programmatic needs.

In support of this effort, a new Computational Sciences Building (CSB) is the highest-priority building for ORNL. Plans are being finalized to construct the CSB using private funds and to lease this building. Current schedules call for the groundbreaking in early FY 2002 and occupancy of the building in mid FY 2003. The CSB will provide 40,000 square feet of state-of-the-art computer room space with another 40,000 square feet for computer science laboratories and offices.

In addition, the State of Tennessee has committed funding for a new facility to house the Joint Institute for Computational Sciences, which promotes collaborative relationships among ORNL, UT, and the UT-Battelle core universities and encourages and facilitates the effective use of high-performance computing resources in the southeastern United States. This $10 million, 50,000-square-foot building is scheduled to start construction in the summer of FY 2002, with move-in planned for late FY 2003.

With the explosive growth of computing expected over the next decade, ORNL must increase the network bandwidth linking the site with other DOE facilities to as much as a terabit per second. This requires that both the internal and external network connections to the Laboratory be upgraded. ORNL's current backbone fiber infrastructure was installed ten years ago. It was designed and architected to provide data interface service only within the main ORNL campus; it offers no service to outlying facilities and is frequently hundreds of feet from buildings where service is needed. It is essential to upgrade this infrastructure to at least 100 times the current capacity and to provide a direct feed to every major ORNL building and facility. In conjunction with this upgrade, several ORNL buildings should also be rewired with modern copper, fiber, and hubs able to support local and interlaboratory networks.

The facilities planned and under construction are expected to provide unparalleled laboratory space for computing and computational sciences. However, as DOE programs become more and more dependent on high-performance computing, the staff of the Computing and Computational Sciences Directorate is expected to continue to grow. To support expected DOE programs, ORNL will need to double the size of the staff to approximately 800 by the year FY 2011. This expansion will certainly require additional office and laboratory space.

3.2.3.1.5 Energy and Engineering Sciences

ORNL's fully integrated strategy of Energy Security, Environment, and Economics (E^3) differentiates ORNL throughout the DOE system. This focus marshals ORNL's extensive capabilities for R&D on energy production, the energy infrastructure, and critical elements of global energy security. This strategy will sustain ORNL's position as DOE's premiere energy laboratory, providing comprehensive, coordinated support across energy efficiency and fossil, fusion, nuclear, and renewable energy.

One of the new facilities needed to support this initiative is the Energy Reliability and Efficiency Laboratory (EREL). The EREL will provide expanded laboratory space, controlled testing, and analytical capabilities necessary to meet DOE's goals in three strategically important R&D areas: distributed energy resources, high-temperature superconductivity, and buildings research.

3.2.3.1.6 University Partnerships

In support of the University Partnerships Initiative, ORNL is undertaking the development of the Oak Ridge Center for Advanced Studies (ORCAS) in cooperation with Oak Ridge Associated Universities. ORCAS will serve as a center of intellectual inquiry to encourage interactions between ORNL researchers and university faculty and students. A building to be constructed with funding from the State of Tennessee will provide offices for visiting faculty, state-of-the-art distance education classrooms, and high-speed network connections to facilitate communication with the six UT-Battelle core universities and other partners. This facility will be jointly housed with the Joint Institute for Computational Sciences.

3.2.3.1.7 User Research Facilities

An important part of DOE's science mission is conceiving, constructing, and operating large-scale, complex facilities for R&D. ORNL is home to 16 designated national user facilities (more than any other national laboratory) that are available to laboratory, industrial, and academic users. Designated user facilities are the following:

- Bioprocessing Research Facility
- Buildings Technology Center
- Californium User Facility for Neutron Science
- Fuels, Engines, and Emissions Research Center
- High Flux Isotope Reactor Facility
- High Temperature Materials Laboratory
- Holifield Radioactive Ion Beam Facility
- Metals Processing Laboratory User Center
- Metrology R&D Laboratory
- Mouse Genetics Research Facility
- National Transportation Research Center
- Oak Ridge Electron Linear Accelerator

- Oak Ridge National Environmental Research Park
- Physical Properties Research Facility
- Power Electronics and Electric Machinery Research Center
- Shared Research Equipment Program

3.2.3.2 Support Programs

ORNL facilities are managed in a safe, secure, environmentally responsible manner to maximize flexibility and adaptability to enable programmatic efforts to respond efficiently to new developments and changing priorities in an increasingly dynamic research environment. The Laboratory support organizations are committed to maintaining facilities for the long term and ensuring that improvements keep pace with advancing technology and new program needs.

3.2.3.2.1 Environment, Safety, Health, and Quality

The ORNL Environment, Safety, Health, and Quality Directorate (ESH&Q) is a service provider. The principal ESH&Q products are technical support services, environmental protection and waste services, industrial medicine services, training services, and, a new major initiative, the deployment of management systems via the Standards-Based Management System (SBMS). The ESH&Q Directorate is responsible for the development and implementation of the following management systems: Environmental Management, Nuclear and Facility Safety, Occupational Medicine, Performance-Based Management, Quality, Radiological Protection, SBMS, Records and Information Management, Training and Qualification, and Worker Safety and Health.

The ESH&Q support services and management systems strengthen scientific integrity, ingenuity, and innovation by helping line organizations protect the health and safety of workers and the public, monitoring the Laboratory's impact on the environment, ensuring compliance with federal and state statutes and DOE regulations in these areas, managing permitting and operations for newly generated waste, and supporting quality and effectiveness in operations. Appendix G details the ESH&Q structure, with current activities and future needs impacting infrastructure.

3.2.3.2.2 FEVA Recommendations for Improvement

A Facility Environmental Vulnerability Assessment (FEVA) was completed and issued in June 2001. The primary goal of FEVA was to establish an environmental vulnerability baseline that could be used to support the Laboratory planning process and place environmental liabilities in perspective. The information developed by FEVA provided the basis for management to identify and initiate immediate, near-term, and long-term actions to respond to the identified vulnerabilities. Although no immediate "stop work" actions were identified, a number of near-term and long-term actions and initiatives were identified to address the FEVA recommendations. Two initiatives that the FEVARI project will fund in FY 2002 include the development of a Strategic Facilities Upgrade Plan and a Strategic Plan for the Minimization of Single-Pass Cooling Water. Current and planned Line Item projects, GPPs, and GPE projects, some of which support FEVA recommendations, are listed in Appendix M. Following development of the Strategic Facilities Upgrade Plan, projects will be identified, scoped, and documented in the ESHQ&I Information Data System. Appendix G provides specific information concerning FEVA.

3.2.3.2.3 Sustainable Designs

ORNL is committed to providing sustainable designs. The initial tool chosen to help incorporate sustainable features into ORNL projects was the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED™) rating system. The LEED rating system helps designers and owners establish sustainable project goals, identify green design strategies, measure and monitor progress, and document success. There are five categories within the LEED system: site planning, water and water efficiency, energy efficiency, conservation of materials and resources, and indoor environmental quality.

The LEED rating system assigns points within each of these five categories with a total of 69 total points available. There are four levels of accreditation in the LEED system:

• Certified	26-32 points
• Silver Level	33-38 points
• Gold Level	39-51 points
• Platinum Level	52+ points

Five of ORNL's FY 2002 GPP and Line Item projects used the LEED rating system to focus design activities on sustainable measures and assess the project's performance. Lessons learned during the design phases of these projects revealed that a custom ORNL sustainable process was needed. This custom process will facilitate communications between ORNL and the Architectural-Engineer design staff, emphasize energy performance, and simplify documentation requirements. This custom ORNL sustainable process is being finalized for use on future projects.

The five FY 2002 projects and their LEED goals are as follows:

• Advanced Materials Characterization Laboratory	26 points
• Laboratory for Comparative and Functional Genomics	26 points
• Research Support Center	33 points
• Energy Reliability and Efficiency Laboratory	33 points
• Parking Lots	16 points

Future projects, including new facilities and renovations, will use the ORNL sustainable system.

3.2.3.2.4 Waste Management and Environmental Restoration

Since April 1, 1998, Bechtel Jacobs Company, LLC, has conducted all of the DOE-EM operations on the ORR. In this role, Bechtel Jacobs Company, LLC, assumed responsibility for the waste management, environmental restoration, technology deployment, and enrichment facilities programs at all DOE-ORO sites (ORNL, Y-12, ETTP, Paducah, and Portsmouth). ORNL UT-Battelle is responsible for its generator functions, including waste packaging, characterization, and certification. To facilitate these functions, UT-Battelle maintains a small (core) staff with waste management experience to assist generators.

Responsibility for the ORNL EM Program resides with the ESH&Q Directorate. Under this directorate, the Environmental Protection and Waste Services Division is responsible for the EM Program Office, Environmental Protection Division, and Laboratory Waste Services Division. The Quality Services Division provides support to the Waste Certification Official. Responsibility for the Environmental Technology Development Program resides in the Biological and Environmental Sciences Directorate. The major UT-Battelle goals for the EM Program are to (1) ensure effective interface with Bechtel Jacobs Company, LLC, in the management of ORNL waste and (2) coordinate the ORNL mission, work force, and Laboratory environment as full-scale remediation in both Melton and Bethel valleys progresses in accordance with the accelerated cleanup plans.

Figures 3.1, 3.2, 3.16, and 3.17 show the facilities operated by Bechtel Jacobs Company, LLC, and Table H.2, Appendix H, provides a list, which will be updated as necessary to reflect contractual responsibilities of the specific contractor. Facilities are classified as CROET leased (CR), watershed projects (MV and BV), Waste Disposition (WD), and Waste Operations (WO). Buildings 3597 and 9735 were accepted for transfer to the EM Program in October 2001. In addition, DOE-EM has contracted with Foster Wheeler Environmental Corporation for the construction and operation of the Transuranic (TRU) Waste Processing Facility. This facility, to be located adjacent to the Melton Valley Storage Tanks, will be used to package solid TRU waste and TRU waste sludges for transport to the Waste Isolation Pilot Plant in New Mexico for disposal.

Low volumes of wastes are produced by a number of UT-Battelle operations, resulting in an aggregate amount for the Laboratory that is substantial. However, another large volume of radioactive and hazardous waste comes from the remediation and demolition projects in the EM Program that will continue to increase over the next ten years. Indeed, ORNL has 344 sites that are contaminated to the extent that they require monitoring and remediation. Previously, these sites were grouped into 20 Waste Area Groupings (WAGs) for management and budgeting. Currently, under the Bechtel Jacobs Company, LLC, EM Program, environmental restoration activities are organized on a watershed basis (Fig. 3.18). Waste management activities across the ORR are organized under the Waste Disposition and Waste Operations Projects. Additional information on waste management activities is included in Appendix H.

3.2.3.2.5 Facilities and Operations Management

The management systems comprising facilities and operations management at ORNL include (1) Facility Operations and Management, (2) Infrastructure Acquisition and Disposition, (3) Emergency Management; (4) Safeguards and Security, and (5) Transportation. The primary emphases of these management systems are to maintain and upgrade the Laboratory's infrastructure and to provide effective stewardship of facilities and operations resources.

3.2.3.2.5.1 Facility Management Model

On April 1, 2000, UT-Battelle became the management and operating contractor for ORNL and began a transition to a building manager/occupant model of facility operations at the Laboratory. Under this Facility Management Model, a building (or group of buildings) is managed and maintained by the Facilities Management Division (FMD) to achieve the Laboratory's overall tactical and strategic objectives for facility management, maintenance, and operation and to satisfy the Laboratory's needs for space management. The expected benefits of this new approach to facility management include improvements in customer satisfaction, work control processes, and safety performance. Successful implementation will also reduce costs and ensure faster delivery of services.

Under this new model, the occupant organizations obtain the facilities they need at a space cost established to support agreed-upon service activities and maintenance. All ORNL facilities are organized into several Complexes, which are each managed by a Complex Facility Manager (CFM). A facility use agreement (FUA) is established between the CFM and the building occupants. This agreement spells out the roles and responsibilities of both parties. The FMD is responsible for buildings and related infrastructure, while the research organizations are responsible for their own laboratory and research operations. In this way, the occupants are free to focus on scientific research and development, while the

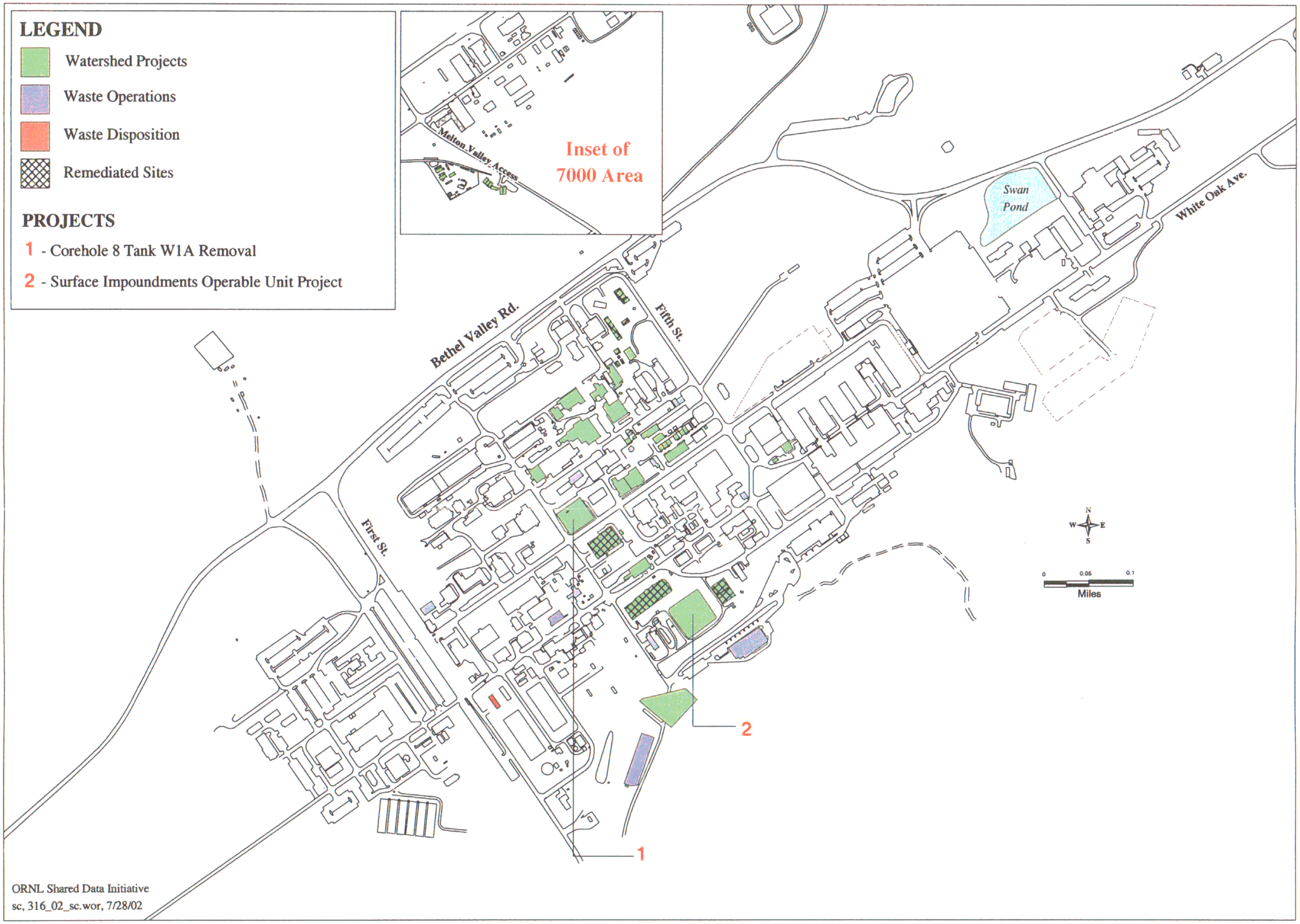


Fig. 3.16. Environmental Management facilities at the ORNL main site, Bethel Valley.

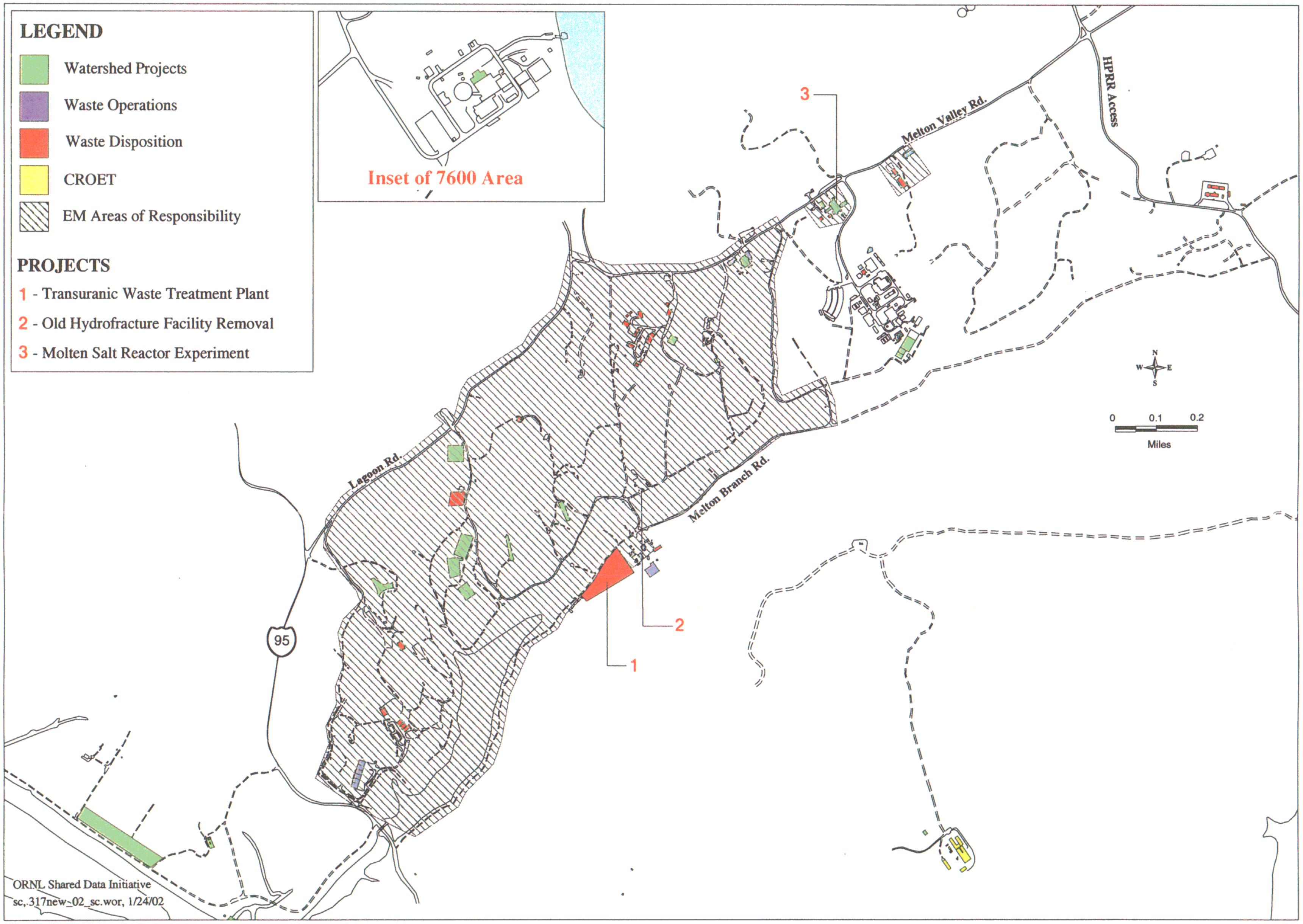


Fig. 3.17. Environmental Management facilities at the ORNL main site, Melton Valley.

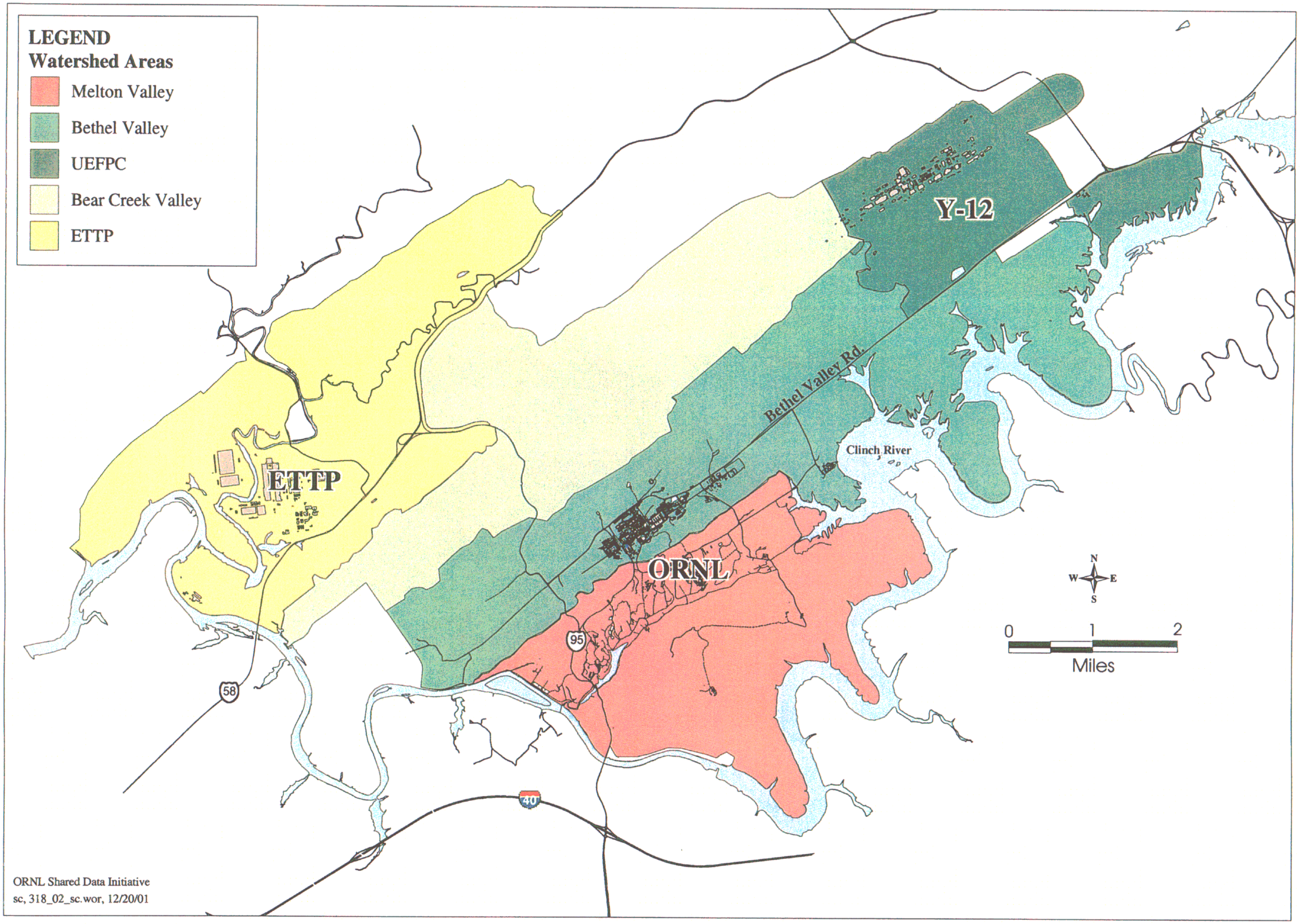


Fig. 3.18. Locations of Environmental Management watershed areas.

building management and maintenance organizations focus on ensuring that the facilities are available for their intended use in accordance with the Laboratory's vision and mission.

To implement the new Facility Management Model, the Plant and Equipment Division was replaced by three smaller organizations with specific organizational missions. The Facilities Management Division serves as the landlord and steward of all facilities at ORNL and also manages functions such as site utilities, leased space, and controls and instrumentation services. The Fabrication and Site Services Division (FSSD) provides fabrication shops (machining, welding, glasswork, etc.) as well as various reservation services (the garage, waste pickup, roads, transportation, etc.). The Craft Resources Division houses the majority of bargaining unit craft workers at the Laboratory. The craft workers report administratively to the Craft Resources Division, but their project-related tasks are directed by Project Leaders in FMD and FSSD.

Within the FMD, each Complex is managed by a Core Team led by a Complex Facility Manager. These Core Teams (seven) consist of building managers, building engineers, craft, ESH&Q professionals, project leaders, and administrative staff. The accountabilities of the Core Teams are implemented through the SBMS. Specific details for services provided, clarity of system ownership, system/building design capabilities and operating boundaries, and similar topics are being included in FUAs between the Core Team and its customers (building occupants). These agreements are planned for completion by FY 2003. The core teams for all non-nuclear facilities were established in FY 2002 and will be established for all non-reactor nuclear facilities by FY 2003. The FUAs and operational work control (also defined within SBMS) establish a documented basis for facility-level controls tailored to the level of hazard and acceptable risk, provide a basis on which to evaluate the conduct of proposed activities in terms of the recognized building work scope and operating boundaries, and drive the implementation of a documented review and change control process when work activities have the potential to exceed the operating boundary. Budgets are allocated by Complex, with each CFM responsible for managing both space-related maintenance funding and customer-funded work (research support, etc.).

Complex Descriptions:

Central: The Central Complex contains more than 500,000 square feet of facilities centered around the 4500 buildings. The Central Complex contains several multiple-occupant buildings. Work environments in the Central Complex range from offices, to high-performance computing, to wet chemistry laboratories. Primary facilities include the Central Research and Administration Buildings (4500N and S), the High-Temperature Materials Laboratory (4515), and the Metals and Ceramics Laboratory (4508).

West: The West Complex contains more than 600,000 square feet of facilities located west of Fifth Street. In general, the Complex consists of buildings in the 1000, 2000, and 3000 areas. Major activities include environmental science research, instrumentation and controls research and support, the ORNL cafeteria, and several maintenance shops. The Solid State Division has a significant presence in the area, and numerous business management functions are performed from Building 1000. These facilities range in age and condition from newly constructed office buildings to contaminated, decades-old research facilities. Some of the older buildings contain legacy contamination as well as ongoing environmental protection issues. The West Complex is a focal point for deactivation activities for the next several years.

East: The East Complex contains more than 500,000 square feet of facilities located east of Sixth Street. In general, the Complex consists of buildings in the 5505, 5510/10A, 6000, and 7000 areas. The facilities house operations ranging from warehouses and shops to research projects involving computational sciences and fiber optics. East Complex facilities are also supporting SNS activities, and the Complex is preparing to receive Fusion Energy operations that will be migrating from Y-12. Multiple infrastructure issues include aging facilities, legacy contamination, and protection of the environment.

Y-12: The Y-12 Complex contains nearly 1 million square feet of facilities located at the Y-12 National Security Complex. Primary occupants of the facilities are ORNL's Engineering Technology, Fusion Energy, and Life Sciences divisions. Many of the facilities have legacy contamination issues that predate ORNL's occupancy of the space. A major focus in the near term will be deactivation of buildings as ORNL continues a multiyear move out of Y-12 space. The movement of people and operations from Y-12 is resulting in construction, maintenance, and logistical needs in the Central, East, and West complexes.

Leased: The Leased Facilities Complex includes several buildings outside the DOE Oak Ridge Reservation, including the National Transportation Research Center, 1060 Commerce Park, 701 Scarboro Road, and 111 Union Valley Road. In the future, several additional privately owned facilities will be built on the ORNL main campus and leased back to UT-Battelle for DOE and other work. Infrastructure issues will be addressed through contract management and oversight of facility maintenance for these buildings.

Utilities: In addition to programmatic and landlord building facility needs, the ORNL utilities systems are also critical components of the plant infrastructure. Traditional utilities services, such as those found in any industrial environment, are provided and managed by the FMD. The Utilities Complex, a suborganization within the FMD, has the day-to-day responsibility for operating, maintaining, and managing what has been divided into two distinct operating entities. The Electrical Operations Group has responsibility for operating and maintaining the electrical distribution system and the central chilled water system. The Mechanical Operations Group has operations and maintenance responsibility for the Steam Plant, Sewage Treatment Plant, water reservoirs, and the associated utility supply, distribution, and collection systems.

Other unique utility systems, such as central off-gas, process waste collection and treatment, and radioactive waste handling and disposal, that are required to support the Laboratory's programs and operations are provided by Duratek Federal Services under contract with Bechtel Jacobs Company, LLC.

Appendix I details the utilities systems with current activities and future needs impacting infrastructure.

Significant Utilities Infrastructure Issues:

Electrical: Although many improvements and upgrades have occurred over the years, many mid-1940s electrical systems, both inside and outside of buildings, need upgrades to meet current codes, to provide redundancy for critical applications, and to install metering and other energy-saving technologies to improve system efficiency. An Electrical Systems Upgrade Line Item project is currently under way that addresses some of these issues, and a future Line Item is proposed that will upgrade and improve ORNL's primary electrical substation. Other GPE and GPP needs have been identified to address facility-specific needs, as well as to provide the equipment and technology needed to ensure that maintenance personnel have the tools needed to operate and maintain this critical and complex system.

While the current operating and maintenance focus is on the main ORNL plant site, work is progressing on the construction of a new electrical substation and distribution system at the SNS site. This ORNL facility is located away from the main ORNL campus and has its own specific power requirements—requirements that could not be met by extending ORNL's existing power system. The Tennessee Valley Authority (TVA) is constructing a new 161-kV substation at the SNS site specifically to address SNS needs. This substation will be fed from TVA's 161-kV Fort Loudon line and can receive power from either the Fort Loudon Dam or through the Elza Switchyard. Because the substation will become another important switching point on the TVA power grid, TVA will retain operating and maintenance responsibility for the 161-kV side, and ORNL will have responsibility for the reduced voltage side of the substation. As designed, the substation will consist of two 45-MVA transformers that will reduce the 161,000 volts to 13,800 volts for internal distribution and usage in SNS facilities and operations.

ORNL is also working with other groups on a proposal that would transfer operating and maintenance responsibility for the existing ORNL substation, Building 0901, to ORNL. This responsibility currently resides with the Power Operations Group working for BWXT at both the Y-12 and ETTP sites. Due to logistical issues, as well as problems associated with having different employers and contracts, groups from Y-12, ORNL, and DOE are investigating different operating scenarios that will enable each site to become more independent and allow each to become more focused on achieving and managing site-specific needs and requirements.

Compressed Air: Significant investments have been made to upgrade the air production capability at the Steam Plant. While air production is not considered a problem, drying the air to a level that is needed by customers is becoming questionable. A new, 4000-scfm dryer unit is being proposed to ensure research customer needs.

Natural Gas: Most of the natural gas distribution system within the Laboratory was constructed in 1948 and is still in reasonably acceptable condition. The geographical area served by the existing system is centered in the older areas of the Bethel Valley Complex with no service lines extending into the Melton Valley areas or areas currently identified in plant revitalization plans. Facilities now located outside the service grid in Bethel Valley and in Melton Valley either do not use natural gas or have installed bottled gas manifold systems to serve in limited applications. A GPP is in the planning base to upgrade the existing distribution system, but no plans exist to expand system coverage using internal funds. Costs to extend natural gas service into the areas identified for East Campus redevelopment will be funded through the landlord GPP program.

Potable and Process Water: Several upgrades have been made and are currently being implemented to improve the potable and process water distribution systems. Fire protection is a driver for many of these issues. The FEVA Recommendations for Improvement have a focus on improvements to legacy-type problems associated with water lines running through the older process areas within the plant. Studies are being conducted to determine risks associated with water lines and potential leaks in areas where potential existing contamination may be present. Current projects for new construction will require upgrades and new installation of water lines. Much of this work will be funded using specific project monies; however, some proposed improvements will address general needs to allow ORNL to continue providing ORNL consumers with a safe and reliable water supply.

The SNS construction and the FY 2001 water plant transition from DOE to the City of Oak Ridge are two areas deserving special recognition. The SNS project required the relocation of over 1 mile of ORNL's sole 24-inch water supply line. Part of the preliminary site work at the SNS involved installation of a new 24-inch line to replace the 1948 vintage line that bisected the SNS site. The new line skirts the outside perimeter of the site and is well out of the way of major construction activities that have the potential to cause significant disruption of ORNL's main campus water supply. SNS construction forces and ORNL maintenance personnel are to be commended on relocating this line without significant disruption to the ORNL water supply. The SNS water system that tees off this main will become part of the ORNL water distribution system. Maximum water usage at the SNS site is expected to be in the range of 1 million gallon per day. This additional demand on the 24-inch supply line should not cause delivery pressure or flow problems at either the SNS site or within the ORNL main campus.

During the past few years, the anticipated change in management at the water treatment plant that provides ORNL's water supply had been an area of concern due to the potential for disruption of services. Since the water plant's transition from DOE to the City of Oak Ridge over one year ago, however, ORNL has continued to receive the same high levels of quality water and extraordinary service previously enjoyed when DOE owned and operated the water plant.

Chilled Water: Water for air conditioning and process cooling is generated at a central plant located in the Bethel Valley portion of ORNL. This central chilled water plant serves the 4500 Complex as well as Building 3500, Building 6010, and buildings in the 5500 Area. In general, most of the production and distribution system is in good condition except for the need to replace an inoperable, out-of-service 1200-ton chiller and a 2400-ton cooling tower located at the central plant. Replacement of this equipment will help equalize tower and chiller capacity and expand opportunities for further improvements and possible expansions of the service area. A 1500-ton cooling tower located at Building 6000 is in need of replacement, and a cost-benefit must be performed to determine whether replacement of the tower or expansion of the central chilled water system into the area is the best option. An ongoing CFC chiller replacement project was initiated in 1994, which has been replacing air conditioning units having the potential to exceed regulatory limits for CFC releases should a leak occur. This effort is funded through FY 2003 when most of the Laboratory's vulnerabilities will have been mitigated. An FY 2001 Laboratory Facilities HVAC Line Item is under way to upgrade components attached to the chilled water system such as coils, supply fans, and controls. Its completion will further improve the overall reliability and effectiveness of the system.

Steam: While the Steam Plant remains reliable, the major equipment systems, including the boilers, have exceeded their useful design lives. A Steam Plant study was completed that identifies replacement and upgrade projects necessary to continue to operate reliably and efficiently. The Steam Plant study provides major component replacement and upgrades needed for planning. Several projects have been completed, and ongoing projects are planned for the next ten years to ensure system reliability.

Stormwater: Generally, the condition and performance of the stormwater collection system is adequate. A FEVA Recommendation for Improvement identified the need to dechlorinate flows related to the use of once-through cooling water systems. The Laboratory is pursuing projects for the procurement and installation of recirculating cooling systems to eliminate this problem.

Conventional Waste (Sanitary/Industrial Wastes and Sanitary Sewage Collection and Treatment): No major deficiencies have been identified. An improvement to the east end collection system to accommodate the new flows generated by the SNS facilities is currently being studied to determine the need for potential upgrades. The Sewage Treatment Plant is halfway through its designed life. Proposed pollution prevention projects include a denitrification system to remove nitrates from the plant's effluent stream to reduce pollutant discharges.

Transportation Infrastructure: Facility modernization, security, and safety have placed significant emphasis on the current transportation infrastructure. Upgrades to the transportation infrastructure include new parking lot construction, Bethel Valley Road improvements, Melton Valley Road improvements, and other on-site transportation initiatives.

Nuclear Facilities: ORNL has a number of unique experimental and production facilities that involve nuclear or other hazardous materials. These facilities utilize design features for safety and implement administrative controls to minimize the probability and consequences of an accidental release of hazardous material to on-site and off-site receptors. DOE-STD-1027-92 provides guidance for the categorization of these facilities based primarily on that facility's nuclear material inventory. Using this guidance, ORNL has one hazard Category 1 nuclear facility (i.e., HFIR), six hazard Category 2 facilities, and four hazard Category 3 facilities. Safe operation of these facilities is ensured by implementing the safety systems and operating within the limitations established by DOE-approved Safety Analysis Reports (SARs) or Basis for Interim Operations (BIOs) and Technical or Operational Safety Requirements (TSRs/OSRs) developed in accordance with DOE Orders 5480.22 and 5480.23. As part of the *ORNL Project Management Plan for Enhancing Non-Reactor Nuclear Facility Operations*, efforts are under way to upgrade the existing Safety Basis documentation to meet 10 *CFR* 830, Subpart B, "Safety Basis Requirements," by April 2003.

Non-reactor nuclear facilities are currently being transitioned to the Facility Management Model. Reactor nuclear facilities are controlled through the Research Reactors Division. Appendix L provides a description of each nuclear facility, infrastructure issues, and safety documentation needs and upgrades.

Significant nuclear facility infrastructure issues include:

- Reactor Nuclear Facilities: A recent upgrade of the HFIR facility has been completed, and the reactor is currently in initial operations. The following infrastructure issues are needed to ensure user research requirements: (1) an increase in the size and intensity of existing neutron beams; (2) addition of a cold neutron source and an experimental guide hall; (3) addition of several neutron beam guides and a second neutron guide hall and new instrumentation; (4) addition of a neutron radiography/ tomography facility; (5) improvements to isotope production, materials irradiation, and neutron activation analysis capacities; and (6) improved/new user access facilities.

- Non-Reactor Nuclear Facilities: Recent studies of non-reactor nuclear facilities have identified several needed improvements for ongoing operations and support to the research community. Specific issues are related to upgrades to ventilation systems, electrical system improvements for feed and distribution center systems, hot cell structure improvements (windows and manipulators), obsolete equipment replacement, drawing updates, waste management system upgrades, and process pump replacements.

3.2.3.2.5.2 Enhanced Maintenance Planning

The Enhanced Operational Discipline Initiative includes the task of upgrading the Laboratory's infrastructure and providing effective stewardship of facilities and operations resources. A key initiative for upgrading the Laboratory's infrastructure is the Facilities Revitalization Project. An outcome of this project is the ability of the Laboratory to redirect the total existing maintenance budget to an improved portfolio of buildings. This portfolio consists of a set of aged buildings that have been greatly reduced in size (by about 1.2 million square feet) and a set of new buildings with fewer initial maintenance demands. As a result, the future maintenance budget, based on a cost per square foot of operated space, will increase 50% in three years (from \$3.73/square foot in FY 2002 to \$5.72/square foot in FY 2004). A bigger budget will thus provide the opportunity to maintain the overall condition and enhance the longevity of Laboratory buildings. Maintenance expenditures in FY 2001 were approximately \$10.9 million, or 0.24% of RPV, and in FY 2002 they are projected to increase to approximately \$14 million, or 0.31% of RPV. This increase serves as an indicator of continuous improvement toward achieving the appropriate level of maintenance, as described in the National Research Council's 1998 publication *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets*, wherein having the necessary level of maintenance is pictorialized in Fig. 3.19.

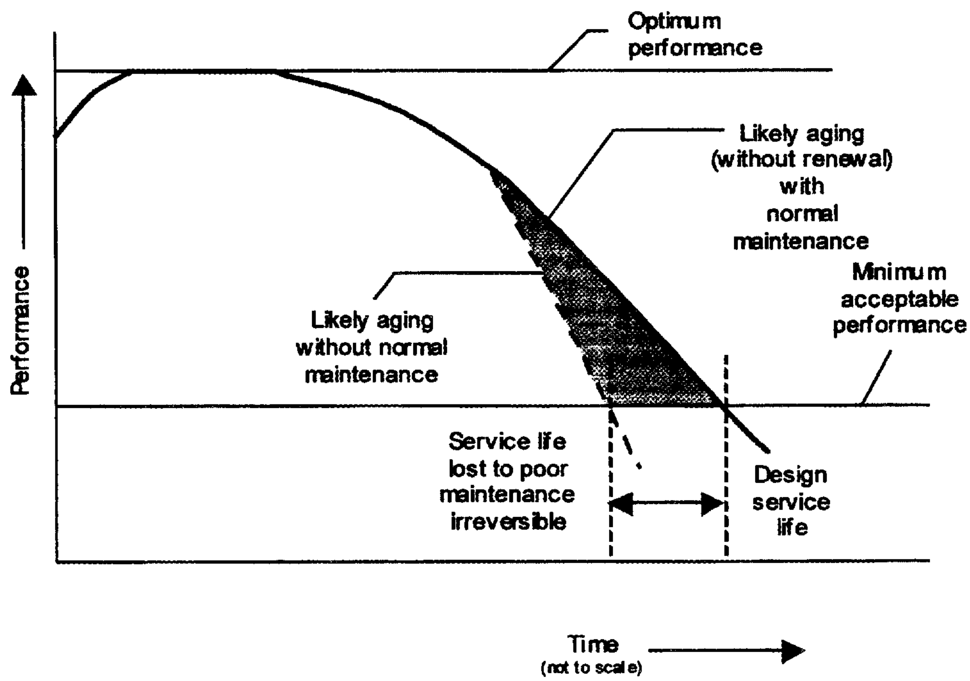


Fig. 3.19. Effect of adequate and timely maintenance and repairs on the service life of a building. *Source:* National Research Council, Fig. 1-1 (p. 13) in *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets*, National Academy Press, Washington, D.C. 1998.

The Enhanced Operational Discipline Initiative is also expected to improve ORNL maintenance requirements planning by promoting a more comprehensive, uniform approach to identifying maintenance needs. In the new ORNL Facility Management Model, each core team complex manager will be responsible for the identification and prioritization of facility needs. Within the core team are building engineers and ESH&Q professionals who will not only utilize the information generated through the CAIS but also their real-time day-to-day knowledge of the buildings for which they are responsible and the expectations defined within the FUAs to establish appropriate needs and priorities. It is also through these core teams and their familiarity with, and ownership of, the facilities, that efficiencies in work management will be realized so that more of the limited indirect maintenance funds can be applied to completion of craft work.

Specific initiatives being pursued to enhance maintenance planning and implementation include development of plans for maintenance and upgrades to site utilities systems patterned after the *Central Steam Plant Ten-Year Plan* developed in FY 1997. The Steam Plan has been an effective tool in guiding system upgrades and maintenance activities for the steam system to meet evolving Laboratory needs. Additionally, a roof asset management program will be developed to maintain Laboratory facility roofs at a high level of repair subsequent to the extensive ORNL roof replacement program recently completed.

3.2.3.2.5.3 Security

The ORNL Laboratory Protection Division (LPD) has the overall responsibility for providing classified matter protection and control, a foreign national visits and assignments program, a foreign travel program, nuclear materials control and accountability, nuclear materials management, personnel security, physical security, security program management and planning, and visitor services to all ORNL organizations and operations. The objective of the LPD is to implement appropriate security measures needed to protect against events that may cause adverse impacts on national security, the environment, and the health and safety of Laboratory employees and the public, while maintaining an environment conducive to the conduct of scientific research and development and the efficient operation of the installation. Appendix J provides additional information concerning infrastructure security improvements at the Laboratory.

Under a prime DOE-ORO contract awarded in September 1999, Wackenhut Services, Inc. - Oak Ridge (WSI-OR) started providing selected security services to ORNL on January 10, 2000. Although WSI-OR provides some select security services to the Laboratory, overall management responsibility for ORNL's multifaceted security programs remains with UT-Battelle. WSI-OR, however, does have programmatic responsibility in two specific areas: ORNL Protective Force operations and the Personnel Security Assurance Program.

Significant Security Infrastructure Issues: Construction of new access control portals along Bethel Valley Road was completed during FY 2002. The new portals provide a more efficient and effective control mechanism for maintaining authorized staff and visitor access to the site. To ensure continued response to security needs, projects have been identified for closed-circuit television (CCTV) replacements, installation of a hardened central alarm station, upgrades to the intrusion detection alarm systems, and continued improvements to the automated access control systems.

3.2.3.2.5.4 Space Management and Inactive Surplus Facilities

ORNL's space charge system promotes effective and efficient use of ORNL buildings and equitable distribution of the costs associated with maintaining these buildings. Space charge components include facility planning and administration, nonprogram Line Item/GPP construction design, space relocation (forced), lease costs, janitors, asbestos abatement (management), building maintenance/ services, HVAC maintenance, grounds maintenance, utilities on returned space, activity data sheet (ADS) requirements, In-House Energy Management, and fire protection engineering. The Space Allocation Management System (SAMS), which contains data associating a specific employee and organization with occupied space, is used for allocation of space charges. The space charge system will continue to be refined to drive greater efficiency in the use of space, supporting the aims of the Enhancing Operational Discipline Initiative. Currently, organizations are assessed space charges based on two categories of space: (1) conditioned space at $21.60 per square foot and (2) unconditioned space at $7.20 per square foot.

As a result of space charge implementation, more than 600,000 square feet of marginal space has been vacated. Approximately 350,000 square feet of this space has been completely deactivated. Seven buildings, totaling 220,000 square feet, have been transferred to the Y-12 National Security Complex; 15,000 square feet is contaminated and is being transferred to the EM Program in FY 2002. Appendix K, Table K.1 provides a list of facilities that are candidates for disposition to DOE-EM or to DOE-SC. Table K.2 provides an outline of the ORNL Space Management Plan being developed to support the Facilities Revitalization Project and other consolidation initiatives.

3.2.3.2.5.5 Facilities Consolidation and Deactivation

The FRP is responsible for developing and implementing an exit strategy for nonstrategic ORNL facilities; transferring nonstrategic, uneconomical, or underutilized facilities that no longer support the Laboratory's mission to other parties; and placing facilities that cannot be transferred in a "cheap-to-keep" mode (i.e., a state of minimum cost, with the minimum utilities, maintenance, and surveillance) until ultimate disposition can be funded. Figures 3.20 and 3.21 provide the disposition status of facilities at the ORNL main site and ORNL at Y-12.

An inventory of existing facilities uses and conditions has been developed to identify nonstrategic facilities. Two disposition paths will be used to handle facilities determined to be surplus: facility transfer and facility deactivation. Facilities on the transfer path will be transferred to another program (DP or EM) or to an entity such as the Community Reuse Organization of East Tennessee (CROET). Facilities on the deactivation path will be placed in "cheap-to-keep" mode and put under a routine surveillance and maintenance (S&M) program. Those that meet the criteria for DOE's Environmental Management Program will be transferred to DOE-EM as soon as possible.

ORNL faces an enormous challenge in the deactivation and disposition of its nonstrategic facilities. Many of these facilities are large and complex, and some contain multiple hazards. There are 40 facilities, representing approximately 1.4 million square feet, as candidates for disposition through DOE-EM, and 57 facilities, including a number of trailers, that will remain the responsibility of DOE-SC. The estimated cost of facilities consolidation and S&M during the time frame of the *ORNL Strategic Facilities Plan* (FY 2001–FY 2011) is $113 million. The estimated cost for ultimate decontamination and decommissioning (D&D) of ORNL's nonstrategic facilities is $126 million.

3.2.3.2.5.6 Energy Management

ORNL's In-House Energy Management (IHEM) program is directed toward saving energy, reducing energy costs, protecting the environment, enhancing the workplace environment, improving operations, and providing leadership in the adoption of new energy technologies. The program has yielded a 20% reduction in energy use per square foot of occupied space since 1985.

Several energy management initiatives are under way, and positive results are being realized. Key activities include the following:

- About 43,000 fluorescent lamps have been replaced with more efficient lamps; almost 23,000 ballasts have been replaced with more efficient units that do not contain polychlorinated biphenyls (PCBs); and about 900 occupancy sensors have been installed to switch off lights in empty rooms. Energy usage and costs have been reduced by 30 to 70% in the affected areas.

- ORNL continues to retire chlorofluorocarbon (CFC) chillers or replace them with high-efficiency, non-CFC chillers. To date, 16 chillers totaling 8,200 tons in cooling capacity have been replaced. As a result, chiller energy use has dropped an average of 21% for annual savings of $280,000, and CFC emissions have been cut by 5000 pounds per year, saving another $76,000 annually.

- Energy management control systems have been installed in 13 buildings. This includes the installation of 19 variable-speed drives on supply and exhaust fan motors.

- Following an assessment of the energy efficiency of 16 office buildings at ORNL, one building has been officially designated as an Environmental Protection Agency (EPA) Energy Star building. Documentation of the performance of the Buildings Technology Center headquarters building was submitted to the EPA, and the certification was subsequently awarded. This was one of the first DOE buildings to achieve this rating and only the second building in the State of Tennessee to do so. Electric metering has been added to 11 other candidate buildings so that they can also be evaluated for Energy Star awards.

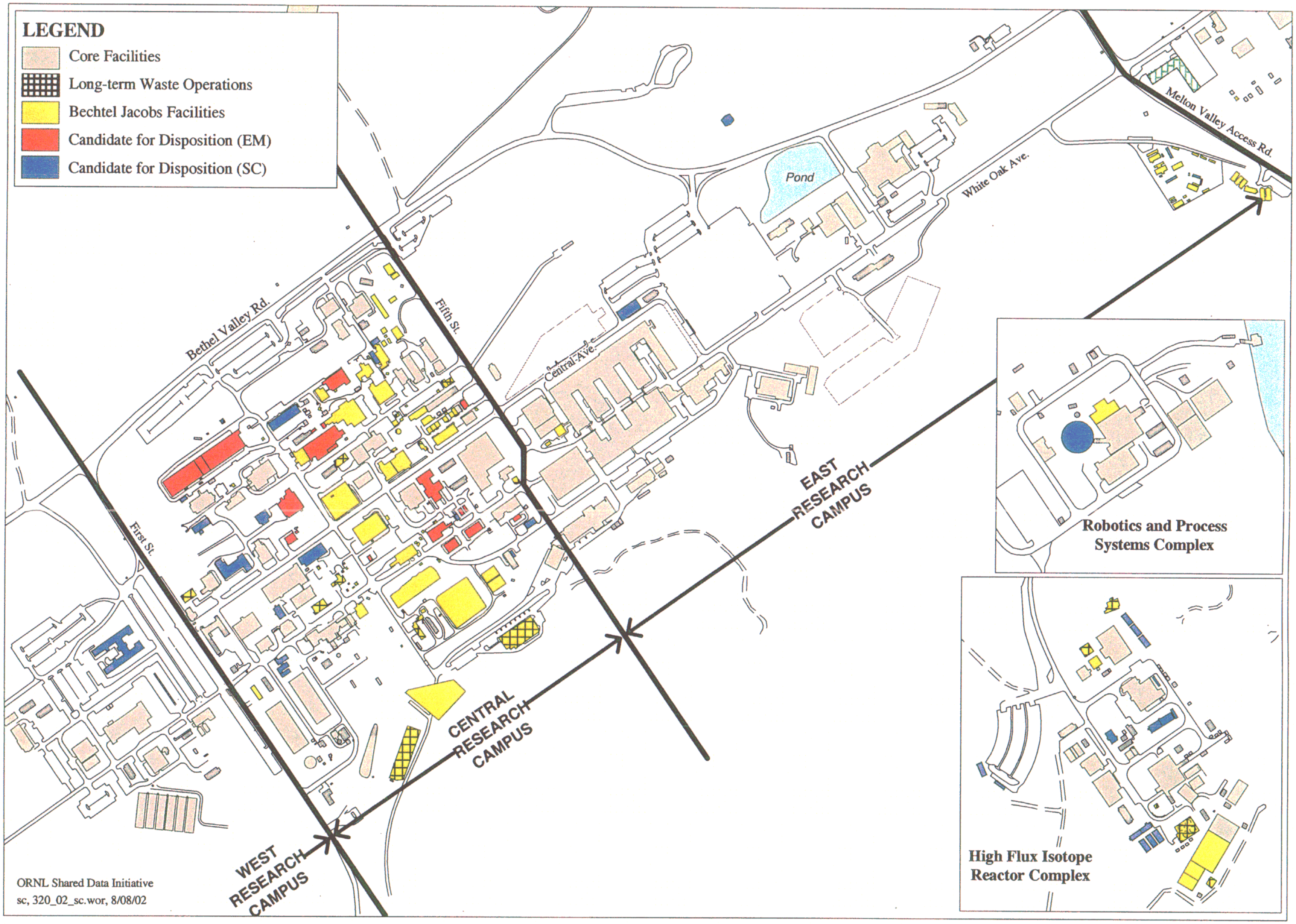


Fig. 3.20. Facilites at the main ORNL site.

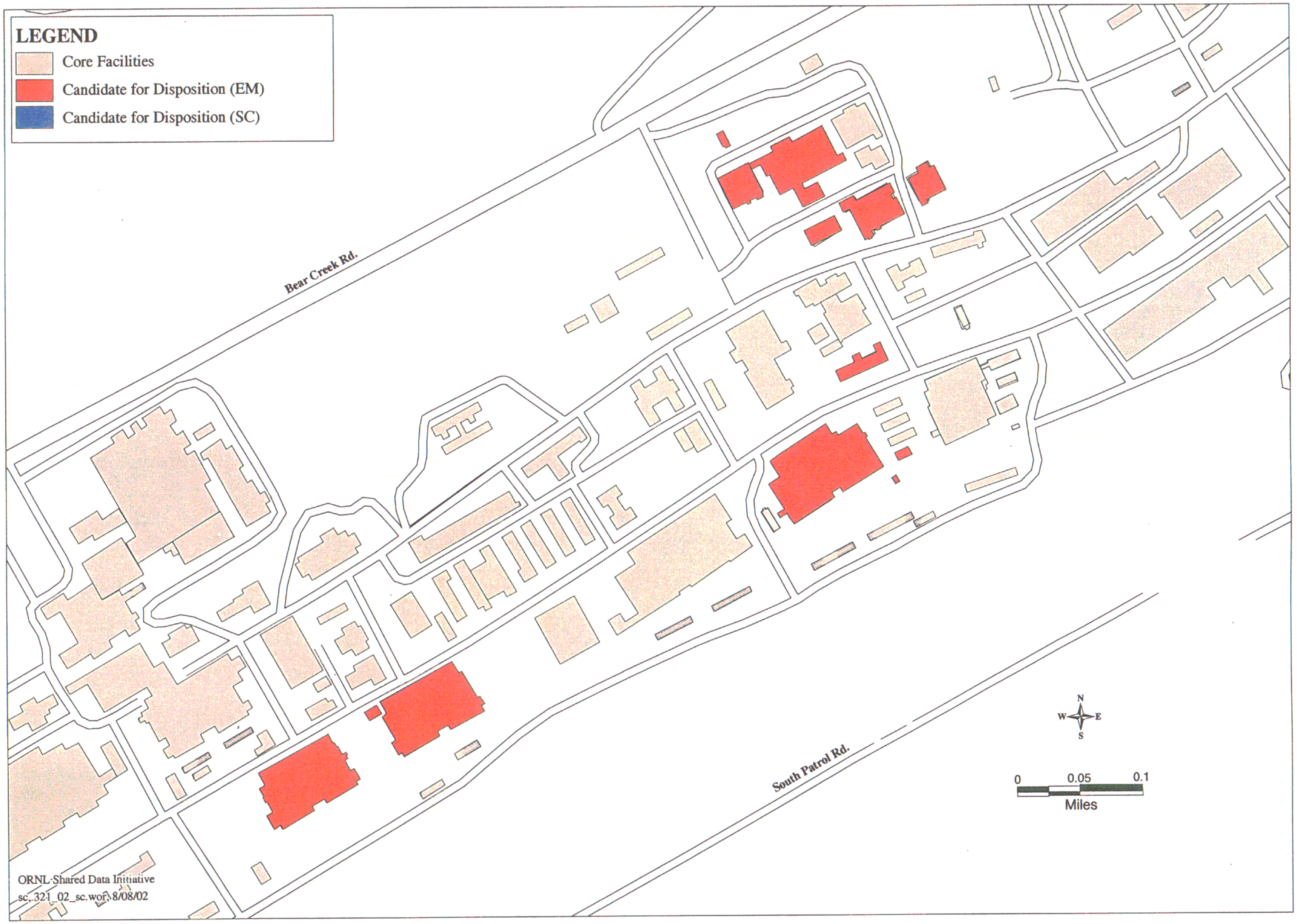


Fig. 3.21. ORNL facilities at Y-12.

ORNL also intends to apply Energy Star rating criteria to future new facilities, major renovations, and infrastructure upgrades where appropriate. ORNL's currently planned Line Item, private-sector, and State-funded facilities will be assessed using the Energy Star rating criteria.

In addition, the conversion of the ORNL Steam Plant from coal to natural gas is expected to save about $1 million per year in operating costs and $8 million in capital funding over ten years, while also avoiding emissions from coal combustion.

ORNL is also pursuing energy savings performance contracting (ESPC) as a way to implement projects using the funding and support of an energy service company (ESCO). When a project is complete, the ESCO is paid back from the energy savings. Once the ESCO is paid in full, the infrastructure improvements and future energy savings belong to ORNL. The first ESPC project has been completed, and a second site-wide ESPC project proposal is being evaluated.

ORNL was the first industrial participant in the Green Power Switch program established by TVA. The program offers power produced using renewable energy sources such as sunlight, wind, and landfill gas. Although this "green power" costs slightly more than power from traditional energy sources, it is expected to improve regional air and water quality by reducing waste and pollution. In addition, increased demand should lead to expanded power production capacity and, eventually, to lower costs.

3.2.3.2.5.7 Hazardous Materials Transportation, Storage, and Handling

Many buildings at ORNL receive, store, or use hazardous materials or chemicals. Storage of chemicals is typically limited to amounts that can be used in short periods and involve small amounts or consumer volume (defined as laboratory quantities, which, if suddenly released, would have no measurable off-site impact). Larger volumes of hazardous materials may be stored in bulk at various locations. Only two facilities have been identified as bulk storage areas, and neither poses any off-site release impact. The refueling station is the primary location where large volumes of hazardous fuels and oils are stored. It is separated from other facilities by sufficient distance to minimize any on-site or off-site impact from an inadvertent spill, release, or fire. The Materials Receiving Area provides large-capacity storage for compressed gases used throughout ORNL. Gas cylinders are properly secured to prevent inadvertent tipover accidents, and hazardous gases are segregated to prevent the formation of toxic chemical combinations. Transportation of hazardous materials and chemicals is typically performed by the ORNL shipping and receiving function in accordance with all applicable DOT regulations. A Transportation Safety Document (TSD) has been completed for on-site transportation that provides a process to transport hazardous material with negligible risk due to equivalent DOT safety practices when all DOT requirements cannot be achieved.

Chemicals and radioactive materials in transit within the ORR are packaged in accordance with DOT regulations or equivalent packaging requirements and are not considered capable of creating an off-site release of hazardous materials. Moreover, receipt, handling, and storage of bulk chemicals is not expected to affect facility operations. Efforts have been made to minimize the probability of these types of accidents so that the potential for off-site releases from the affected facilities is minimal.

Table 3.5 Future mission facility needs

Title and description	Proposed funding years(s)/type
Joint Institute for Neutron Sciences (JINS) ▸ Center to provide a world-class user program that provides access to the capabilities of the SNS, HFIR, and other ORNL neutron sciences research programs. 60,000-square-foot facility housing office, laboratory, process, and meeting space for collaborations	FY 2005–06 $8.0M State funded
HFIR Maintenance Building ▸ Building to provide facilities critical to the maintenance and support of reactor operations. 22,000-square-foot facility to house maintenance shops and process space	FY 2004–05 $2.9M GPP
Small-Angle Neutron Scattering (SANS) Guide Hall ▸ Building to provide the necessary space to support a new 20-m SANS instrument and a new 16-m biological SANS instrument, which will be dedicated to biological research	FY 2001–03 $4.3M BES
William L. and Liane B. Russell Laboratory for Comparative and Functional Genomics (LCFG) ▸ Building to provide facilities for the location of the mutant mouse colony. 36,000-square-foot facility with accredited, environmentally controlled accommodation areas for housing animal research	FY 2001–02 $13.9M LI
Modifications to Building 1059 ▸ Modifications to support research in LCFG by providing laboratories to perform microinjection of mouse embryos and cryopreservation of mouse gametes and embryos	FY 2004–05 $1.2M GPP
ORNL Center for Systems Biology ▸ Research programs for functional genomics, structural biology, proteomics, and systems biology staged facilities to house the Center for Systems Biology user facilities. 50,000-square-foot facility with a modular complex of buildings, equipment, and supporting infrastructure to be located in the West Campus	FY 2007–09 $20.0M LI
Proteomics and Protein Complex Analysis Laboratory ▸ The Proteomics and Protein Complex Analysis Laboratory would consist of a 130,000-square-foot laboratory/office complex. This building would house facilities for cell growth, molecular biology, protein chemistry, mass spectrometry, protein analysis, and computational biology.	FY 2004–2008 $150.0M LI
Joint Institute for Biological Sciences (JIBS) ▸ Center for the promotion and development of collaborative education and research in the biological sciences of functional genomics, structural biology, and computational biology and bioinformatics 60,000-square-foot facility housing office, laboratory, process, and meeting space for collaborations	FY 2004–05 $8.0M State funded
Modifications to Building 1503 ▸ Upgrade of greenhouses and research laboratories to support plant genomics	FY 2003–04 $1.7M GPP

Table 3.5 Future mission facility needs

Title and description	Proposed funding years(s)/type
Private-Sector-Funded Facilities (Fig. 3.22) ▸ Computational Sciences Building – Center for computer science research to address effective use of distributed computers and massive parallel computer systems composed of symmetric multiprocessing clusters linked with high-speed network fibers. 137,000-square-foot facility to house supporting laboratories, process space, offices, and supporting infrastructure ▸ Engineering Technology Facility – Multidisciplinary R&D facility relevant to energy conservation and utilization; mechanical, structural, and thermal sciences; and manufacturing sciences. 98,000-square-foot private-sector-funded facility to house supporting laboratories, process space, offices, and supporting infrastructure ▸ Research Office Building – Multistory 133,000-square-foot office building for research and support staff personnel	FY 2001–03 $72.0M Private-sector funded
Joint Institute for Computational Sciences and Oak Ridge Center for Advanced Studies (JICS/ORCAS) ▸ JICS – User- and visitor-oriented facility to provide access to high-performance computers, inspire collaborations and outreach between ORNL and partnering universities, facilitate enhanced high-speed networking systems, and facilitate auxiliary technologies. 40,000-square-foot facility to house computing system laboratories, offices, and meeting space for collaborations ▸ ORCAS – Theoretical and applied R&D-oriented facility to explore grand queries, big thoughts, and major potentials for long-term program development for ORNL and core universities. 30,000-square-foot facility to house state-of-the-art collaboration meeting room with teleconferencing and computing networking, offices, and information resource center	FY 2002–03 $10.0M State funded
Energy Reliability and Efficiency Laboratory ▸ Facility designed to operate as a demonstration of energy efficiency technology and to support R&D initiatives in distributed energy resources, electricity transmission and distribution, and net zero energy building systems. 52,000-square-foot research facility to be located in the Central Campus to house about 40 occupants with conference/ meeting rooms, a highbay, and two cranes	FY 2004–05 $16.0M LI
Central Campus Research Building ▸ Activity to provide for the construction of a research building of approximately 14,000 square feet. This facility will house a number of research programs currently located in Buildings 2024, 3115, 3080, and 2019. These very old and high-maintenance buildings provide substandard space for many high-profile research programs. The new facility will house multidivision programs supported by a number of agencies within the Office of Science (KC, EW, and EB) with direct ties to other national laboratories and industry	FY 2005–06 $4.5M GPP
Laboratory Expansion for Nanoscience Metrology and Instrumentation ▸ Space for scientific and engineering research initiatives for nanomaterials, nanostructures, and their applications. 3,000-square-foot renovation of space in Building 3500 to house laboratory and process space with two new clean rooms	FY 2000–02 $1.9M GPP

Table 3.5 Future mission facility needs

Title and description	Proposed funding years(s)/type
Advanced Materials Characterization Laboratory (AMCL) ▸ Facility for next generation of research for materials characterization and for centralization of advanced materials structural characterization equipment to include the Aberration-Corrected Electron Microscope Facility to house the advanced materials research user facilities. 12,000-square-foot structure with microscope modules	FY 2001–03 $4.8M GPP
Center for Nanophase Materials Science (CNMS) ▸ National center for nanoscience research on soft materials, interfaces, nanoscale magnetism, and other nanophase systems that benefit from access to neutron scattering ▸ Response to BES panel recommendations for the creation of Nanoscale Science Research Centers ▸ Provision of clean rooms and specialized equipment that cannot be accommodated in existing space. 80,000-square-foot laboratory/office complex adjacent to the SNS	FY 2002–05 $63.8M LI

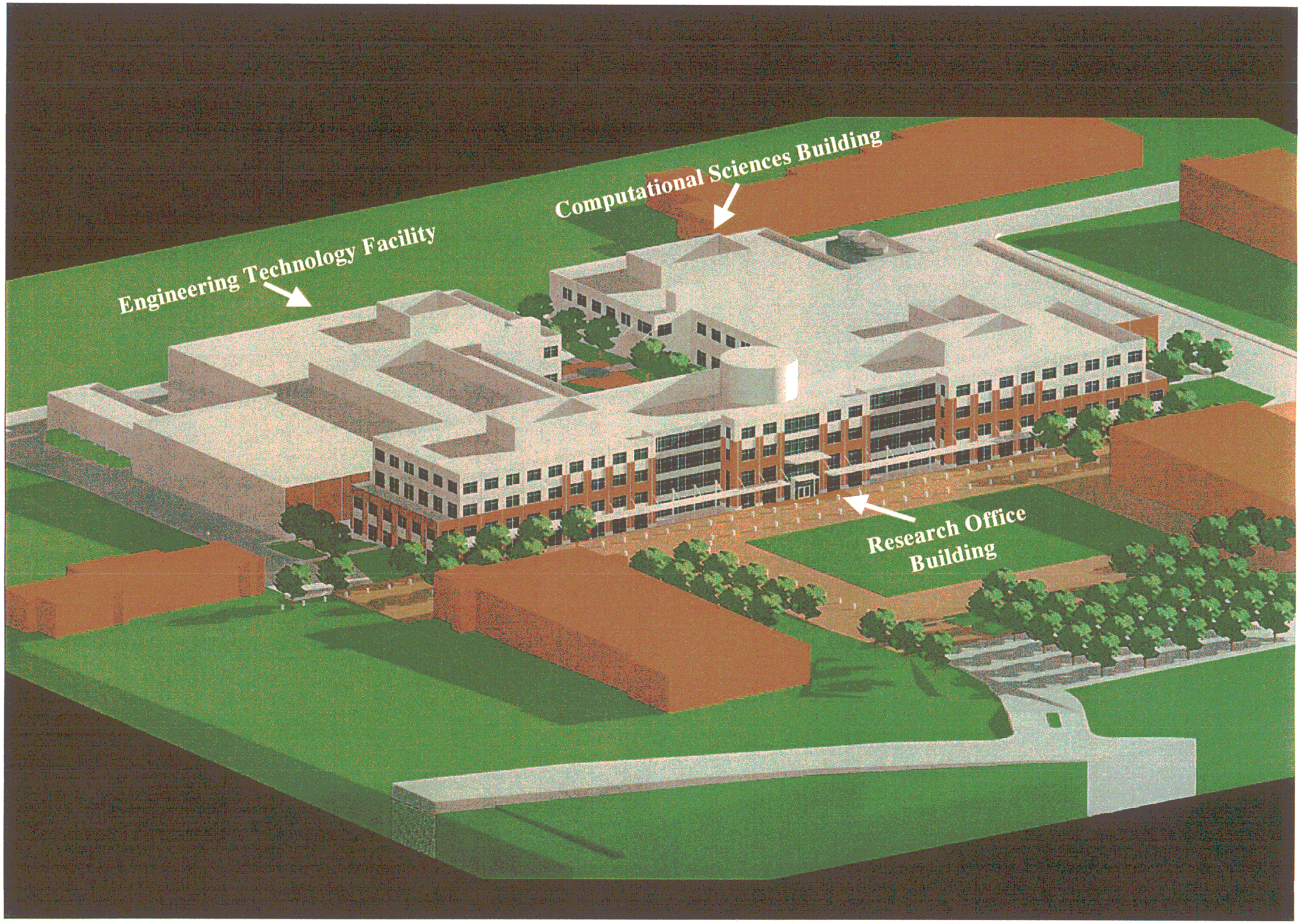


Fig. 3.22. Private-sector funded facilities.

3.3 RESOURCE PLANNING, PRIORITIZATION, AND ALLOCATION PROCESS

The ORNL ESHQ&I budget formulation and management planning process provides the planning structure and tools needed to identify and prioritize ESHQ&I needs, make and communicate cost-effective ESHQ&I risk-management decisions, integrate ESHQ&I into all activities and operations, and establish accountability for ESHQ&I performance. ESHQ&I resource planning and prioritization are implemented in a manner consistent with guidance from DOE, as provided in the *DOE Guidance Manual for the ES&H Planning Process*, the Office of Environmental Management Budget Formulation Guidance, DOE Order 430.1A, "Life Cycle Asset Management," and any supplemental guidance received from individual DOE program offices. The ORNL site planning methodology is outlined in Fig. 3.23.

The process generally consists of the following steps:

- Needs assessment identification — Needs assessments are performed by ORNL organizations and line management to identify the activities, systems, and programs needed to ensure the effective management of operations, ES&H, and infrastructure risks and to create a culture within ORNL that effectively integrates employee protection into work planning and the execution of work activities.

- Activity data sheet (ADS) preparation — ADSs contain the essential scope, schedule, cost estimate, and management information necessary for ORNL organizations to support planning and provide input to the budgeting process. ADSs are prepared for all landlord programs and activities needed to operate ORNL in a manner that protects the employees, the public, and the environment; meet those requirements set forth in the ORNL Work Smart Standards and by DOE; and ensure adequate infrastructure resources to meet the mission of the Laboratory.

- Risk-based prioritization of activities — The ORNL Risk Ranking Board uses a Risk-Based Priority Model (RPM) to perform risk evaluations of all landlord operations, ES&H, infrastructure activities, and other identified ADSs. Using the RPM, a risk-reduction benefit score is derived for each ADS, and ADS scores are used to establish preliminary priority lists that are reviewed by senior management. Priority adjustments are made, as necessary, in consideration of additional planning factors.

- Allocation of resources — Resource planning and allocation are done on the basis of programs essential for compliance, fulfillment of ORNL missions, and assurance of the safety and well-being of ORNL personnel, the public, and the environment. Resource allocation is determined by supporting the highest-ranking activities within the target funding levels. The ORNL Leadership Team and the DOE Site Office review and approve proposed GPP, GPE, and overhead programs.

For capital and operating cost requirements outlined in this plan, the individual projects will be evaluated through this formal process prior to funds allocation and project execution.

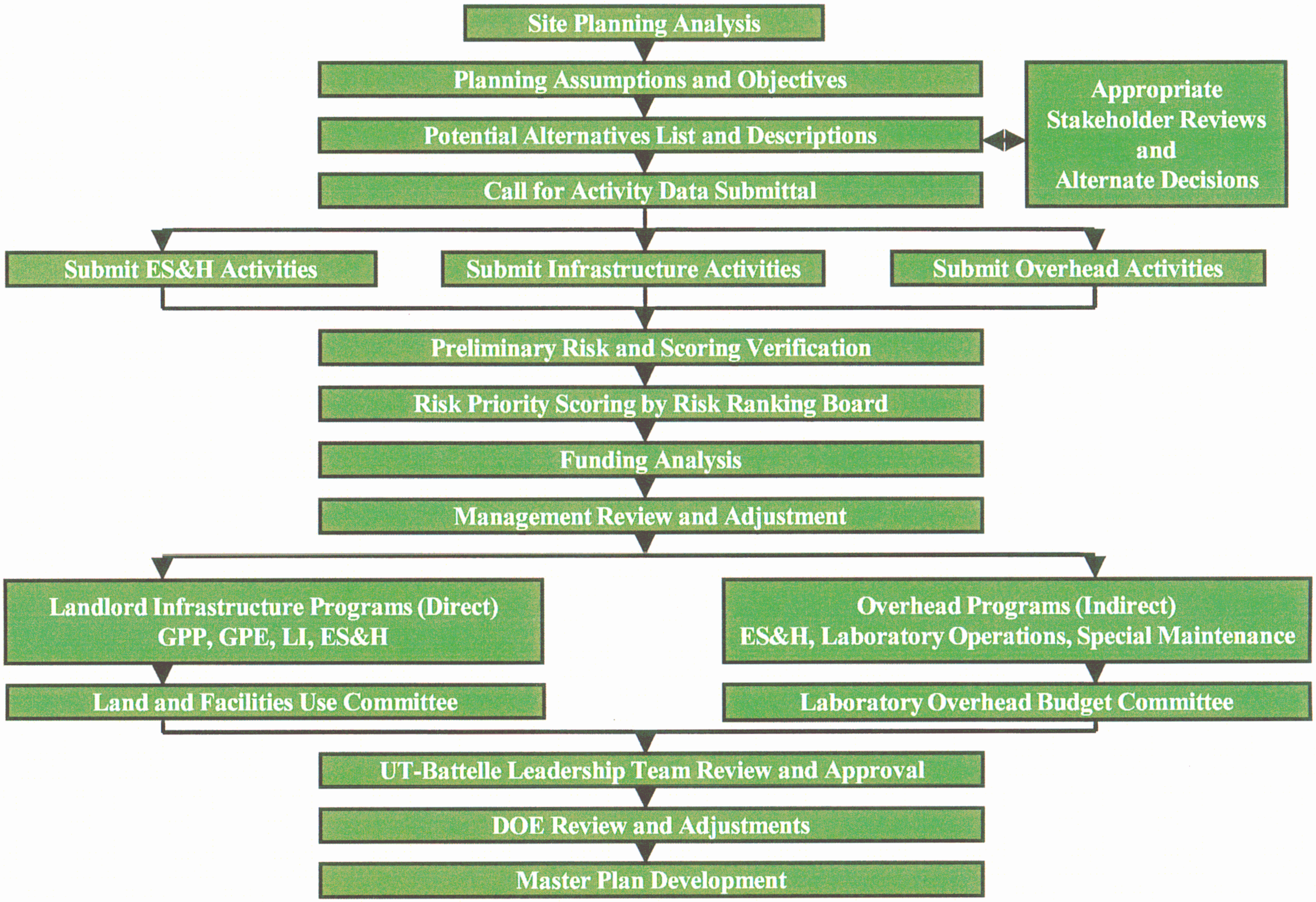


Fig. 3.23. ORNL site planning methodology.

3.4 ORNL MASTER PLAN

The Master Plan for development of the ORNL Laboratory of the 21st Century has been formulated to meet the scientific needs of the research community utilizing the facilities; provide a safe, quality, and energy-efficient work environment for ORNL staff; and ensure adequate flexibility and growth potential for future expanded research missions. The following description of the Master Plan includes a review of the basic guiding principles used in developing the plan, an overall view of the long-term Master Plan, and separate descriptions of each of the phases of the Master Plan growth. Appendix M provides detailed information concerning projects listed in the Master Plan.

3.4.1 Master Plan Vision/goals

The guiding principles for the ORNL Master Plan were developed early in the Laboratory revitalization planning process and incorporated input from a variety of stakeholders, including ORNL research, operations, ESH&Q, land use, program development, and DOE staff. From formal brainstorming sessions, stakeholder surveys, management- and staff-level briefings, and written DOE guidance, an overall vision for the facilities revitalization effort was developed and adopted. That vision is to provide ORNL staff with world-class facilities, consolidated at the main ORNL site, that lay the foundation for ORNL's scientific excellence into the 21st century.

Specific Master Plan goals to be realized when modernization is complete are defined in each of the following areas:

Scientific Mission: Support the multiprogram nature of the Laboratory and accommodate program growth and technology changes well into the 21st century. Integrate the program needs into a research campus environment that encourages interdisciplinary teaming.

Work Environment: Provide a quality work environment for employees and visitors that enhances their productivity and attracts the next generation of world-class scientists to ORNL. Facilities will contain the latest advances in information technology and research laboratory infrastructure and will be designed to provide maximum flexibility for program changes.

Environment, Safety, Health, and Security: Provide a safe, healthy, environmentally conscious, secure workplace for employees and visitors. The Master Plan should maximize the use of already disturbed (brownfield) areas for new development, emphasize energy efficiency and sustainability design features, and provide an open campus security environment wherever possible.

Operations and Maintenance: Provide facilities and infrastructure that are efficient to operate and maintain. New building designs will incorporate energy-efficient heating/cooling systems, utility services, insulation, and exterior surface materials that are state-of-the-art, yet durable and maintainable.

Architectural: Provide a new ORNL campus of unifying architectural style that reflects the mulitprogram scientific nature of the Laboratory mission and celebrates the unique history of the main ORNL site and the natural beauty of East Tennessee. The new research facilities will be built around an identifiable campus center where staff, visitors, and the general public will be welcomed and allowed to meet and exchange ideas.

To accomplish the goal of a fully modernized Laboratory of the 21st Century, ORNL has established a dedicated project team to implement the Facilities Revitalization Project. The FRP team reports to the Director for Facilities and Operations and has a Steering Committee led by the ORNL Deputy Directors for Operations and Science and Technology. DOE-ORO is providing direct support and leadership for the facilities revitalization effort through a similar Steering Committee headed by the ORNL Site Office Deputy Manager.

The UT-Battelle facilities revitalization approach is to provide new, integrated facilities constructed in close proximity to the existing ORNL strategic research facilities, utilizing a combination of DOE, State of Tennessee, and private-sector financial resources. UT-Battelle will focus DOE capital funding on capabilities that are not likely to be financially or technically feasible by third parties, use State funds for the type of shared scientific facilities appropriate for collaborative research, and use private-sector construction for light laboratory and office support needs that accompany research efforts. These facility types will be constructed in an integrated campus layout that allows the free flow of scientific research between multidivision teams, with consistent architectural themes, regardless of construction funding source.

Because of the magnitude of needed facilities improvements and the historical limitations on federal funding availability, UT-Battelle has implemented an innovative use of federal, private, and State funds to accomplish the facilities revitalization. The key component of this approach is the transfer of land ownership from DOE to allow for (1) construction and lease of buildings by the private sector and (2) siting and construction of State of Tennessee facilities. A mutually acceptable approach for land transfer has been developed between the DOE-OR Realty Office and UT-Battelle that involves the use of DOE's authority under Sect. 161(g) of the Atomic Energy Act and the establishment of a not-for-profit 501(c)(3) corporation by UT-Battelle that will be the responsible party for acceptance of the DOE land, with subsequent lease of that land to the private sector for construction and space rental of the property to UT-Battelle (with DOE approval) for research activities. Under this arrangement, UT-Battelle utilizes the 501(c)(3) corporation to oversee land management, building construction, and lease (for private sector) or MOU implementation (for State of Tennessee) for the FRP, and DOE has transferred, through fee simple title via a Quitclaim Deed, specifically identified parcels of land to that development corporation. A block-flow diagram of this approach is provided in Fig. 3.24. The legal and contractual details associated with this concept are beyond the scope of this document but can be obtained through contact with the UT-Battelle or DOE project managers.

This unique approach requires integrated planning and new facilities construction and operations models to be employed; hence, the decision to implement the first phase as an identifiable project with a specific short-term mission and scope. The FRP team will define the process, implement it for the first round of construction, and provide the project execution framework for the remaining phases of the revitalization effort. However, those future projects will be managed as part of the routine ORNL Facilities and Operations organization mission.

3.4.2 Master Plan for ORNL Site Development

A view of the Master Plan for long-term site development at ORNL is provided as Fig. 3.25, with the planned new facilities highlighted in color by phase of construction. This plan, incorporating the vision and goals described above, focuses on a multicampus layout (East, Central, and West Campuses) to accommodate the multiprogram nature of ORNL research activities. The East Campus was structured to continue the historical mission work in High Energy Physics, Computational Sciences, Chemical/Analytical Sciences and Engineering, and Materials Research, as well as to provide expansion room for the Engineering Technology field of study and future collaborations with UT and the broader university community through new Joint Institutes. The West Campus Master Plan focuses on support of Environmental and Life Sciences research needs, making the Marilyn Lloyd Environmental and Life Sciences Complex historical vision a reality. The Central Campus plan for redevelopment is a bit more

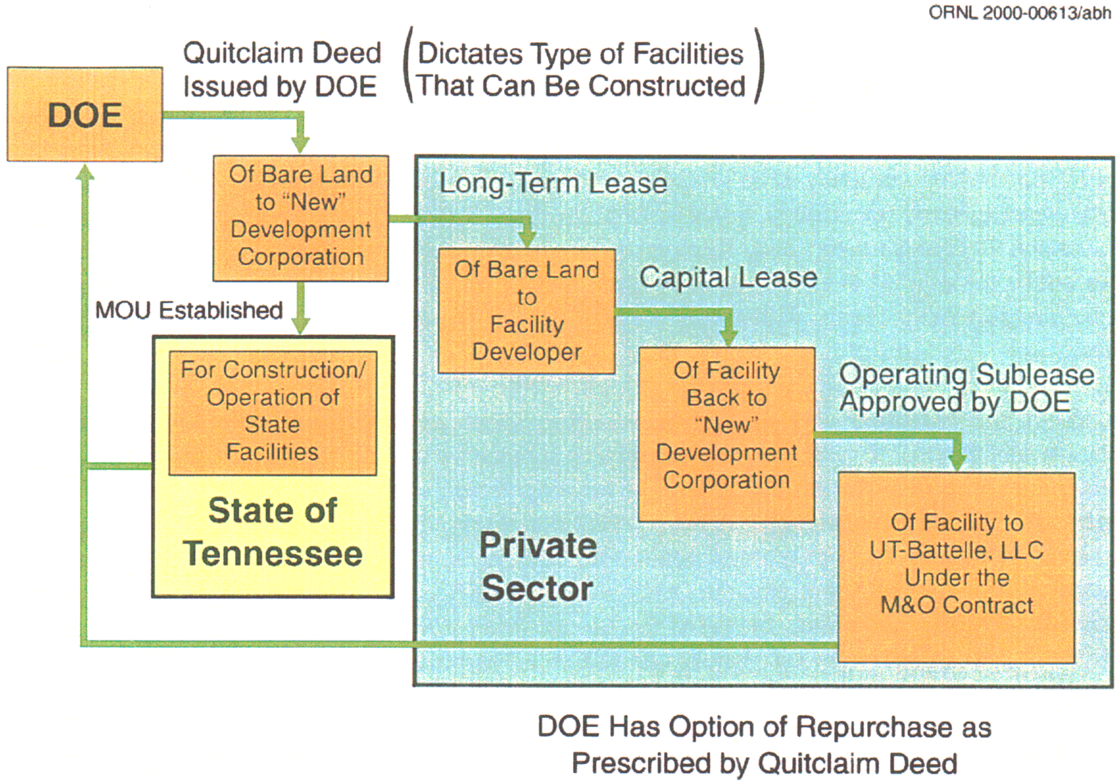


Fig. 3.24. Property/facility lease flow diagram.

complicated, due to the presence of a large number of contaminated facilities that were critical to ORNL's early years and are now part of the EM Program for D&D. That portion of the ORNL site will continue to be a primary area for Solid State, Materials, Energy, Instrumentation, and Chemical Technology research, but with limited new facilities construction planned until D&D activities are completed in 10 to 15 years. Once the Central Campus area is returned to useable/ buildable status, then additional research and support development will occur as part of the long-term Master Plan.

The multicampus site layout provides identifiable campus centers for development in the East, Central, and West portions of the site, around commons areas that promote researcher collaboration, and with reasonable walking distances maintained for all critical services to promote energy savings and improved worker health. The close-pack arrangement of new buildings, and their purposeful proximity to the existing strategic ORNL buildings, minimizes the area required for new development and allows reuse of already disturbed land (parking lots, remediated sites) in a brownfield-type approach. The natural areas on the hillsides overlooking the ORNL site to the north are maintained in their current state under this plan. This entrance area comes to a focal point at the Research Support Center where visitors to the Laboratory will be welcomed, conference facilities are provided, and ORNL staff are encouraged to congregate and collaborate in the main cafeteria facility and surrounding open areas.

Architectural consistency will be provided within each campus to ensure blending of new construction with the existing strategic structures, while allowing state-of-the-art improvements in building sustainability designs. Recognition of the history of the ORNL site will be a critical element of the design and siting of new buildings, with preference given, where possible, to protecting those important features

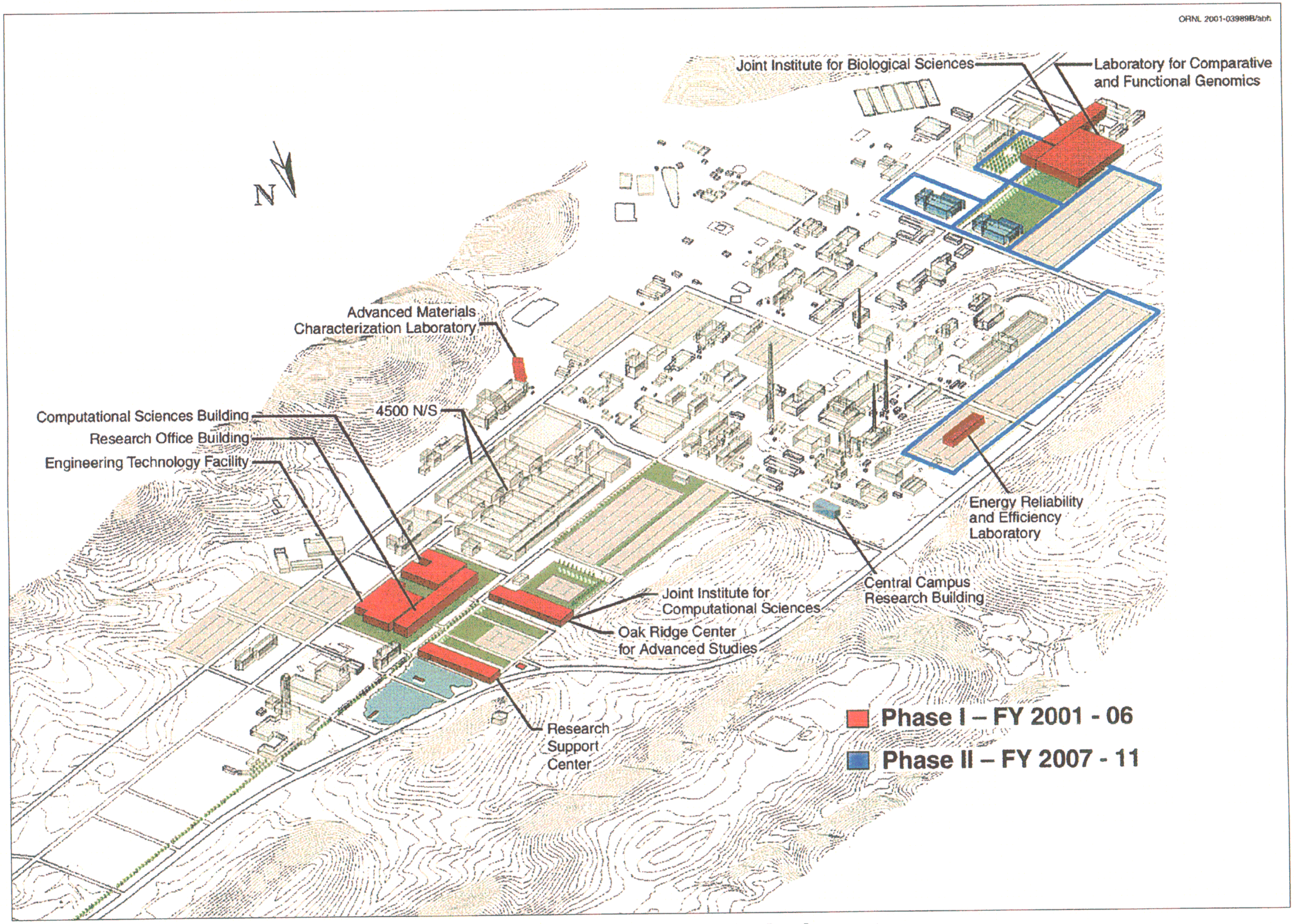


Fig. 3.25. ORNL Master Plan for site development.

of the Laboratory. The proposed site layout, use of between-building spaces, and dispersed parking concepts are predicated on a change in the physical security approach at the Laboratory. Such a change would involve, in its simplest form, implementation of access controls on a building-by-building basis through a badge-reader-type system at each building entrance, while site access will be controlled at new portals located east and west of the developed site on Bethel Valley Road.

The emphasis of the Master Plan is on the main ORNL site in Bethel Valley since the majority of the research staff and the old facilities are located there; however, the important missions at HFIR and the Robotics and Process Systems areas (the 7900 and 7600 Areas, respectively) are also integrated into this plan. Facilities improvements and new construction investments will continue to be made in those areas throughout the planning horizon, as noted in the details that follow. As well, the significant investment being made by DOE in constructing the SNS is factored into the ORNL Master Plan, with recognition of the entrance requirements for that facility and the availability of shared resources and facilities.

3.4.2.1 East Campus Design Features

The East Campus (see Fig. 3.25) is built around the new ORNL Research Support Center as the central point for interface with visitors and for congregation of Laboratory staff. This facility contains the visitor reception area, the main ORNL cafeteria, and the primary large auditorium for Laboratory seminars and briefings (with adjacent breakout conference rooms). These conference rooms will also become a critical resource to the Laboratory for support of normal research project teams, university/commercial partnerships, and routine audit teams. Commons areas in front and behind the Research Support Center will provide a quality environment for researcher/visitor interactions and congregating space for conference attendees and lunch-time crowds.

Support for the research mission is a primary emphasis in the East Campus design, with siting proposed for up to eight new research and related buildings within walking distance of the Research Support Center and the current research/administration hub of 4500N/S. These buildings will be phased, as required by program growth, and located in strategic proximity to collaborating organizations. Existing research laboratories and offices in the 4500N/S complex, as well as those in the Physics and Computational Sciences complex in the 6000 Area and the HTML area (4515), will be upgraded, as required, under this Master Plan to bring them up to 21st century technology and infrastructure capabilities to allow them to continue serving as the research backbone for this portion of the Laboratory.

A key component of the new research capabilities in the East Campus will be the addition of a facility to house the Joint Institute for Computational Sciences (JICS) and the Oak Ridge Center for Advanced Studies (ORCAS), a commitment made by the State of Tennessee as part of the UT-Battelle facilities revitalization proposal. This user-facility/scientific-collaboration-type building will be consistent with the open campus nature of the East Campus setting and will be sited to best accommodate researcher/visitor needs. The location of this facility is shown in Fig. 3.25.

Additional facilities currently under construction in the East Campus are a Computational Sciences Building, an Engineering Technology Facility, and a Research Office Building. The Computational Sciences Building, to be located near the JICS, will contain the latest high-speed super computer and research staff associated with computational science research and development. The Engineering Technology Facility will consist primarily of laboratories for testing and research associated with transportation, materials development, and energy research. Research and support staff will be housed in the Research Office Building, which will be located adjacent to these new research facilities. These three facilities, which will contain in excess of 350,000 square feet of new space, will be interconnected and are designed to improve circulation among 4500N, JICS/ORCAS, and the Research Support Center to promote collaboration.

Utilities and infrastructure improvements will be made as part of the development of the East Campus, with upgrades anticipated in potable water, electrical distribution, steam, HVAC, and wastewater collection/distribution systems. As the majority of new facility construction activities are sited on the former main ORNL parking lot, replacement of that critical piece of infrastructure also becomes important. Traffic flow and parking availability planning has been factored into the Master Plan, with particular emphasis on traffic calming along Bethel Valley Road, visitor parking associated with the Research Support Center, and use of previously disturbed areas for provision of staff parking near places of work assignments.

3.4.2.2 West Campus Design Features

The emphasis on the West Campus development (Fig. 3.25) is to consolidate Environmental and Life Sciences research activities into an identifiable complex surrounding a natural commons area. The existing strategic research facilities housing ESD and Life Sciences Division (LSD) staff will be retained and upgraded as required to meet the state of science in the 21st century. Adjacent to those buildings, the new Laboratory for Comparative and Functional Genomics, the Joint Institute for Biological Sciences, and a proposed Center for Systems Biology office/laboratory facility will be constructed around a commons area, all of which are tied visibly to the East Campus by the landscaped avenue that runs east to west through the main ORNL site. Accomplishing this vision for the West Campus will require the demolition of Building 1000, one of the prime examples of outdated, substandard office buildings that are the focus of the revitalization effort. Similar to the East Campus, upgrades will have to be made in the general infrastructure of the West Campus to accommodate planned growth and replace/reorient roadways and parking.

3.4.2.3 Central Campus Design Features

Few design features have been developed at this point for the long-range redevelopment of the Central Campus area (Fig. 3.25), since remediation of the majority of the structures located there is still 10 to 15 years away. What is planned, however, is the continued use and upgrade of current strategic research facilities in the heart of the campus, the addition of a few key near-term facilities in proximity to existing concentrated program complexes (e.g., the Energy Reliability and Efficiency Laboratory), and longer-term development of a central commons area to be bounded by future mission-related research laboratories/offices. In addition, the Master Plan includes an ultimate relocation of ORNL support services capabilities from the 7000 Area into the center of the ORNL site to complete the consolidation of ORNL operations within the compact, three-campus setting. While the existence of closed/remediated EM sites within the Central Campus area will certainly restrict the location and type of buildings sited, sufficient unrestricted development areas are expected to be made available for the needed ultimate consolidation. In fact, early planned reuse of the remediated surface impoundments area for parking is a good example of the type of brownfield redevelopment that will be the hallmark of the Central Campus revitalization.

3.4.3 Master Plan Phase I: FY 2002–06

Accomplishment of all of the ORNL Master Plan objectives will obviously take many years. Phasing of the project will be required to correspond to the availability of each of the various funding types, the programmatic needs of the research organizations, and the constraints of the existing/planned infrastructure to support construction and operations. The following discussion of each of the planned construction phases is intended to outline the general goals desired for accomplishment during those time frames, blending the reality of these constraints with the strong push from the Office of Science to modernize ORNL on an ac celerated schedule. The Master Plan has been separated into three primary phases, representing plans for the periods FY 2002–06, FY 2007–11, and beyond FY 2011. Obviously, the details of specific projects and timing gets less clear after the first five years, and for the period beyond FY 2011, information deals only with general programmatic mission potential and the anticipated successful remediation of the Central Campus area by EM.

Phase I is the most critical stage for the revitalization effort, as it is here that the concept of private-sector involvement and State of Tennessee investment in the ORNL campus upgrade must happen. It is here, also, where the "new" look of 21st Century ORNL begins to take shape around the Research Support Center in the East Campus and the Laboratory for Comparative and Functional Genomics in the West Campus. This phase also includes completion of the relocation of ORNL staff (from off-site locations at Y-12 and most leased space) to the main ORNL site. Details of the activities in each campus area are outlined as follows.

East Campus. The research campus nature of the Laboratory will appear during Phase I, with the planned construction of the Research Support Center, three private-sector research buildings, two State of Tennessee Joint Institutes, a general purpose support office building, and the infrastructure that integrates the new facilities with the existing Laboratory and provides a new face to the public and visiting scientists. In addition to the new construction, renovations will begin to take place on existing research and support buildings to accommodate staff consolidation and new science initiatives, the most notable of those being the upgrades to 4500N/S, the HTML, and Building 5500 (for ESH&Q consolidation). Research wings of the 4500N/S complex will be prioritized for upgrade, and staff will be temporarily relocated in a phased approach to allow the existing 1950s laboratories to be updated to current technology. Adjacent to the HTML, a new facility, the AMCL, will be constructed to allow consolidation of the primary ORNL electron microscopes into a single, unique, and highly stable facility to support long-term use of these supersensitive instruments.

As described earlier, the Research Support Center will contain the most public parts of the campus, housing the visitor reception area, main Laboratory conference center, and cafeteria. This roughly 53,000-square-foot facility will be built with DOE Line Item funds and will become the "statement" building for ORNL, with design features that will emphasize the importance of ORNL as one of the country's premier research institutions and incorporate energy efficiency and sustainability in building materials of construction and operation. Its glass facade will front the expanded pond area to the east and a courtyard to the west, providing ORNL staff and visitors an opportunity to embrace the beauty of the East Tennessee setting of the Laboratory during normal conduct of business. Similarly, each of the private-sector buildings will have a view to the north of the existing pond and hillside landscape through glass-enclosed fronts that form the southern boundary of the new campus quadrangle. These roughly 120,000-square-foot laboratory/office buildings will be built in a style complementary to the Research Support Center but will be focused on very specific research mission functions. One will be dedicated to the work performed by Engineering Science and Technology Division, which will be moved from its location at Y-12 into a facility designed to house its special mechanical, thermal, and materials research needs. The second will be designed for movement of the ORNL supercomputer capabilities into 21st Century Laboratory space and establishment of a Computational Science Building at ORNL. The third private-sector building is expected to house energy and materials research staff, as well as support organizations critical to the research mission.

The other new buildings in the East Campus area consist of a DOE GPP-funded office building adjacent to the existing Building 5002, and the two State-funded joint institutes. The Joint Institute for Computational Sciences and the Oak Ridge Center for Advanced Studies will be sited in the East Campus, in close proximity to the Research Support Center and the ORNL Computational Sciences Building to ensure close ties to those complementary functions. The East Campus Service Building has been proposed to provide a new, more space-efficient and centrally located home for the ORNL Graphics and Reproduction Center, along with office space to be used for temporary overflow space for staff being displaced during the 4500N/S complex upgrades. This facility is expected to utilize the standard office design concept for GPP offices that has worked so effectively in minimizing the cost of construction of standard office facilities at ORNL. The 4500N upgrade program will be initiated in Phase I and will focus on Wing 4 and the headhouse portions of that complex as the first Line Item project, with subsequent projects (over a ten-year period) sequenced, as appropriate, to address the laboratory upgrade needs in the rest of 4500N, 4500S, and the adjacent attached buildings, such 4501, 4505, and 4508.

The primary infrastructure improvements in the East Campus during Phase I will be associated with providing necessary utilities support to the new facilities construction; construction of the roads, walkways, and commons areas between buildings; and the replacement of parking that is eliminated by new campus construction. Another key infrastructure change during Phase I is the reorientation of the security perimeter for the main ORNL site to allow building-controlled access in the East Campus and implementation of a revised traffic/parking plan.

Central Campus. Limited development will be initiated in the Central Campus during Phase I due to ongoing environmental remediation activities throughout this campus. The Advanced Materials Characterization Laboratory, a 12,000-square-foot facility, will house electron microscopes that will foster state-of-the-art materials characterization. This facility will be constructed adjacent to, and west of, the High Temperature Materials Laboratory. The Energy Reliability and Efficiency Laboratory, a new multistory building of approximately 52,000 square feet, will be constructed in the Central Campus. It will be located at the north entrance of ORNL and will provide facilities for R&D activities in support of the Energy Efficiency and Renewable Energy program initiatives in distributed energy resources, electricity transmission and distribution, and net zero energy building systems. This building will be an attractive state-of-the-art facility designed to operate as a demonstration of energy efficiency technology. Energy Star certification will be sought for applicable portions of the building, which will include on-site power generation, virtual laboratory capabilities, and built-in flexibility to incorporate new R&D and next-generation technologies. Utilities will be extended from the existing distribution systems adjacent to the site and will be upgraded as required. New parking lots will be provided in areas that have been remediated by the EM Program.

West Campus. Phase I activities in the West Campus will be centered around the new Laboratory for Comparative and Functional Genomics, a DOE Line Item now in the design stage that will house the ORNL mouse colony critical to ORNL's future genomics research. This 35,000-square-foot facility will allow the mouse colony to be moved from its historical (but now deteriorated) home at Y-12 and open the availability of that important DOE resource to a broader research community.

That enhanced research community will be better able to utilize this resource through the Joint Institute for Biological Sciences (JIBS), a State of Tennessee funded research laboratory and office facility to be co-located in the West Campus during Phase I. Only the necessary infrastructure to support the construction and operation of these facilities will be provided in the West Campus during Phase I, with commons areas, restructured parking, and roads to await Phase II funding.

7600 and 7900 Areas Development. While not within the main ORNL campus boundaries, critical activities are occurring in the Phase I time period in the HFIR/REDC complex (7900 Area) and the Robotics and Process Systems Complex (7600) Area that are important to the overall ORNL revitalization initiative. The improvements to HFIR operations and research capabilities occurring during their ongoing upgrade programs will make the reactor and adjacent facilities more user-friendly and available. To support that increase in mission, several DOE GPP-level projects will be undertaken in

Phase I that will eliminate multiple trailers housing research and support staff, provide much-needed highbay operations and storage areas, and improve the user-facility status of the complex. The 7600 Area has been selected to be the location for consolidation of staff and facilities that have been historically located at Y-12. To allow that consolidation to occur, staff from several divisions in existing 7600 space will have to be moved to the East Campus, upgrades provided for the vacated space, and new DOE GPP facilities constructed (for highbay process space needs). Locations of the planned new facilities in the 7600 and 7900 Areas are shown in Figs. 3.26 and 3.27.

Spallation Neutron Source. The SNS is an accelerator-based, next-generation neutron scattering facility that is under construction on the ORR. It will produce neutron beams that are 12 times as intense as those available from any existing pulsed source, enabling researchers to "see" never-before-observed details of physical and biological materials, ranging from high-temperature super-conductors to proteins. The SNS is the top-priority project of DOE's Office of Science (DOE-SC), which has committed nearly $841 million through FY 2002 for its design and construction. It will play a key role in supporting DOE's goals and strategies in science. (Fig. 3.28).

General-Purpose Line Item, GPP, and GPE Projects. In addition to projects directly associated with the Facilities Revitalization Project, there are numerous projects for general-purpose facilities, improvements, and upgrades needed to assure the adequacy and viability of ORNL's utility system, facilities, and other site infrastructure. Figures 3.29 and 3.30 show locations of general-purpose Line Items and major GPP and GPE projects in Bethel and Melton valleys, respectively. Descriptions of these projects are included in Appendix M.

3.4.4 Master Plan Phase II: FY 2007–11

Phase II of the Master Plan focuses on continuation of the upgrade to the 4500N/S complex in the East Campus area, additional development of the West Campus quadrangle, and refinements of the infrastructure (roads, parking, and utilities) across the ORNL site (Fig. 3.25). While the site construction efforts decrease in Phase II of the plan, significant investments are made in the placement of vacated buildings in "cheap-to-keep" mode and implementation of facility decommissioning for the highest-priority projects. During this phase, cost savings from the Phase I exit from inefficient buildings will peak and will help fund many of the ongoing maintenance improvements needed for the remaining inventory of ORNL facilities.

East Campus. The primary construction activities in the East Campus during this phase will be continuation of the 4500N/S complex laboratory upgrade projects, with completion of that work expected in Phase III. Infrastructure improvements will also continue throughout Phase II, focusing on final road and parking lot upgrades to support the private-sector buildings, traffic calming improvements along Bethel Valley Road, and the more routine utilities and facilities needs for the existing main plant area.

West Campus. In the West Campus, Phase II brings form to the commons quadrangle at that end of the ORNL site. A new Center for Systems Biology Line Item facility will be constructed with common space between it and the Genomics Laboratory/Joint Institute for Biological Sciences complex further to the west. The Biological Sciences facility will provide space to complete the consolidation of all LSD staff from off-site and other on-site locations, finally bringing to fruition the concept of the Environmental and Life Sciences Complex.

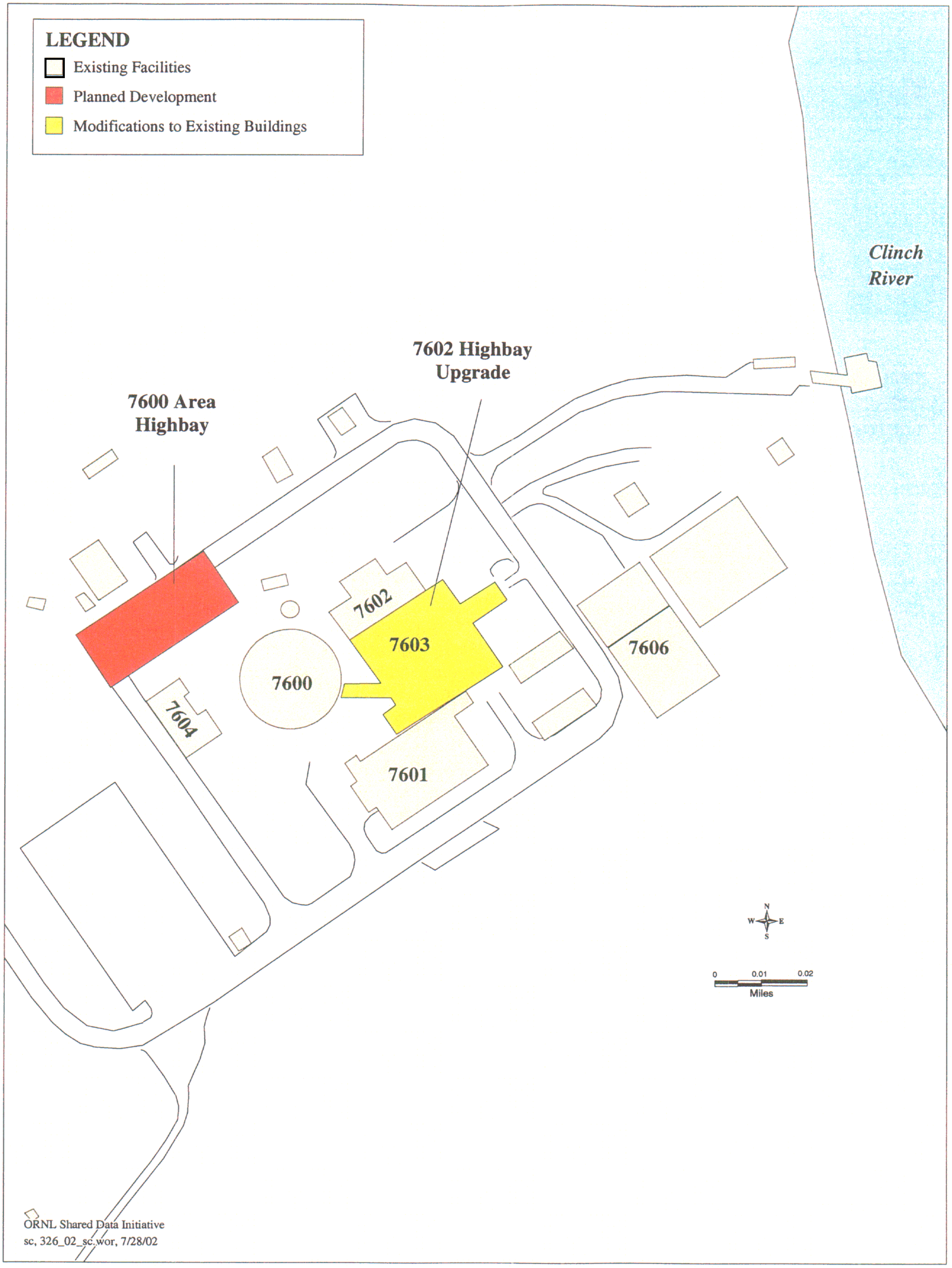


Fig. 3.26. Planned new facilities in the 7600 Area.

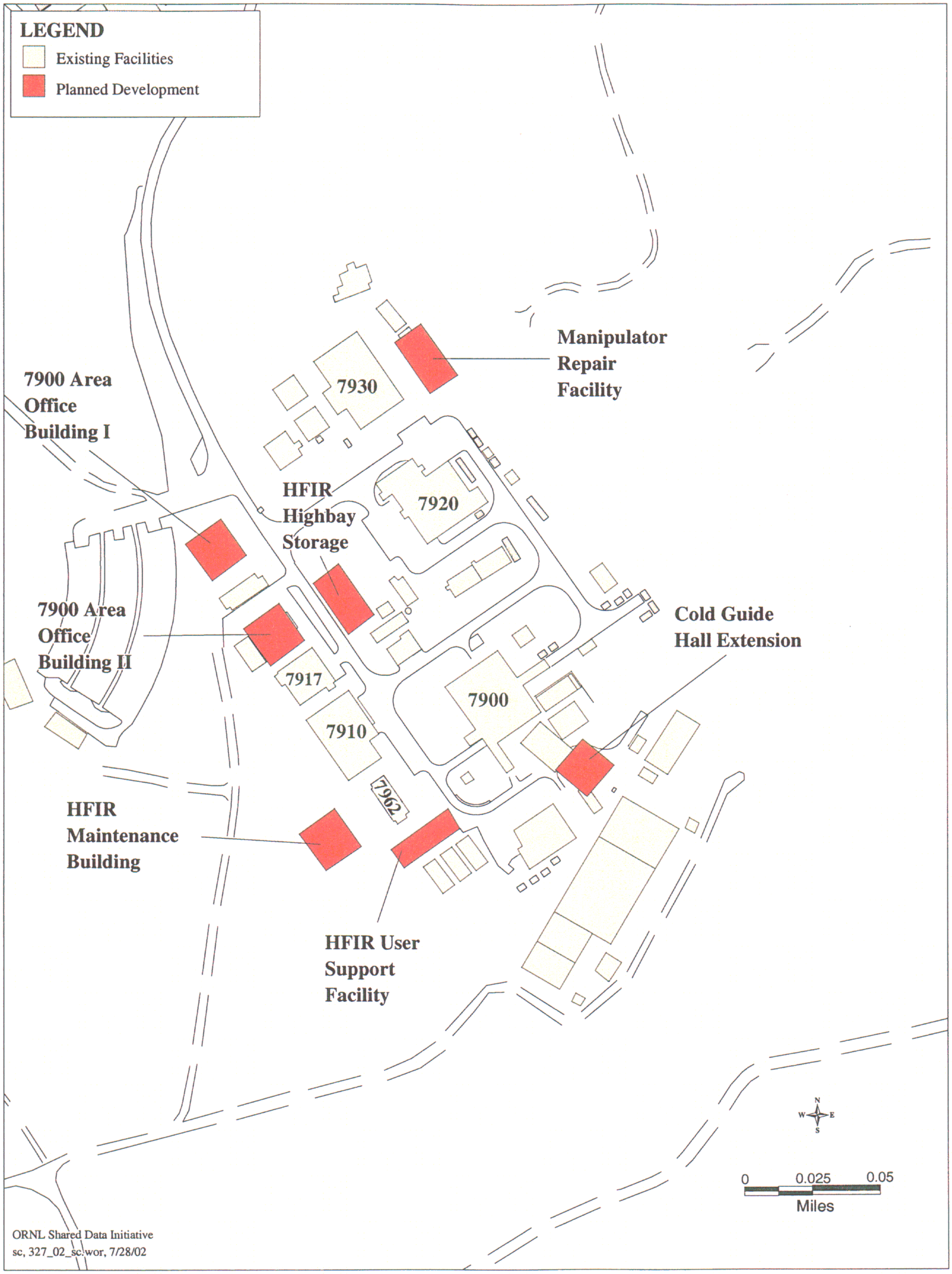


Fig. 3.27. Planned new facilities in the 7900 Area.

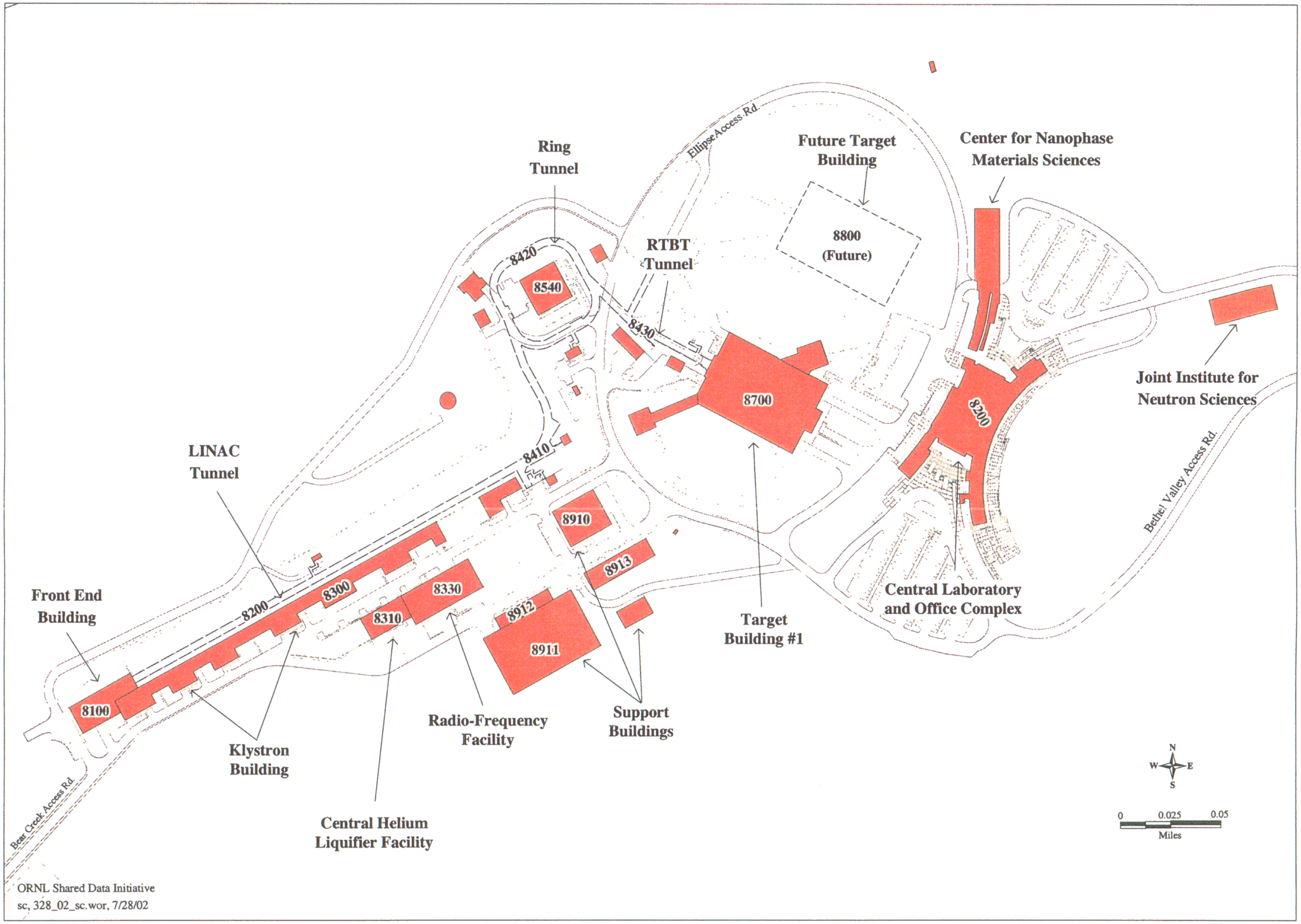


Fig. 3.28. Spallation Neutron Source and associated facilities.

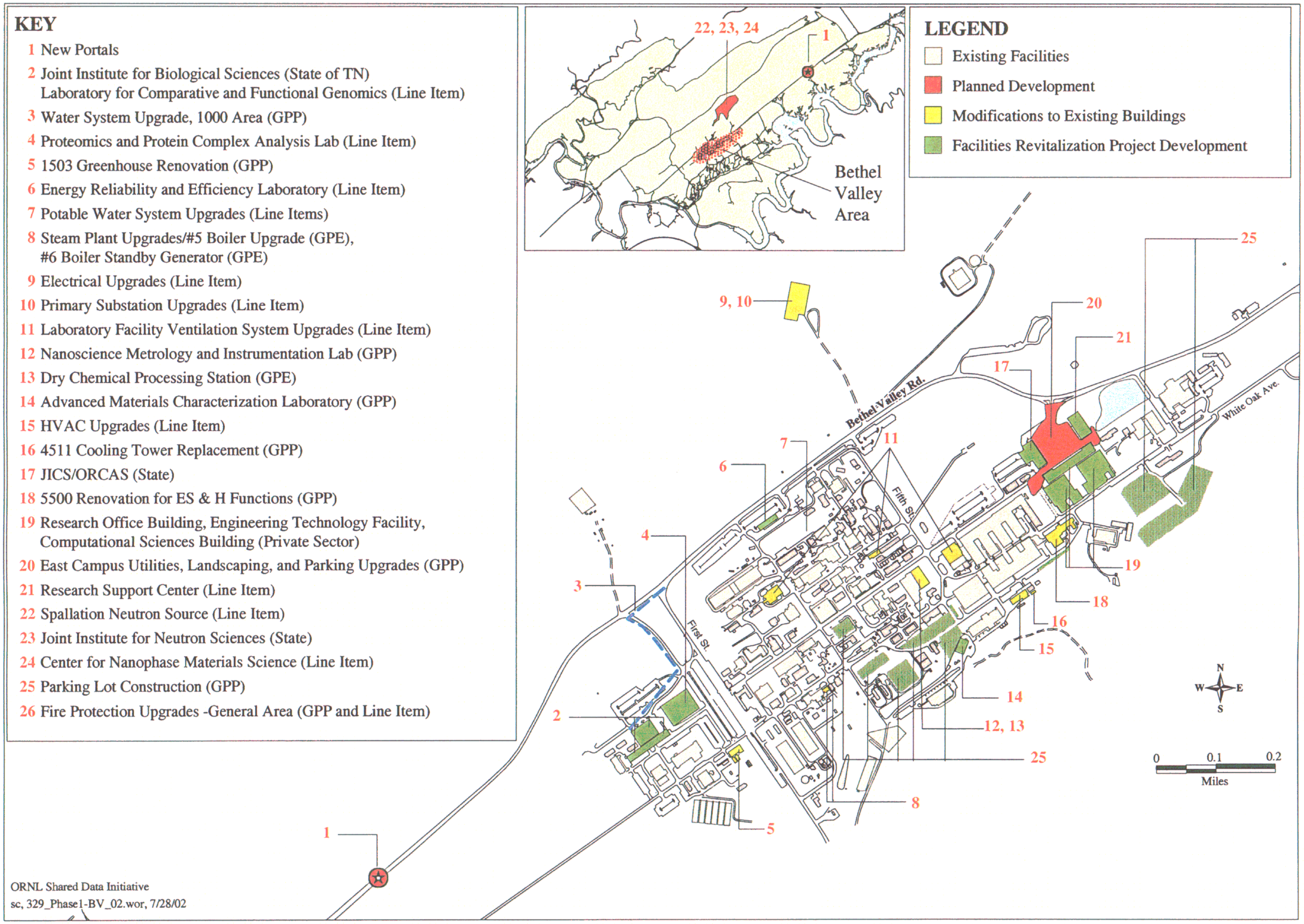


Fig. 3.29. ORNL projects for Bethel Valley, Phase I, FY 2002-06.

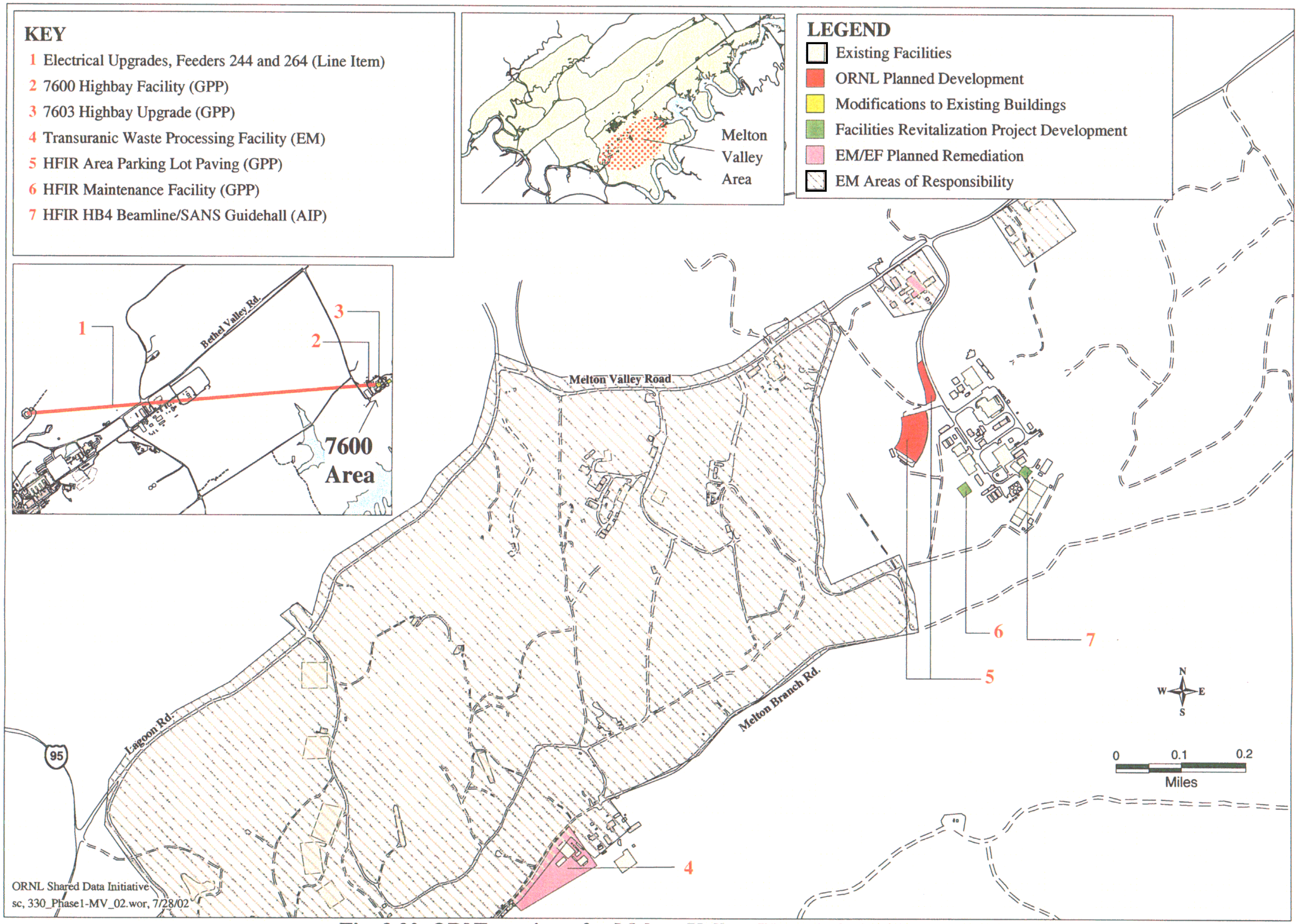


Fig. 3.30. ORNL projects for Melton Valley, Phase I, FY 2002-06.

General-Purpose Line Item, GPP, and GPE Projects. In addition to projects directly associated with the Facilities Revitalization Project, there are numerous projects for general-purpose facilities, improvements, and upgrades needed to assure the adequacy and viability of ORNL's utility systems, facilities, and other site infrastructure. Figures 3.31 and 3.32 show locations of general-purpose Line Items and major GPP and GPE projects in Bethel and Melton valleys, respectively. Descriptions of these projects are included in Appendix M.

3.4.5 Master Plan Phase III: Beyond 2011

While programmatic and site infrastructure needs are not well defined for the period beyond FY 2011, the Master Plan has incorporated the necessary flexibility and expansion room to accommodate any level of growth that would conceivably occur. This phase of expansion could involve construction of office/laboratory space in the East Campus north of 4500N, additional office/laboratory space to the east of the 6000 Area, new Environmental and Life Sciences expansion in the West Campus, and/or redevelopment of a Central Campus area on sites that are remediated by the EM Program by that time frame (Fig. 3.25). The specific location and program content of those facilities would be determined in the outyears, but the Master Plan approach provides growth potential in areas adjacent to all major science centers within the ORNL main research campus. At this point in time, it may be appropriate to relocate the service functions currently being performed in the 7000 Area into the Central Campus redevelopment in order to make that support more efficient in serving the Laboratory research mission and allow appropriate disposition of those aging facilities.

Infrastructure needs to support the long-range site development will be addressed as decisions are made on the ultimate growth locations. Utilities upgrades and distribution, as well as road access and parking improvements, will be provided as required.

3.5 MASTER PLAN COST AND SCHEDULE

Based on the Master Plan presented in Sect. 3.4, an analysis of the cost and schedule associated with implementation of identified planned projects is shown in Table 3.6. The cost tables in Appendix N provide detailed cost information for each project identified in the Master Plan. Cost and schedule information is necessarily preliminary; detailed construction project estimating will be completed as projects are initiated for design.

The preliminary cost estimates provided are based on the use of site- or region-specific cost factors for each of the primary projects expected to be accomplished during the planning period. These factors include (1) current operating costs of facilities, (2) transition costs of facilities, (3) routine annual S&M costs for transition facilities, (4) gross D&D costs for permanent disposition of surplus facilities, (5) construction costs for facilities to be built by DOE, the State of Tennessee, and the private sector, and (6) relocation costs for moving staff and associated equipment/furniture into new/refurbished facilities.

Traditional funding sources for infrastructure modernization include GPP and GPE budgets, programmatic Line Items, and DOE's MEL-FS Program. The funding levels for landlord GPP and GPE in Table 3.6 for the years FY 2002 through FY 2008 are the target funding levels provided by the Office of Science in April 2002. Also in April 2002, an interim Institutional GPP (IGPP) program was authorized for the years FY 2002, 2003, and 2004. Projections for IGPP funding are provided for each year in Table 3.6. The IGPP program will provide much-needed additional funding; however, additional landlord GPP, GPE, and MEL-FS Program funding is still needed to support the most desirable

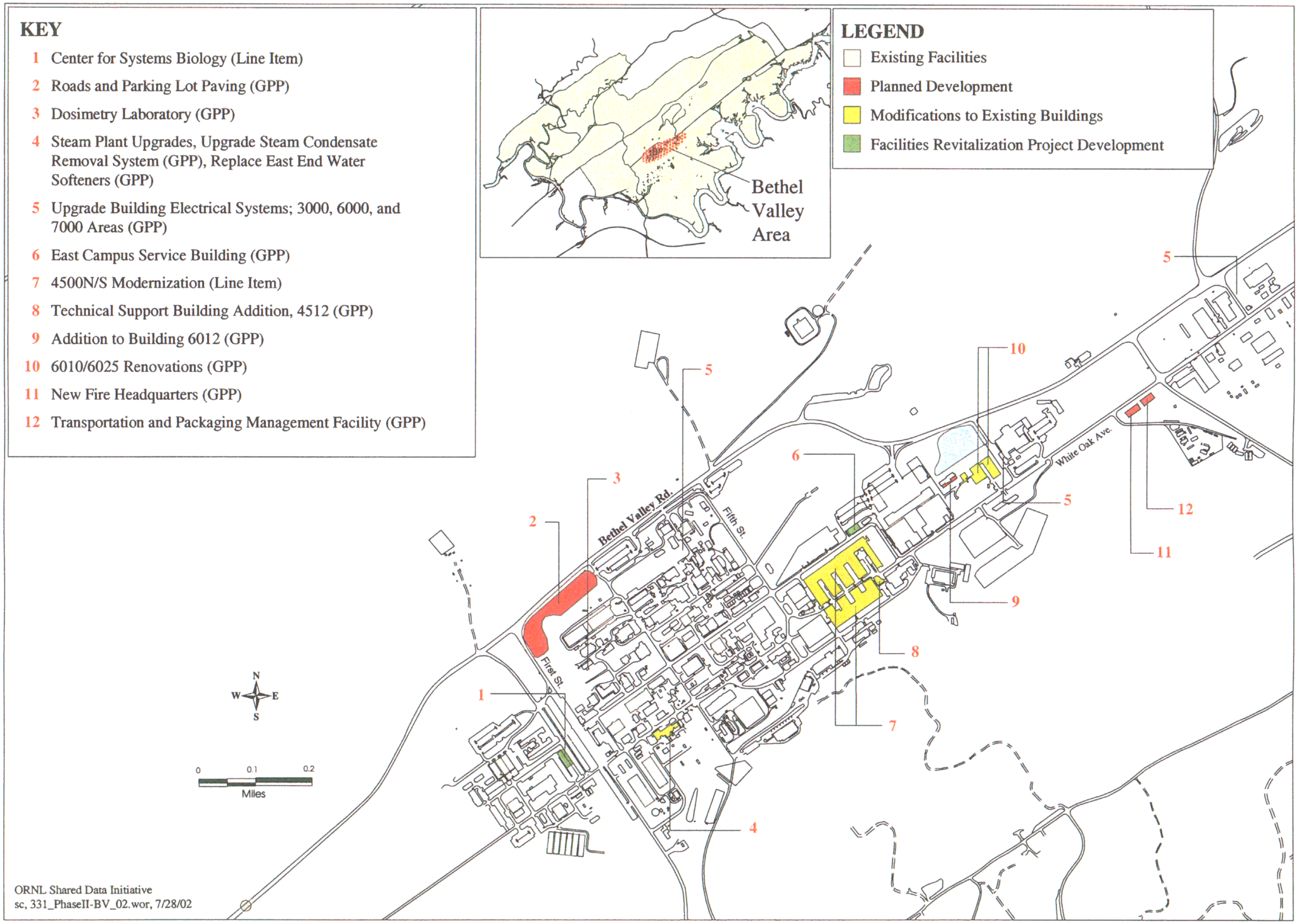


Fig. 3.31. ORNL projects for Bethel Valley, Phase II, FY 2007-11.

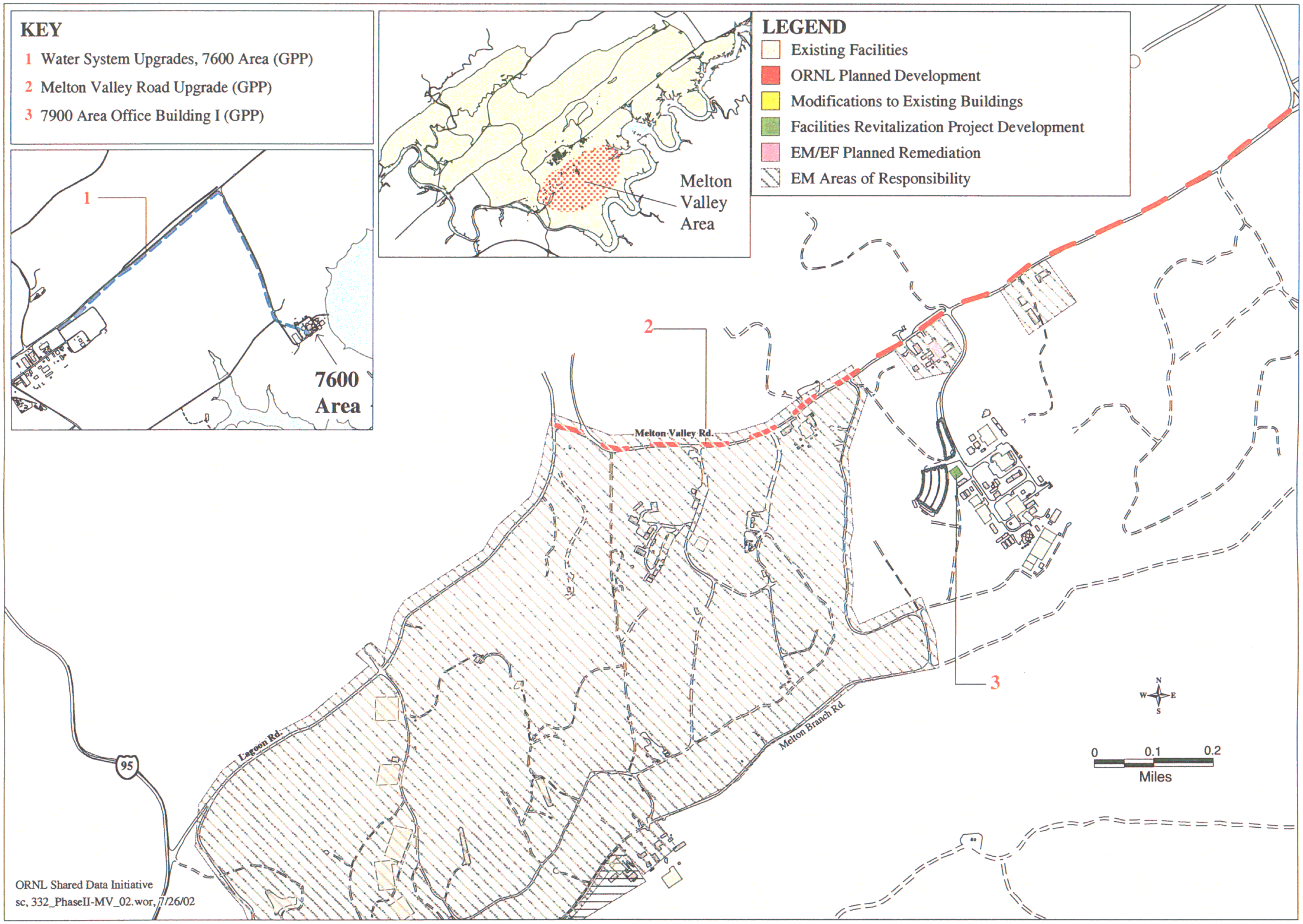


Fig. 3.32. ORNL projects for Melton Valley, Phase II, FY 2007-11.

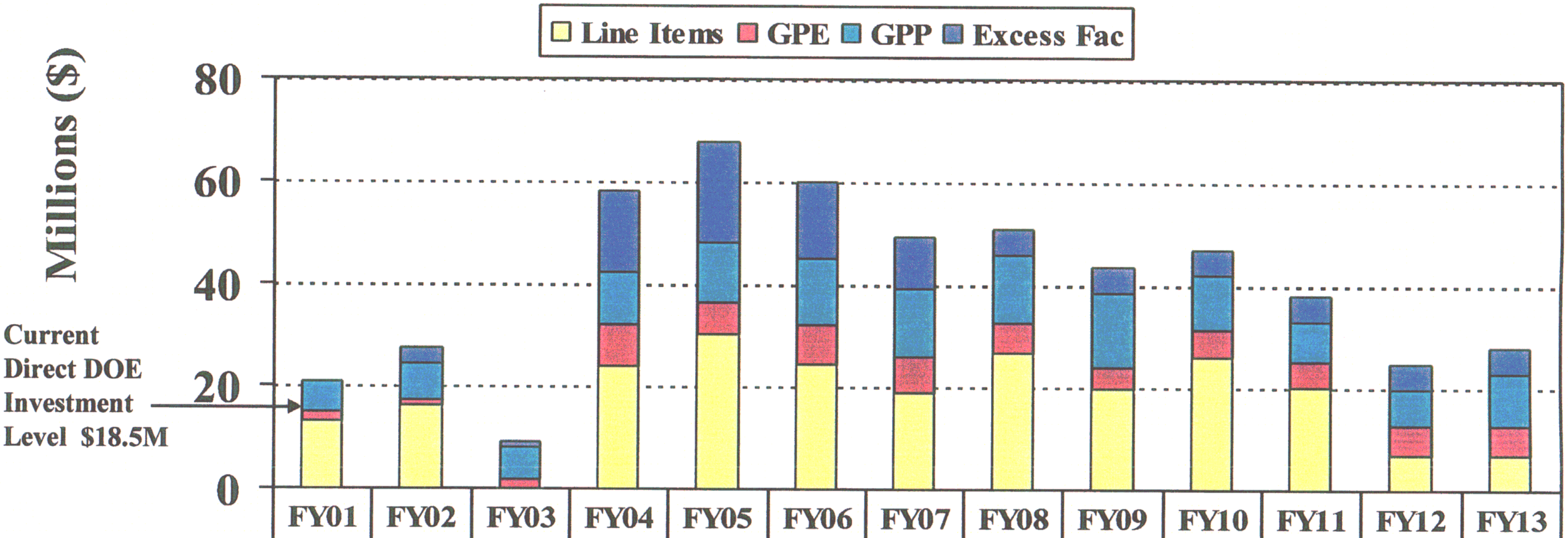
Table 3.6. Projected funding requirements for ORNL site development
($ in millions)

FUNDING SOURCE	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
DOE Funding										
Landlord Line Item	7,620	10,816	12,230	24,385	31,225	28,050	26,600	23,400	20,600	18,200
Landlord GPP	7,029	6,200	6,400	6,500	7,200	7,800	8,000	9,350	13,200	10,800
Institutional GPP	2,250	3,870	5,540	5,200	4,825	3,515	3,200	3,800	2,100	1,100
Landlord GPE	1,413	2,549	2,820	1,900	1,900	2,000	2,000	6,140	7,231	7,179
Total	**18,312**	**23,435**	**26,990**	**37,985**	**45,150**	**41,365**	**39,800**	**42,690**	**43,131**	**37,279**
Programmatic Line Item	293,305	236,971	149,600	119,980	68,400	82,900	52,800	30,400	1,400	1,400
Programmatic GPP	2,810	9,523	9,563	8,170	7,325	500	1,350	500	0	0
Programmatic GPE	271	596	750	0	0	0	0	0	0	0
Total	**296,386**	**247,090**	**159,913**	**128,150**	**75,725**	**83,400**	**54,150**	**30,900**	**1,400**	**1,400**
State of Tennessee Funding										
Facilities Construction	8,000	2,000	2,000	8,000	6,000	0	0	0	0	0
Facilities Operation	0	206	212	436	672	692	713	734	756	779
Total	**8,000**	**2,206**	**2,212**	**8,436**	**6,672**	**692**	**713**	**734**	**756**	**779**
Private-Sector Funding										
Facilities Operation & Utilities	0	3,652	8,550	8,550	8,500	8,500	8,500	8,500	8,500	8,500
Total	**0**	**3,652**	**8,550**	**8,550**	**8,500**	**8,500**	**8,500**	**8,500**	**8,500**	**8,500**
DOE Operating Expense										
Facilities Consolidation	1,200	4,500	14,900	875	500	225	225	225	225	225
Facilities D&D	3,125	1,200	15,700	20,000	15,000	10,000	5,000	5,000	5,000	5,000
Facilities Operation	20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600
Total	**24,925**	**26,300**	**51,200**	**41,475**	**36,100**	**30,825**	**25,825**	**25,825**	**25,825**	**25,825**

development schedule for ORNL's Facilities Revitalization Project. ORNL has also established innovative arrangements to add funding from the State of Tennessee and the private sector to support modernization needs.

Figure 3.33 is a needs chart for landlord funding to support the timely implementation of infrastructure modernization at ORNL. The FY 2001 through FY 2003 figures for general plant projects and general-purpose equipment reflect current budget guidance from the Office of Science. FY 2004 through FY 2011 reflect requirements, originally identified in the FY 2000 *ORNL Strategic Facilities Plan*, which have subsequently been updated to reflect the impact of actual budgets. The Line Item project requirements reflect all funding for each Line Item being budgeted in the first year of the Line Item schedule.

A high-level schedule of major modernization projects is shown in Fig. 3.34.



	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13
Excess Fac	0	3.1	1.2	15.7	20	15	10	5	5	5	5	5	5
GPP	5.8	6.8	6.2	10.4	11.5	13.1	13	13.2	14.4	10.2	7.7	7.2	10.1
GPE	2	1.3	1.8	8.1	6.1	7.4	7.1	6	3.9	5.4	5	5.7	5.7
Line Items	13	16.1	0	23.8	30.2	24.5	18.8	26.5	19.9	26	20.2	7	7

Fig. 3.33. Needs chart for ORNL landlord-funded infrastructure modernization.

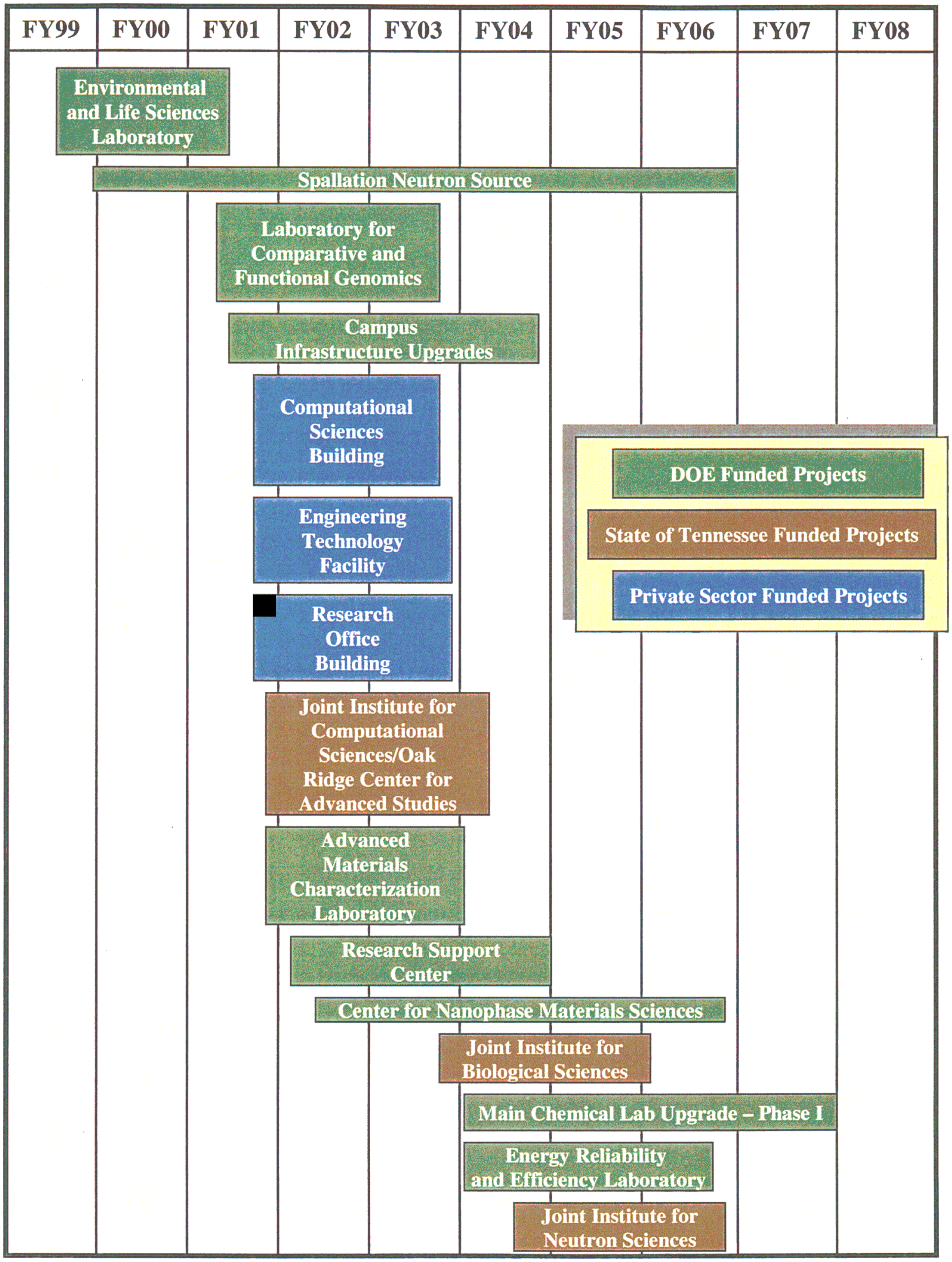


Fig. 3.34. Preliminary schedule for ORNL site development.

4. CONCLUSIONS AND RECOMMENDATIONS

The vision to establish ORNL as a 21st Century Laboratory and to ensure that the Oak Ridge Reservation (ORR) serves as an integrated science, education, industrial, and technology complex is vital to the future mission of the Laboratory. UT-Battelle has established a comprehensive and innovative approach to accomplish this vision and has the support and cooperation of DOE, the State of Tennessee, and stakeholders. With completion of the ORNL Integrated Facilities Master Plan and attainment of goals for the ORR, present missions will be successfully achieved while preparing for changing national goals and interests and reduced federal budgets.

4.1 LAND AND FACILITIES PLAN CONCLUSIONS

The ORR is a unique and irreplaceable resource for DOE to use for its national science and technology missions. Availability of the land on the ORR for future DOE projects requiring large land areas (e.g., SNS, Fusion Energy, environmental research, safety, and security) is a primary concern.Future use is to include a mixture of activities that are compatible with and contribute to ongoing and anticipated DOE missions. According to current plans, the reservation will be used to support many of the same programs it currently supports while adapting to changing national goals and interests and reduced federal budgets. Portions of the reservation will be used to promote the development of private-sector enterprises in ways that are consistent with and complementary to DOE missions. As outlined in Sect. 2, input from discussions with DOE programs as part of the DOE Land Use Planning Process indicates that most of the ORR land, except for areas around ETTP, will be needed for future DOE missions during the next 5 to 20 years. Land use planning for the ORR should identify and prioritize needs for preservation of reservation land to meet the requirements of existing and future scientific facilities, environmental research, education, and other compatible uses.

ORNL currently has one of the oldest physical plants in the DOE laboratory system, which requires efforts to maintain, renovate, and rehabilitate general-purpose buildings and utility systems, as well as to provide new mission-related facilities for expanded scientific endeavors. As outlined in Sect. 3, ORNL has developed a Master Plan for site development that supports the Laboratory's expected mission needs during the planning period; establishes a safe, high-quality, energy-efficient work environment for research and support staff in a research campus setting; and addresses the long-term maintenance and ultimate disposition of "retired" facilities in an environmentally acceptable manner. This plan will result in the consolidation of ORNL space from the current occupied levels of more than 4.8 million square feet to just over 3.2 million square feet, with the consolidated staff residing almost exclusively at the main ORNL site. Considerable resources will be required for the consolidation, deactivation, disposition, and surveillance and maintenance of excess facilities. The Master Plan outlines a phased approach to facilities modernization, with the primary emphasis during the planning period placed on establishing the East Campus infrastructure, constructing and refurbishing critical mission-oriented research facilities, and moving staff from Y-12 to the main ORNL site. The second phase will include completion of the East Campus core construction, continuing consolidation of off-site staff at the main ORNL site, and primary development of the ORNL West Campus for life and environmental sciences research.

The Enhanced Operational Discipline includes the task of upgrading the Laboratory's infrastructure and providing effective stewardship of facilities and operations resources. The development of a management process to enhance research and support operations through Facility Use Agreements, Complex Managers, Facility Core Teams, and integrated operations has been initiated. The system will define work processes and ownership, establish responsibilities and authorities, and develop continuous improvement targets for work processes.

ORNL faces an enormous challenge in the deactivation and disposition of its nonstrategic facilities. Many of these facilities are large and complex, and some contain multiple hazards. The estimated cost of facilities consolidation and S&M during the time frame of the ORNL *Strategic Facilities Plan* (FY 2001–FY 2011) is $113 million. The estimated cost for ultimate D&D of ORNL's nonstrategic facilities is $126 million. Under the present schedule and budget projections, most D&D activities will be conducted after FY 2011.

4.2 LAND AND FACILITIES PLAN RECOMMENDATIONS

4.2.1 Oak Ridge Reservation

1. Land must be preserved for future DOE programs. (The ability and/or opportunity to acquire another land area such as the ORR is not feasible.)

2. Research and scientific values are critical and must be reflected in land use planning.

3. Buffer zones must be considered. (They are required by environmental Records of Decision, safety basis documents, security requirements, etc.).

4. Future land use should incorporate provisions for potential Fusion Energy programs.

5. Future biomass opportunities, in existing programs and as a program itself, should be considered.

6. Future Carbon Sequestration program opportunities should be considered.

7. Energy Efficiency programmatic requirements must be considered in land use planning, even if it is not a DOE-EE facility/program.

8. The Environmental Management (EM) strategy for waste management must be considered in planning.

9. The funding mechanism for management of the reservation should be resolved. ORNL should not be "tin cupping" the National Nuclear Security Administration (NNSA) and EM for resources to support this DOE asset. There is an immediate and growing threat to personnel safety and property and concern regarding wildfire potential to the entire site as a result of dead and dying trees.

4.2.2 ORNL Facilities

1. DOE funding for the MEL/FS Line Item Program must be increased in order to meet Facility Revitalization objectives. Specifically, increased funding for the Research Support Center line item is needed so that this project can be completed in FY 2004 rather than FY 2005. If not, major disruptions to the entrance to the Laboratory will exist for approximately the next three years.

2. DOE customers must be prepared to support relocation costs. Four divisions continue to occupy facilities at the Y-12 National Security Complex: the Nuclear Science and Technology Division, the Life Sciences Division, the Engineering Science and Technology Division, and the Fusion Energy Division. Programs supporting these divisions must be prepared for decreased levels of scientific productivity during periods of physical relocation. Additional program resources may also be needed to move high-value program-dedicated equipment.

3. DOE support in revising an MOU concerning the disposition of facilities at Y-12 is critical to reducing ORNL's cost of exiting from Y-12. Buildings 9102-1, 9102-2, 9105, 9108, and 9201-3 have already been transferred from ORNL to Y-12. Further transfers are being vigorously pursued.

4. An increase in GPP and GPE budgets is needed. Since FY 1997, GPP and GPE funding have been approximately half of the FY 1995 level. As ORNL facilities continue to age, requirements in these areas continue to grow, and projected funding levels are clearly well below the level needed. Although the addition of Institutional GPP funding will help, an increase in GPP and GPE funding levels by DOE to pre-FY 1996 levels is still critical.

5. Strong support is needed for the ORNL Science Laboratory Infrastructure budget request associated with disposal of excess facilities. ORNL has numerous facilities that are not part of the DOE-EM cleanup baseline. These facilities may not represent large ES&H risks, but they are no longer needed to fulfill DOE missions and are expensive to maintain in a safe shutdown condition.

6. Resources necessary to address legacy issues should be provided. ORNL has targeted four legacy items to be addressed in FY 2003: cleanup of legacy materials, upgrade of nonreactor nuclear facilities and consolidation of hot cells, facilities modernization, and disposition of vacant space. The estimated cost to begin to address these items in FY 2003 is $10 million, $7.2 million of which has already been included in the Indirect Cost Stack. We will allocate this cost via a rate applied to direct labor hours (excluding SNS). We anticipate that this legacy tax will be required for a minimum of five years. This separate legacy tax not only provides incremental resources but also ensures that these legacy challenges remain highly visible to both our internal and external customers. It is essential that DOE recognize and acknowledge the institutional nature of this legacy effort.

7. Disposition of legacy material must be addressed. A major vulnerability was identified that is associated with legacy material in ORNL facilities. Legacy materials range from remote-handled reactor components, to small quantities of chemicals used and created at the bench, to furniture and excess laboratory and infrastructure equipment. These materials present safety issues, mission impacts, and, in some buildings, are a critical path item in executing facility revitalization. A major focus in FY 2003 is to identify and implement "breakthrough" disposition methods that will reduce costs and shrink time lines. A significant cost savings could be realized if some of these materials could be disposed of in the EM CERCLA Disposal Cell.

8. Resources for transition of waste management responsibilities should be provided. DOE-EM is seeking an accelerated transfer of responsibilities for currently generated wastes to ORNL. This transfer of responsibilities, if not accompanied with commensurate resources, could be the single largest new overhead cost driver facing the Laboratory in FY 2003. We need DOE-SC's support in ensuring appropriate resources are transferred along with this responsibility.

9. Consolidation of nonreactor nuclear facilities should be pursued. We have initiated a reorganization plan at ORNL that includes the consolidation of the ten nonreactor nuclear facilities into a single "Nonreactor Nuclear Facilities Complex" that will be managed in an "owner/tenant" model. A key objective to be accomplished in FY 2003 will be to gain DOE approval on a consolidation strategy to reduce the number of nuclear facilities. A second aspect of this plan is to secure $7 million in base program funding for the ongoing maintenance and operation of the Bethel Valley Hot Cell complex. We need DOE-NE support for these critical resources; otherwise, long overdue upgrades to these nuclear facilities will continue to be delayed.

10. The Facility Management Model to enhance support for R&D operations and improvements in maintenance of Laboratory infrastructure should be aggressively pursued.
11. The Facility Information Management System should be updated and maintained with current and accurate data.

12. Detailed plans, patterned after the *Central Steam Plant 10-Year Plan*, should be developed for each site utility system.

13. Integrated planning of infrastructure revitalization activities with EM Program remediation, decontamination, and demolition activities should be enhanced.

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APPENDIX A

ORNL Stakeholder Responses

No stakeholder responses received by date of publication.

APPENDIX B

Self-Sufficiency Parcels for the City of Oak Ridge

Self-Sufficiency Parcels for the City of Oak Ridge

In 1979, the Secretary of Energy approved a program to permit DOE to make financial assistance payments to the City of Oak Ridge for a five-year period under the authority of the Atomic Energy Community Act of 1955. The city submitted a self-sufficiency plan which proposed that DOE sell land to the city for industrial and commercial development. ORO determined that the land could be transferred directly at fair market value to the city in support of the self-sufficiency program rather than being reported as excess to the General Services Administration for screening and subsequent disposal. When the self-sufficiency program ended, certain remaining designated parcels that had been in review at the time were "grandfathered," thus permitting DOE to consider those transfers should the land become excess to the needs of DOE. These parcels are shown in Fig. B.1.

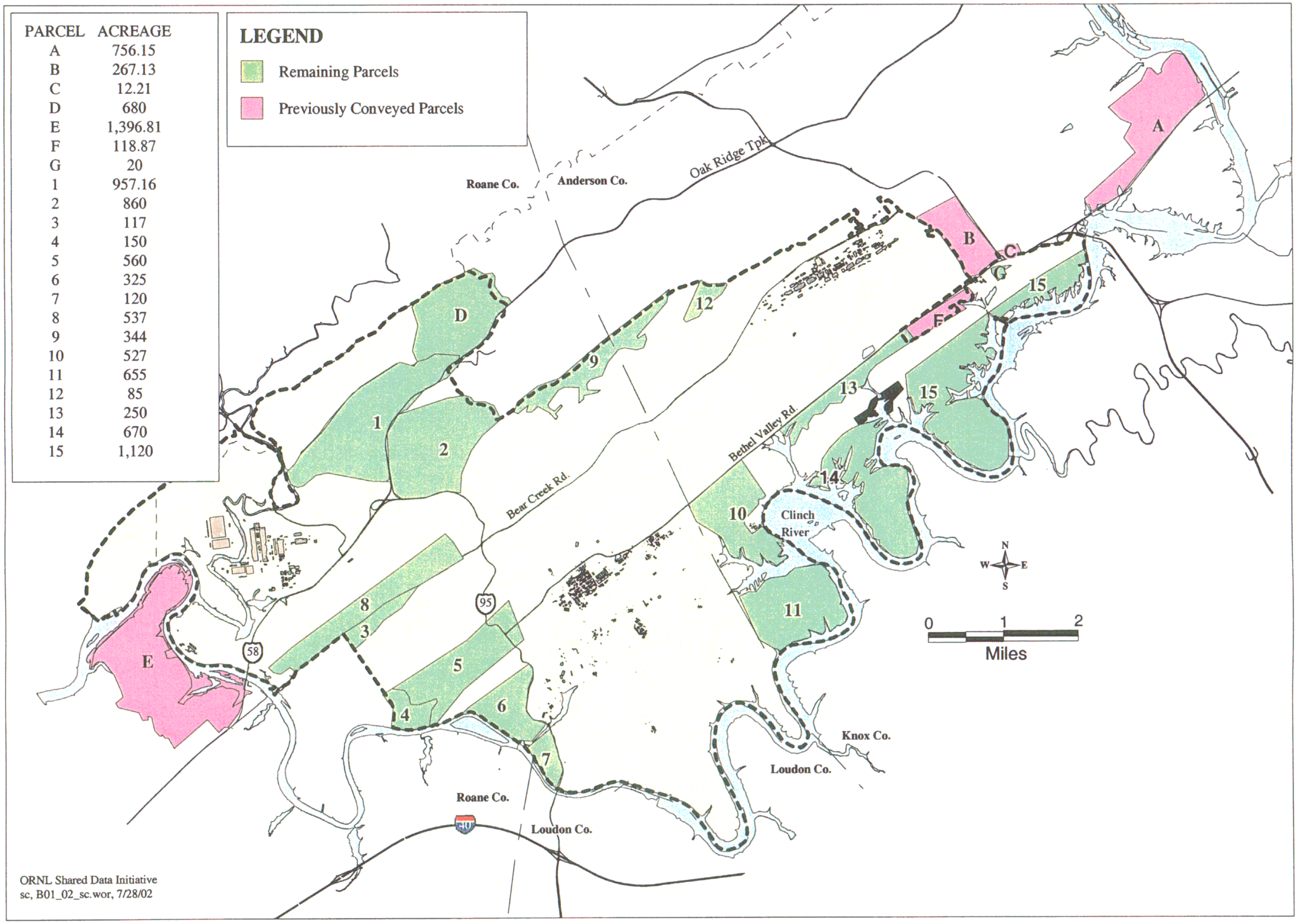

Fig. B.1. Oak Ridge Reservation self-sufficiency parcels.

APPENDIX C

Oak Ridge Reservation Research Focus

Oak Ridge Reservation Research Focus

The location of the ORR in a suburban/industrial setting in the Southeastern United States makes it a particularly valuable site for addressing several important issues dealing with future ecosystem management. The Southeastern United States is experiencing higher rates of population and industrial growth than most areas of the nation. Such growth will place increased stresses on the diverse ecosystems of the region, particularly the abundant forests and freshwaters. Forest productivity and vitality are important to the large forest products industry in the region, and water quality is critical for domestic, industrial, and recreational interests. The Southeastern United States is also thought to be among the most vulnerable regions to global climate change (Neilson and Marks 1994). Future management of terrestrial and aquatic ecosystems in the region will require a much better understanding of the interactions between these expected anthropogenic stresses and climate changes. Many species and communities in the Southeast are at the southern limits of their distributions, and warming may result in elimination. The humid climate and high rates of evapotranspiration (ET) in the Southeast increase the vulnerability to drought resulting from warming effects on ET or possible reductions in rainfall. Plant distributions and productivity, aquatic productivity and biodiversity, and water quality in the Southeast are likely to be strongly impacted by climate change.

One of the most important issues concerning the well-being and security of the nation is how to accommodate future economic development and maintain the ecosystem integrity and sustainability on which human systems ultimately depend. Management approaches to development and land use are frequently driven by emphasis on short-term productivity or economic gain, rather than the long-term sustainability of ecosystems. The ability to make rational decisions about land management and to be adaptable to changing needs and priorities while, at the same time, preserving long-term options requires a combination of long-term monitoring and research based on a fundamental understanding of the ecological processes and relationships necessary for long-term sustainability of ecosystem structure and function. The Ecological Society of America recently identified several barriers to long-term sustainability: (1) inadequate information on the biological diversity of environments, (2) widespread ignorance of the function and dynamics of ecosystems, (3) the openness and interconnectedness of ecosystems on scales that transcend management boundaries, and (4) a prevailing public perception that the immediate economic and social value of exploiting supposedly renewable resources outweighs the risk of future ecosystem damage or the benefits of alternative management approaches.

The ORR will be used for experimental research and monitoring activities addressing the following areas for the eastern deciduous forest type:

- Vegetation response to atmospheric stresses (ozone, high nitrogen deposition) under variations in climate (productivity, water use, natural pathogens);
- Changes in plant community dynamics in response to land use, atmospheric stresses, and climate variation (rare species, shifts in dominant vegetation types);
- Biogeochemical cycling and output of nitrogen with changes in nitrogen deposition and forest succession and growth;
- Interactions among different vegetation and animal communities at the landscape scale;
- Terrestrial-aquatic interactions under climate variations and terrestrial community succession or change; and
- Recovery of stream communities from past disturbances.

Expected outcomes:

- A viable, working framework and model for sustainable development of the Oak Ridge subregion.

- Establishment of the ORR as a national showcase for the environmental and social sciences missions of DOE.

- Creation of the long-term context within which the infrastructure assets of the ORR are preserved and enhanced for new initiative development.
  - -Bioremediation Demonstration Center
  - -Global Change Ecosystem Research
  - -Biofuels Feedstock Demonstrations
  - -Plant Genome Introductions
  - -Environmental Technology Demonstrations

Research on the ORR will continue to address major national issues and contribute to national and international collaborative research initiatives and issues such as:

Global Climate Change

- Manipulative experiments to evaluate impacts of future climate change
  - -U.S. Global Change Research Program
    - -Water balance manipulation
    - -Elevated CO_2
    - -Temperature manipulations
  - -NOAA/ATDD
    - -Air-surface exchange studies of interchange of heat, water vapor, carbon dioxide, ozone, sulfure dioxide, and other air pollutants
    - -Climate-related estimates of carbon balance of atmosphere

- Biodiversity
  - -Southern Appalachian Man and the Biosphere Program
    - -Biosphere Reserve Unit
    - -DOE National Environmental Research Park
    - -Threatened and endangered species
    - -Neotropical migratory birds
    - -Wildlife management

- Tropospheric Air Quality
  - -National Acid Precipitation Assessment Program
  - -North American Research Strategy for Tropospheric Ozone Program
  - -Ozone secondary air quality standard research

- Sustainable Development
  - -Council on Environmental Quality/PCSD Initiative
    - -Indices of sustainability
  - -DOE Science of Sustainability

- Multiple Stress Interactions
  -Climate Change X Ozone X Nitrogen

- Solar Radiation Monitoring
  -NOAA long-term observations for Integrated Surface Irradiance Study

There are a number of important issues where future research will draw upon the land resources of the ORR to meet future mission needs:

- Monitoring and Scaling Issues
  -National Environmental Monitoring and Research Program
  -National Index Site
  -National Environmental Report Card
  -National Aeronautics and Space Administration Ground-Truthing of Ecological Processes, Scaling
  -EPA Environmental Monitoring Technologies Test Bed

- Ecological Recovery
  -Natural and Accelerated Bioremediation Research Demonstration Site
  -Test Bed for Environmental Restoration Technologies
  -Demonstration of Ecological Recovery

- Basic Forest Biology Research
  -Genotypic and phenotypic mapping of significant forest species, either for global change research or for forest industry research
  -Forest biotechnology demonstrations
    -Short rotation woody crops
    -Herbaceous crops

- Other interagency research missions for which the ORR serves as a resource:
  -Wetlands research, wetlands banking
  -Wildlife research
    -Game species (e.g., deer and turkey)
    -Beaver
  -NOAA
    -Improving global climate-related estimates of carbon balance of atmosphere

- Landscape Dynamics/Land Use/Urban Ecosystems
  -Patch dynamics
  -Ecologically significant corridors
  -Minimum size of patch

APPENDIX D

ORNL Stakeholder Plan

ORNL Stakeholder Plan

Many individuals, communities, industries, agencies, and institutions are interested in the successful planning and growth of ORNL. While some of the stakeholders for ORNL are the same as those for ETTP and the Y-12 National Security Complex, many groups are specific to ORNL because of differing mission objectives. Recognizing these unique site needs, DOE has requested that each site establish and implement a "tailored" stakeholder plan. Through the tailored stakeholder plan, input specific to a particular site and its mission is targeted. This stakeholder plan identifies the process used for ORNL. Local stakeholder input obtained in 1995 through the DOE Future Use Initiative for the entire Oak Ridge Reservation (ORR) has been incorporated into the ORNL plan as appropriate. General land use plans for the entire ORR are identified in a comprehensive integrated planning document published in September 1999. Continuing updates to this *ORR Comprehensive Integrated Plan* will have public review for comments and will incorporate stakeholder input obtained through the site planning documents.

Requesting Input

Electronic communication is the preferred method of stakeholder review and input. Stakeholder review will be requested by E-mail, when possible, or by letter with reference to the document location on the World Wide Web. Reviewers unable to access the electronic version can request a hard copy of the document sections of interest. A comment box at the end of the Web document will facilitate reviewer input on individual document sections. Comments will be returned to Pat Parr, ORNL Area Manager, and Tony Medley, Director, ORNL Facilities and Operations Infrastructure Planning. The number of hits and the location of the hits on the document will be recorded.

Incorporation of Stakeholder Comments

All comments will be evaluated for compatibility with the ORNL Vision for Land Use. Where appropriate and possible, these responses have been or will be incorporated into the Plan of Current Land Uses and Planning for Future Land Uses. Planning land uses is an opportunistic and dynamic process. Through the ORNL Land and Facility Use Committee, additional comments, ideas, and suggestions will be evaluated in a timely manner for implementation and reviewed through the Reservation Management Organization, as needed.

Responding to Stakeholder's Input

Receipt of stakeholder comments will be acknowledged. For the most part, however, a response to each stakeholder comment will not be provided to the stakeholder. Updated versions of the document will be brought to the attention of the participating stakeholders. Opportunities to comment on additional drafts of the document, as well as document updates, will be provided.

Identification of ORNL Stakeholders

A diverse group of agencies, institutions, and organizations will be contacted for stakeholder input and includes

A. DOE Oak Ridge Operations and Headquarters Sponsors/Programs - such as *ORNL Institutional Plan* reviewers, DOE Office of Science, DOE ORNL Site Office, National Environmental Research Parks.

B. Other agencies that support research - including UT-Battelle, National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency, Electric Power Research Institute, National Aeronautics and Space Administration, Department of Defense, Southern Appalachian Man and the Biosphere, National Park Service, Tennessee Valley Authority.

C. Educational users - The University of Tennessee, Oak Ridge Associated Universities, Tennessee Technological University, University of Tennessee Forestry Experiment Station.

D. Natural Resource Trustees or Agencies - DOE's List of Natural Resource Trustees, Tennessee Wildlife Resources Agency, Tennessee Department of Environment and Conservation Natural Heritage Program, Tennessee Department of Environment and Conservation Oversight Office, U.S. Fish and Wildlife Service, Tennessee Valley Authority.

E. Professional organizations with large-scale perspective on ecosystem management - Ecological Society of America, Association of Southeastern Biologists, Tennessee Nature Conservancy, Partners in Flight.

F. Other - Friends of Oak Ridge National Laboratory, Tennessee Citizens for Wilderness Planning, World Engineering Partnership for Sustainable Development, Advocates for the Oak Ridge Reservation, Southern Appalachian Man and the Biosphere, Local Oversight Committee, Citizens' Advisory Panel, DOE Land Use Planning Process Focus Group, local elected officials, general public.

APPENDIX E

DOE/UT-Battelle Contract
(Section on Land-Use Planning and Management)

Excerpts from Contract No. DE-AC05-00OR22725

C-2. Statement of Work (SOW)

(a) Research and Development

(6) The Contractor shall manage and maintain government-owned buildings and facilities at the Laboratory site and the NERP, together with the utilities and appurtenances thereto. The Contractor is also responsible for certain buildings at the Y-12 Plant which house major facilities and equipment in support of ORNL programs. Some of the facilities at the Laboratory related to the cleanup of the site are managed by the DOE-Oak Ridge Operations (ORO) Environmental Management, Management and Integration prime contractor.

(e) Other Activities

(2) The Contractor shall support DOE/ORO in its responsibilities for land use planning and land management activities for the DOE Oak Ridge Reservation, which consists of 34,545* acres of federally-owned land. The Contractor's responsibilities, as directed by DOE and as identified in the DOE/ORO Reservation Management Plan and the Facility Information Management System (FIMS) database, include land and facility planning for the Laboratory site, conducting research and operational and maintenance activities within the NERP, and integrating reservation activities among contractors and other parties to support DOE's management responsibility.

Section I

I-131. 970.5204-60 Facilities Management (Nov 1997)

(a) *Site Development Planning.* The Government shall provide to the contractor site development guidance for the facilities and lands for which the contractor is responsible under the terms and conditions of this contract. Based upon this guidance, the contractor shall prepare, and maintain through annual updates, a Long-Range Site Development Plan (Plan) to reflect those actions necessary to keep the development of these facilities current with the needs of the Government and allow the contractor to successfully accomplish the work required under this contract. In developing this Plan, the contractor shall follow the procedural guidance set forth in the applicable DOE Directives in the Life Cycle Facility Operations Series listed elsewhere in this contract. The contractor shall use the Plan to manage and control the development of facilities and lands. All plans and revisions shall be approved by the Government.

*As of April 2002, the Oak Ridge Reservation consists of 34,235 acres.

APPENDIX F

Supporting Information

SUPPORTING INFORMATION

This plan has been developed with the philosophy of referencing existing, relevant planning documents whenever possible and duplicating information from those documents only to the extent necessary to assure a cogent, comprehensive presentation of appropriate information within the context of this plan. Users, therefore, should access the referenced documents for detailed information. The *ORNL Land and Facilities Plan* will be updated periodically on the World Wide Web as significant changes to the information in the plan occur. *Paper copies of this plan should be utilized with the understanding that they may not contain the most current information available.*

Listed below are the key planning documents that support this plan. A short description of the referenced document is provided along with a World Wide Web Uniform Resource Locator (URL) address, if one is available. An organizational contact responsible for the specific document is also provided (Table 3.1).

F.1 COMPREHENSIVE INTEGRATED PLANNING PROCESS FOR THE OAK RIDGE OPERATIONS SITES

The *Oak Ridge Reservation (ORR) Comprehensive Integrated Plan* is intended to assist DOE and contractor personnel in implementing a comprehensive/integrated planning process consistent with DOE Order 430.1A, "Life Cycle Asset Management." DOE contractors are charged with developing and producing the *ORR Comprehensive Integrated Plan*, which serves as a summary document, providing information from other planning efforts regarding vision statements, missions, contextual conditions, resources and facilities, decision processes, and stakeholder involvement.

The *ORR Comprehensive Integrated Plan* is a planning reference that identifies primary issues regarding major changes in land and facility use and serves all programs and functions on-site, as well as the DOE-ORO and DOE Headquarters. The plan illustrates (1) how the ORR, as a valuable national resource, is and shall be managed based on the principles of ecosystem management and sustainable development and (2) how mission, economic, ecological, social, and cultural factors are used to guide land and facility use decisions. The long-term goals of the comprehensive integrated planning process, in priority order, are to support DOE critical missions and stimulate the economy while maintaining a quality environment. (Available at URL http://www.ornl.gov/~dmsi/cip/.)

F.2 ESHQ&I MANAGEMENT PLAN INFORMATION SYSTEM

The ESHQ&I Management Plan Information System was developed to serve as a management decision-making support tool. It accepts and stores data associated with ESHQ&I activity data sheets (ADSs) either from the ORNL Program Management Tracking System (PMTS) or as direct input information into an ADS. The system accepts the risk matrix scores assigned to each ADS by the ORNL Risk Ranking Board and screens for entry of all pertinent data associated with an ADS and support data validation where possible and appropriate. This system provides flexibility in viewing and editing data with powerful features for querying, indexing, and reporting data. (Available on the Web at URL http://svr1.cmo.ornl.gov/eshwc/wc.dll?eshweb~TopPage.)

F.3 ENVIRONMENTAL MANAGEMENT PROGRAM LIFE CYCLE BASELINE

The Environmental Management Program Life Cycle Baseline (LCB) is the primary tool used by Bechtel Jacobs Company, LLC, in planning the cleanup of contaminated sites and facilities within the scope of the program. The LCB is used to perform long-range and strategic planning, develop financial budget requests, identify resource requirements, measure performance, and facilitate the development of subcontracting plans. (Current and prior year baselines are available on the World Wide Web at URL http//www.bechteljacobs.org/ busmgt/baseline/Baselines.html.)

F.4 ESHQ&I BUDGET FORMULATION SUBMISSION FOR ORNL

ORNL's annual *ESHQ&I Budget Formulation Submission* is developed in accordance with the annual *DOE Guidance Manual for the ES&H Planning Process*. ESHQ&I activities are identified to ensure the health and safety of employees and the public; protection of the environment; and compliance with applicable laws, regulations, DOE policies and orders, and other ESHQ&I requirements, while carrying out the site's missions and the planning for ORNL infrastructure needs that support R&D as well as the environment, safety, health, and quality. This plan is developed using risk-based planning and priority-setting methodologies to (1) establish and communicate ESHQ&I expectations to all stakeholders, (2) support the development of Departmental budgets and secure funding for ESHQ&I programs and activities, (3) support the integration of ESHQ&I principles in site-wide work planning and execution, and (4) assess ESHQ&I performance and provide feedback to promote continuous improvement. (Available at URL http://www.ornl.gov/camext/CAMIndex.htm.)

F.5 ESHQ&I MANAGEMENT PLAN AND EXECUTION PLAN FOR ORNL

The annual *ORNL ESHQ&I Management Plan and Execution Plan* was developed to describe the approach used at ORNL to ensure the health and safety of employees and the public, protect the environment, comply with contractual requirements set forth in the Work Smart Standards (WSSs) agreed upon by the contractor and DOE, and manage physical assets and infrastructure from acquisition through operation and disposition. This plan documents the systems and processes used by ORNL to (1) establish and communicate ESHQ&I expectations and requirements to the ORNL community, (2) identify and secure funding for ESHQ&I activities using risk-based planning and priority setting, (3) conduct R&D activities and operations through integration of ESHQ&I principles in work planning and execution, and (4) assess ESHQ&I performance and provide feedback to promote continuous improvement. The plan is prepared annually in accordance with guidelines in the annual *DOE Guidance Manual for the ES&H Planning Process*, and its issuance satisfies the requirement in the DOE/UT-Battelle Management Contract, I.101 970.5204-2(c). ORNL has an integrated ESHQ&I database system that enables the Laboratory to (1) meet major ESHQ&I commitments, (2) address key issues, (3) manage unfunded ESHQ&I risks, (4) systematically provide information for the reduction of ESHQ&I risks, and (5) establish and maintain stakeholder confidence. (Available on the World Wide Web at URL http://www.ornl.gov/camext/CAMIndex.htm.)

F.6 ORNL FACILITY INDEX

The ORNL Facility Index is an internally available Web-based database of ORNL facilities with related links that include ORNL site maps, the ORNL Facilities Management Database, the ORNL Area Responsibility Listing, the ORNL Condition Assessment Survey (CAS), the ORNL Space Allocation

Management System (SAMS), the Property Management System (PRISM), GLI Web-General Locator Information, and Whos. Photographs of the facilities are also found in this index. (Available at http://home.ornl.gov/~q9t/facility/.)

F.7 ORNL INSTITUTIONAL PLAN

ORNL produces an institutional plan each year to convey information about the Laboratory to DOE. The institutional planning process provides a means for DOE to consider the Laboratory as an institution (rather than as a collection of programs) and to review its mission, its health as an institution, and its plans for the future. DOE approval of ORNL's institutional plan indicates that the Laboratory's mission, vision, and strategic plan are aligned with Departmental needs and plans. (Available on the World Wide Web at URL http://www.ornl.gov/inst_plan/IP_Outline.html.)

F.8 ORNL LABORATORY AGENDA

UT-Battelle's plan for ORNL is guided by a commitment to achieving simultaneous excellence in the areas of science and technology, Laboratory operations and ES&H, and community service. The UT-Battelle Leadership Team has developed a Laboratory Agenda to provide a structured framework for the long-term initiatives, critical outcomes, and near-term actions through which it will deliver on this commitment. The Laboratory Agenda is focused on the most significant activities that UT-Battelle must accomplish to achieve its vision of simultaneous excellence. It includes clear statements of the primary results that will be delivered to DOE over the next few years. (The URL is http://home.ornl. gov/offices/strategic_planning/stratplan/ labagenda/lab_agenda.htm.)

F.9 ORNL LAND AND FACILITIES PLAN

The *ORNL Land and Facilities Plan* provides current information concerning DOE-ORO reservation land use development, integrated strategic facilities planning, cost and schedules for planned projects, and conclusions and recommendations. The plan contains maps and tables describing major facility systems and structures. (Available at URL http://www.ornl.gov/~dmsi/landUse/.)

F.10 OAK RIDGE RESERVATION ANNUAL SITE ENVIRONMENTAL REPORT

This document contains a summary of environmental monitoring activities on the ORR and its surroundings. The monitoring and documentation criteria are described within the requirements of DOE Order 5400.1, "General Environmental Protection Program." The results summarized in this annual report are based on the data collected prior to and through the reported year. (Available on the World Wide Web at URL http://www.ornl.gov/Env_Rpt/aser2000/aser2000.htm.)

F.11 OAK RIDGE RESERVATION MANAGEMENT PLAN

The primary purpose of this management plan is to define responsibilities and authority for ORR management. The management plan treats the ORR as a single site wherever possible and addresses roles and responsibilities for managing the physical and human resources of the reservation on both a day-to-day and long-term basis. The focus of the document is to address general overall reservation policy and management, particularly as it relates to the portion of the ORR outside the immediate site boundaries. (Available on the Web at URL http://home.ornl.gov/general/orrmp/.)

F.12 ORNL STRATEGIC FACILITIES PLAN

The *ORNL Strategic Facilities Plan* provides: a brief overview of the Facilities Revitalization Project (FRP) team established to accomplish the revitalization mission; a review of the current inventory and condition of existing ORNL facilities, as well as the programmatic mission drivers that are the basis for future facilities needs; and an outline of the specific facilities consolidation, upgrade, and new construction needs that leads to the overall Master Plan for ORNL development. The preliminary cost and schedule estimates for completing that Master Plan are then provided, followed by a short discussion of the conclusions and recommendations of the strategic planning exercise. (Available on the World Wide Web at URL http://www.ornl.gov/~dmsi/ strategic_plan/index.html.)

F.13 ORNL PARKING LOT AND TRAFFIC FLOW PLAN

The *ORNL Parking Lot and Traffic Flow Plan* addresses the impact of the FRP on Laboratory parking areas and traffic flow. Included in the plan are activities that will be implemented to properly mitigate the impact to employees and visitors, including parking lot construction and operations, a summary of parking supply and demand, new transportation initiatives, communication, and site access and control. (Available on the World Wide Web at URL http://www.ornl.gov/~dmsi/parking.)

APPENDIX G

Environment, Safety, Health, and Quality
Facility Environmental Vulnerability Assessment

Environment Protection and Waste Services/
Facility Environmental Vulnerability Assessment

Environmental Protection and Waste Services (EP&WS) is ORNL's liaison with regulators, interpreting and translating requirements, managing all aspects of the permitting processes and operations for newly generated waste, and monitoring and reporting on the environmental impact of ORNL operations. EP&WS is also responsible for the Facility Environmental Vulnerability Assessment Recommendations Implementation (FEVARI).

Environmental and waste services provided include programs focusing on ensuring UT-Battelle's compliance with federal and associated state environmental regulations, such as the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), and Comprehensive Environmental Response, Liability, and Compensation Act (CERCLA); monitoring (including sampling and sample management for laboratory analyses) for the ORNL site and the ORR to support compliance with permitted programs, compliance agreements, and regulatory requirements; environmental surveillance on the ORR to monitor the effect of DOE activities on-site and off-site on environmental and natural resources; environmental management to provide resources for the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), state oversight agreements between DOE and the State of Tennessee; coordination of ORNL environmental management, including managing Work Authorization Documents, developing strategic connections between ORNL remediation and facility modernization efforts, and coordinating ORNL interfaces between ORNL and Bechtel Jacobs Company, LLC; and ensuring that UT-Battelle's waste is properly characterized and certified to meet all requirements and assisting in getting its waste ready for receipt by Bechtel Jacobs Company, LLC.

Current Activities and Future Needs: Facility upgrades are planned for environmental sampling laboratories and administrative space within the scope of work for the Building 4500 Line Item Project.

Facility Environmental Vulnerability Assessment (FEVA)

In the spring of 2001, a Facility Environmental Vulnerability Assessment (FEVA) was conducted at ORNL (ORNL/TM-2001/123, June 2000). The primary goal of the FEVA is to establish an environmental vulnerability baseline that can be used to support the Laboratory planning process and to place environmental liabilities in perspective. The information developed by FEVA provided the basis for management to identify and initiate immediate, near-term and long-term actions to respond to the identified vulnerabilities.

The FEVA did not identify any need for immediate "stop work" actions. It is recognized, however, that the potential exists for low-level releases of contaminants from the aging ORNL infrastructure. A number of near-term and long-term actions and initiatives has been identified to address the FEVA recommendations. These recommendations can be grouped into the following major types of actions: (1) systems implementation (e.g., environmental policy, Systems Based Management, and Environmental Management and Facility Operation and Management Systems) to address fundamental Laboratory management process vulnerabilities; (2) investigations and studies to confirm existing conditions, determine if additional vulnerabilities exist, and identify actions to address them (e.g., once-through cooling evaluation, facility process evaluations, waste inventories, Land and Facilities Plan, ESHQ&I Budget Submission); and (3) actions to directly address identified vulnerabilities (e.g., contaminated vegetation removal, reduction in discharges to the Process Waste System drains, reduction/consolidation

Environment Protection and Waste Services/
Facility Environmental Vulnerability Assessment
(Cont'd)

of ORNL waste inventories, infrastructure upgrades, etc.). The FEVARI project, funded through the Operations Improvement Program (OIP), will initiate selected actions to address FEVA recommendations. A number of currently planned activities are also being used to respond to the FEVA recommendations. Results from FEVARI will be incorporated into existing Laboratory initiatives (*ORNL Land and Facilities Plan* and *ORNL ESHQ&I Budget Formulation Submission*) to help ensure that environmental vulnerabilities and infrastructure upgrades are identified and addressed.

Operational Safety Services

Operational Safety Services programs provide managers and employees with technical support, consultation, and oversight in the areas of industrial hygiene, radiation protection, occupational safety, and nuclear safety to minimize the risk of exposures to chemical, physical, radiological, and biological hazards.

Services provided in radiation protection include surveillance of ongoing activities involving radiation hazards; characterization of radiation and contamination hazards in work environments; identification and control of areas where hazards exist; clearance of materials; maintenance of an effective and efficient dose assessment program, including whole-body counting, bioassay, external dosimetry, and dosimetry data management; guidance and control for ALARA; and collection and dissemination of data for performance measures.

Services provided by fire protection include both establishing a fire-safe posture at ORNL and ensuring that fire-related threats to life, property, and the public are minimized.

Services provided in industrial hygiene and industrial safety include analyzing regulations; analyzing injury/illness and vehicle accident reports; conducting accident/illness trend analysis (Laboratory level); maintaining current material safety data sheets; monitoring employees and analyzing employee monitoring results; assisting in the implementation of health and safety programs; assisting with work planning; assisting in the selection, use, and training for personal protective equipment; participating in operational readiness reviews; conducting hazard analysis/control; investigating accidents/injuries, motor vehicle accidents, and employee concerns; and supporting self-assessment, the respiratory protection program, and training development and delivery.

Services provided in nuclear/facility safety include guidance for configuration management, conduct of operations, and unreviewed safety question determinations; facility surveillance and support visits; occurrence investigations, readiness reviews and assessments, and special task reviews; support for the Accelerator Safety, Criticality, and Reactor Review Committees; and guidance and reviews for facility authorization basis documents.

Current Activities and Future Needs: Building 5500 has been upgraded to house industrial hygiene and industrial safety services. The respiratory protection program's cleaning, testing, and issue activities have been co-located in Building 5500 to improve services. Future needs include upgrades to Building 2007 for the Whole-Body Counting Laboratory change rooms and administrative areas, relocation of the External Dosimetry Laboratory from a trailer to a permanent upgraded facility, and relocation of the Internal Dosimetry Laboratory to upgraded laboratories. Internal dosimetry laboratories are currently located in Building 4500S and will be relocated as part of the Building 4500 Renovation Line Item.

Quality Services

Quality Services programs provide services in the areas of quality planning; quality engineering; inspection, surveillance and verification assessment; and occurrence and issues management.

Services provided in Quality include interpretation of quality requirements for customers and ensuring the development of implementing systems; supplier evaluation services (SES) and procurement document quality reviews; metrology (NIST-traceable calibration of M&TE); ORNL Occurrence Reporting; technical evaluations of quality-related activities; issues management; alerts and Lessons Learned Program; radiographic, ultrasonic, liquid penetrant, magnetic particle, mass spectrometer examinations of materials and weldments; visual inspections of mechanical, electrical, structural, and civil activities; quality engineering functions for planning, design, construction, and acceptance; welding engineering functions for weld procedures, reviews, and consultation; and intercomparison studies.

Current Activities and Future Needs: Quality Services programs are currently located in substandard facilities. Quality management and inspection programs, currently located in Building 3017, are scheduled for relocation to Building 5500 by FY 2006. Respirator cleaning and testing services, which were located in Building 2013, have been relocated to Building 5500. Building 2013 is scheduled to be demolished by September 30, 2002. Metrology Services, located in Building 2033, is scheduled to be moved to Building 5510A by December 31, 2002. General plant projects are planned to provide upgraded facility space for other Quality Services programs in Buildings 5500 and 5510A.

Records, Training, and Standards-based Management System (SBMS)

Records, Training, and SBMS Services Division (RTSSD) is responsible for services and support for ORNL records management functions; corporate management and integration of all ORNL training activities and provision of core training services; and development and implementation of the ORNL Standards-Based Management System (SBMS).

Records Management provides services and support to ORNL for achieving life cycle management of its information resources, and promotes compliance with records management and document control requirements. Included in these services are the development of records retention and disposition schedules; management of the ORNL Inactive Records Center; management of the transfer of inactive records to the National Archives or Federal Records Center; coordination of Laboratory activities relating to the use of ORNL information by federal, state, and citizen groups; compliance coordination in areas of records management and document control; and development and implementation of electronic solutions to information management.

Training Program Administration and Training Services provides for corporate management of all ORNL training and qualification activities, as well as core training services in the areas of environmental protection, staff safety and health protection, and quality management (ESH&Q). Included in these services are management and administration of the Training and Qualification (TQ) Management System; development and maintenance of procedures established to support the TQ Management System; guidance for implementation/conduct of training activities; administration of the corporate training data management system and provision of user support services; training information management and communication; training assessments and program evaluations, assistance in determining staff training and qualification needs, provision of over 150 ESH&Q training courses through classroom, web-based, and other delivery methods; and training design, development, and implementation.

RTSSD is responsible for development, deployment, and management of the ORNL Standards-Based Management System (SBMS), an operations improvement initiative with phased implementation during the FY 2001-2003 period. The SBMS translates laws, orders, and regulatory requirements into Laboratory-wide subject area documents (procedures and guidelines) that are current, accurate and relevant to the work being performed by staff. This area of service includes *Information Development and Integration* for basic support for developing management system descriptions and subject area documents (Laboratory-wide procedures and guidelines) and integration review of all new and revised policies, management system descriptions, R2A2s (Roles, Responsibilities, Accountabilities and Authorities), subject areas documents, and Program Descriptions; and *Operations and Administration* to provide on-line delivery of management system descriptions, policies, subject area documents, program descriptions, the Support Services Directory, R2A2s, and document review/comment process tools.

The SBMS Help Desk is provided for Requirements Management for initiation/maintenance of the requirements decision record (RDR); preparation of response letters to DOE; maintenance of the listing of contract requirements (Work Smart Standards); distribution of other external drivers that are identified by management system owners to other management system owners, as appropriate; maintenance of the listing of other internal or external drivers; maintenance of FMC, Draft DOE orders and Impact Assessment reviews/comments; maintenance of review and comment information on potential contract changes; and maintenance of variances to requirements.

Current Activities and Future Needs: No specific needs are identified for these activities.

Fire Protection

ORNL maintains a professionally staffed and equipped fire department to respond to fire, medical, rescue, and other general emergencies. A comprehensive, looped proprietary fire alarm system serves facilities at the ORNL site. ORNL facilities at the K-25 Site and the Y-12 National Security Complex are provided fire and emergency response by on-site fire departments. The ORNL Fire Station, located in Building 2500 near the western end of the Bethel Valley site, provides a central alarm signal receiving station and houses emergency equipment, including fire engines, rescue vehicles, and ambulances. A second fire alarm receiving station location is provided at Building 4512, the Laboratory Emergency Response Center. Most ORNL buildings are equipped with fire protection systems having automatic capabilities which include fire detection, occupant notification of evacuation, alarm signal transmission to the ORNL Fire Department, and fire suppression system initiation. National and State of Tennessee codes and consensus standards require a rigorous Inspection, Testing, and Maintenance (IT&M) program of fire alarm and protective systems. The Fire Department performs and/or coordinates systems IT&M or repairs of all site fixed fire protection systems.

Fire Protection Engineering reviews all engineering plans to ensure that fire codes and applicable DOE orders are met. Codes also require that roads to buildings be constructed with the required width and capability to support the emergency response and fire equipment.

The system that supplies water for fire protection is generally adequate. However, a small percentage of the system has vulnerabilities due mostly to age. System vulnerabilities include (1) old, deteriorated water lines that are likely to cause an impairment; (2) an inadequate number of sectional valves to isolate an impairment; (3) dead-end lines without loops; and (4) insufficient lines to adequately service developing sites.

Wildland fire control is primarily provided by the ORNL Forestry Management Group. This group maintains access to trained personnel, equipment, and other resources to initiate emergency and preventive wildland fire control operations on the Oak Ridge Reservation.

Current Activities and Future Needs: Significant fire protection upgrades are being addressed through a Line Item project for the installation of improved, reliable fire alarm and suppression capabilities by replacing deteriorated, obsolete systems; replacing the single 16-inch water main in the east central section of ORNL with a looped system; and extending coverage of automatic alarm systems and sprinkler systems to areas not previously served. A General Plant Project is providing improved fire protection equipment and systems in selected facilities at the ORNL main site. Fire protection reviews are ongoing as a method to identify and list concerns and improvement opportunities for future funding and project activity.

Construction Support Services

Construction Safety provides an interface to ensure that site-specific ES&H requirements are identified and incorporated into project planning and documentation. Through interaction and individual alignment with project managers (PMs) and subcontract requesters (SRs), Construction Safety provides the liaison between the PM/SR and the Procurement Division to ensure that ES&H is included during the project planning process, as well as during work execution in the field.

Current Activities and Future Needs: Construction Support Services personnel are currently located in a substandard facility and will be relocated to upgraded facilities in the FY 2005–FY 2006 time frame.

Health Services

The Health Services programs provide assessment of worker health and fitness for work assignments, on-site primary care for minor illnesses and injuries as well as first response for medical emergencies, and monitor both short- and long-term effects of occupational activities on worker health.

Health Services provides programs (1) to assist in the maintenance and protection of optimal health through occupational medicine, psychology, and nursing and (2) to maintain a close interface with allied health disciplines and programs offering employees counseling, treatment, rehabilitation, and/or referral services for a wide range of problems ranging from drug and alcohol abuse to marital, financial, job and/or career development issues.

Current Activities and Future Needs: The upgrades to Building 4500N and the construction and modernization of other facilities will allow for additional space in Building 4500N for expansion and modernization of the medical facilities.

Hazardous Material Transportation, Storage, and Handling

Many buildings at ORNL receive, store, or use hazardous materials or chemicals. Storage of chemicals is typically limited to amounts that can be used in short periods and involve small amounts or consumer volume (defined as laboratory quantities, which, if suddenly released, would have no measurable off-site impact). Larger volumes of hazardous materials may be stored in bulk at various locations. Only two facilities have been identified as bulk storage areas, and neither poses any off-site release impact. The refueling station is the primary location where large volumes of hazardous fuels and oils are stored. It is separated from other facilities by sufficient distance to minimize any on-site or off-site impact from an inadvertent spill, release, or fire. The Materials Receiving Area provides large-capacity storage for compressed gases used throughout ORNL. Gas cylinders are properly secured to prevent inadvertent tipover accidents, and hazardous gases are segregated to prevent the formation of toxic chemical combinations. Transportation of hazardous materials and chemicals is typically performed by the ORNL shipping and receiving function in accordance with all applicable U.S. Department of Transportation (DOT) regulations. A Transportation Safety Document (TSD) has been completed for on-site transportation that provides a process to transport hazardous materials with negligible risk due to equivalent DOT safety practices when all DOT requirements cannot be achieved.

Chemicals and radioactive materials in transit within the ORR are packaged in accordance with DOT regulations or equivalent packaging requirements and are not considered capable of creating an off-site release of hazardous materials. Moreover, receipt, handling, and storage of bulk chemicals is not expected to affect facility operations. Efforts have been made to minimize the probability of these types of accidents so that the potential for off-site releases from the affected facilities is minimal.

Current Activities and Future Needs: Future plans identify a need to construct a Transportation and Packaging Facility. The current operations are in a substandard building that was not designed for this operation.

APPENDIX H

Waste Management and Environmental Restoration

WASTE MANAGEMENT AND ENVIRONMENTAL RESTORATION

H.1 WASTE MANAGEMENT

On February 1, 1999, Bechtel Jacobs Company, LLC, assumed responsibilities for waste storage, transport, and disposal at ORNL. Most of the functions previously performed by the ORNL Waste Management Operations Division transitioned to Bechtel Jacobs Company, LLC.

To ensure that ORNL waste is properly characterized and certified to meet all requirements and to assist ORNL in getting its waste ready for receipt by Bechtel Jacobs Company, LLC, ORNL established an organization called Laboratory Waste Services (LWS), which has three major groups: (1) Planning and Administration, (2) Waste Characterization and Handling, and (3) Waste Certification.

The Planning and Administration Group focuses on day-to-day operations; strategic planning, including up-front waste management planning with new generators, such as the Spallation Neutron Source Division; the interface with Bechtel Jacobs Company, LLC, and its subcontractors; and waste management performance measurement. This group also integrates and coordinates the pollution prevention and recycle functions for ORNL.

The Waste Characterization and Handling Group focuses on assuring that waste is adequately characterized, packaged, and certified for transfer to Bechtel Jacobs Company, LLC, or its subcontractors for treatment, storage, or disposal. In addition, the group operates a consolidated 90-day area and schedules all waste transferred to Bechtel Jacobs Company, LLC.

Another organizational element, the Waste Certification Office, reviews characterization and certification information and provides the final Laboratory waste certification.

ORNL's wastes are managed in seven categories: conventional, low-level radioactive, transuranic, hazardous, mixed, toxic, and classified. This section discusses the sources of these wastes and the facilities for treatment, storage, and disposal.

H.1.1 Conventional Waste

Conventional wastes include sanitary/industrial wastes, sanitary sewage, process wastewater, and stormwater. Solid conventional wastes are regulated by the Tennessee Solid Waste Management Act.

Sanitary/Industrial Wastes. See Appendix I.

Sanitary Sewage Collection and Treatment. See Appendix I.

Process Wastewater. The collection system consists of a series of underground pipes where process wastewater flows from the source facility to a pumping station for transfer to the Process Waste Treatment Complex (Buildings 3544 and 3608). At strategic points throughout the collection system, manholes are equipped with alpha and beta-gamma radiation monitors, pH monitors, and/or flow monitors that are continuously monitored at the Waste Operations Control Center (WOCC) to allow personnel to detect any unusual activity within the system. Wastewater goes to either the radiological or nonradiological treatment process based on radiation limits monitored at these manholes. Wastewater going to radiological treatment is transferred to the storage tanks (two 350,000-gallon and one

1,000,000-gallon capacity each) at Building 2600. An underground pipe is used to transfer the wastewater to Building 3608 for water softening prior to its transfer to Building 3544 for radiological treatment.

Process Waste Treatment Complex - Building 3544. The process equipment installed for the Building 3544 operations was originally sized on a process water design flow rate of 200 gallons per minute (gpm). In early 1997, modifications were made to Building 3608 to relocate the water softening operation from Building 3544 to the spare clarifier at Building 3608. This modification allowed personnel to achieve treatment rates of 300 gpm at Building 3544 and was placed in service in the spring of 1997 after an extensive test and evaluation. The existing clarifier and filter press at Building 3544 were placed in standby for use if needed under unusual circumstances.

The Building 3544 treatment process consists of three basic operations: precipitation (which actually takes place at Building 3608), filtration, and ion exchange. The first two of these, together called head-end treatment, utilize conventional water-treatment equipment: a sludge recycle tank, a sludge-blanket-type precipitator-clarifier, and pressure filters. The ion-exchange equipment, utilizing a process with strong acid cation exchange resins, is tailored to the process based on criteria developed during the pilot plant operations. There is also the capability, when needed, to treat up to 180 gpm of wastewater through a chabazite zeolite resin for the removal of radioactive cesium.

Process Waste Treatment Complex - Building 3608. This facility was designed to treat process wastewater from the Process Waste Treatment Complex - Building 3544, the 4500, 2000, and 1505 Areas, and the HFIR/REDC site to remove particulates, heavy metals, and organics, as well as to adjust the pH of the wastewater before discharge to White Oak Creek. Building 3608 was designed to segregate its incoming waste streams into two streams: one containing heavy metals and one not containing heavy metals. At the facility are two 325,000-gallon surge tanks: one receives heavy metals wastewater, and the other receives the nonmetals wastewater. The facility consists of the following unit operations: precipitation, filtration, air stripping, treatment through granular-activated carbon columns, and pH adjustment.

Building 3608 has the capacity to treat up to 760 gpm (1.1 Mgd) of wastewater. This facility is operated 24 h/day, 7 days/week. The plant is controlled using a computerized system that allows the operator to monitor and control the plant operations either from the Building 3608 control room or from backup control consoles at other waste management facilities that are manned 24 h/day, 7 days/week.

In late 1996, modifications were made to route process waste from the surge tanks at Building 2600 to Building 3608 for water softening prior to treatment at Building 3544. This was done to eliminate mechanical restrictions that limited the throughput of the existing water-softening process at Building 3544 to no more than 200 gpm. With the modifications to Building 3608, the water-softening throughput was increased to over 300 gpm. The modifications included installation of piping to allow the water from Building 2600 to bypass the metals tank at Building 3608 and go directly to the clarification process. One of the clarifiers was modified for water-softening operations. A new surge tank and feed pumps to transfer the softened water to Building 3544 for further treatment were also installed. The modifications were declared fully operational in the spring of 1997.

H.1.2 Liquid Low-Level Waste System

The Liquid Low-Level Waste (LLLW) system/facilities are located throughout ORNL—the LLLW storage tanks are located near the LLLW source buildings, the LLLW Evaporator Facility is located near

Third Street, and the Melton Valley Storage Tanks (MVSTs) and LLLW Solidification Facility are located in Melton Valley.

LLLW Collection Tanks

Bethel Valley. The collection tank (F-1401, located at Building 2099) currently in service in Bethel Valley is fabricated of stainless steel and was placed into service in Bethel Valley in April 1996. This tank is double-contained in a stainless-steel-lined concrete vault with leak detection and meets all requirements of the Federal Facilities Agreement (FFA) for the LLLW system. This tank services Building 2026. Waste from F-1401 is transferred to the LLLW Evaporator System. Other buildings on the LLLW system in Bethel Valley transfer directly to the system without first being collected in a collection tank outside of the generating building.

Melton Valley. There is only one tank currently in service in Melton Valley. Tank F-1800 (located at Building 7966) is a 10,000-gallon horizontal collection tank located in Melton Valley to serve Buildings 7920 and 7930 (the REDC). This tank is fabricated of 304L stainless steel and is installed in a reinforced underground concrete vault, which is lined with stainless steel to provide secondary containment. This facility also contains transfer pumps and associated valving so that the tank's contents can be transferred to the LLLW Evaporator Facility in Bethel Valley through a double-contained pipeline (also placed in service in September 1997). This facility meets all requirements of the FFA for the LLLW system.

Engineered Safeguards

The LLLW collection tanks are provided with liquid level measuring devices. Alarms indicating over-filling are telemetered to the WOCC, which is manned continuously. Also, Tanks F-1401 and F-1800 are provided with combustible gas analyzers.

Tanks F-1401 and F-1800 are doubly contained, and both the tank and secondary containment vault are provided with liquid level alarms. In all cases, the tanks are vented, either via off-gas systems or directly to the atmosphere, through HEPA filters.

LLLW Bottling and On-Site Transportation

As an alternative to the LLLW collection system utilizing a network of underground piping and tanks, LLLW is also transported by surface vehicles to the LLLW collection system for treatment. Bulk liquid wastes that are not transferred by pipeline are transported from the generating facility by tank motor vehicle to the collection header in the South Tank Farm for further transport by pipeline to the storage tanks and Building 2531 for treatment. Smaller quantities of liquid waste, such as those produced in some of the research laboratories, are bottled and transferred from the generating facility by motor vehicle directly to Building 2531 for treatment.

Vehicular Tanks. Two tanks are presently in use. The first is a 1000-gallon flatbed-mounted tank operated by Duratek Federal Services personnel to transport up to 800 gallons of LLLW to the LLLW collection system, where it is gravity drained to the hard-piped system. The second tank is the Building 3074 dumpster tank, which is owned by the Facilities Management Division (FMD). Duratek Federal Services empties this tank as requested by FMD personnel.

Bottled Waste. Small quantities of LLLW are routinely transferred from the generators' facilities to the LLLW evaporator facility in a DOT Specification 7A Type A Bottle Package System, which consists of a 2.5-gallon thick-walled reusable polyethylene bottle with a 20-gallon drum overpack.

Bethel Valley Evaporator Service Tanks

The Bethel Valley Evaporator Service Tanks (BVESTs), consisting of Tanks C-1, C-2, W-22, and W-23, store evaporator concentrate and dilute radioactive LLLW. Accumulated sludge was removed from these tanks in 1998 and 1999 using AEA Technology's fluidic pulsed jet mixing process. The sludges were transferred to the MVSTs for storage.

LLLW Evaporator System

Two 600-gal/h evaporator systems, housed in Building 2531, are used to concentrate the LLLW. The first of these was put into operation in 1965 and the second in 1979 (the vessel was replaced in 1994 due to deterioration of the internal steam coils). The original evaporator is served by a 4400-gallon feed tank (A-1). The newer evaporator is fed directly from one of the evaporator service tanks (normally W-21 or W-22). Both evaporator installations consist of an evaporator vessel, a vapor filter, a water-cooled condenser, and a condensate catch tank. With the exception of the feed and the condensers, the equipment in both systems is identical. The overheads from the evaporator vessels are condensed and receive treatment at the Process Waste Treatment Complex - Building 3544 for the removal of radiochemicals from the evaporation process. The 50,000-gallon evaporator storage tanks are used to store the LLLW concentrate until it can be transferred to the MVSTs.

Melton Valley Storage Tanks

Storage capacity for the concentrated LLLW has been provided by eight 50,000-gallon storage tanks installed in two underground vaults located adjacent to the LLLW Solidification Facility in Melton Valley (Building 7830, also called the Melton Valley Storage Tanks). The tanks are contained in two concrete vaults with stainless steel liners and leak detection instrumentation.

Construction of additional storage capacity for the concentrated LLLW has recently been completed with the turnover on November 13, 1998, of Building 7856 (Melton Valley Storage Tanks Annex) to Liquid and Gaseous Waste Operations Project (LGWOP) personnel. This facility, which was placed in service on December 3, 1998, after undergoing a DOE-ORO Readiness Assessment, provided an additional six 100,000-gallon storage tanks installed in individual vaults located southeast of the existing MVSTs (Building 7830). The tanks are contained in individual concrete vaults with stainless steel liners and leak detection instrumentation, which were constructed by the Melton Valley Storage Tanks - Capacity Increase Project.

Principal Process

The LLLW system at ORNL collects, neutralizes, concentrates, and stores aqueous radioactive waste solutions from various sources at the Laboratory. The Waste Acceptance Criteria (WAC) administratively limits the wastes added to the LLLW system to a total radionuclide concentration of the ingestion dose equivalent of 2 Ci/gal ^{90}Sr. The sources of these waste solutions are "hot" sinks and drains in R&D laboratories, radiochemical pilot plants, and nuclear reactors located in both Bethel and Melton valleys. With the exception of some facilities that do not contain radioactive operations, virtually all of the buildings at ORNL are serviced by this system.

Waste is generated from buildings and sent to collection tanks near the facility or directly to the LLLW Evaporator Service Tanks W-21 or W-22. Tanks W-21 and W-22 are connected directly to the LLLW Evaporator systems, and their contents are transferred on a batch basis to the evaporator facility for volume reduction.

At the evaporators, the aqueous waste is routinely concentrated by a factor of 20 to 35. The radioactive concentration of the condensate is less than the feed solution concentration by a factor of 10E4 to 10E5. Evaporation is achieved by the use of steam coils located in the bottom of the evaporator vessel. The evaporators are operated in a semicontinuous manner. Raw waste is transferred by steam jet to an evaporator, and blowdown proceeds at a rate of 50 $lb/h/ft^2$ of surface area. During this period, more raw waste is automatically sent to the evaporator at a rate controlled by the level in the evaporator vessel. Condensate from the evaporator is directed to the Process Waste System for further treatment prior to discharge. When the specific gravity of the concentrated waste reaches a value between 1.20 and 1.25, the evaporator is shut down. Its contents are cooled and then transferred to one of the 50,000-gallon storage tanks for interim storage.

The concentrate stored at the evaporator facility is periodically pumped to the MVSTs or MVST Annex for long-term storage. Transfer from the LLLW Evaporator Facility to the MVSTs is through approximately 6000 ft of double-contained stainless steel pipe. This pipe is buried in a specially prepared bed of select clay and is cathodically protected.

H.1.3 Stack Ventilation 3039 System Description

The 3039 Stack Ventilation System, which was originally built in 1950, was extensively modified and upgraded in 1984 to increase its efficiency and reliability. In 1997 several of the cell ventilation blowers and the off-gas primary blower and backup fan were replaced to increase the system's reliability. Also in early 1997, a new scrubber solution tank and associated transfer equipment was installed that met requirements of the FFA for the Liquid Low-Level Waste system.

The 3039 Stack Ventilation System consists of seven collection systems, each with its own underground and/or aboveground ducting, fans, and controls. Five of these are designed to handle the cell-ventilation waste streams from limited-access areas and hot cells. The other two systems are designed to handle the off-gas from process equipment and laboratory experiments. The Oak Ridge Research Reactor pressurized off-gas system is not active and has been disconnected from the 3039 Stack Ventilation System.

The 3039 stack is a 76.2-m-(250-ft)-high unreinforced radial brick masonry chimney. It has an acid-proof lining utilizing a special acid-proof brick. The stack is supported on a 50-ft-diameter octagonal reinforced concrete footing, cast on bedrock with a varying thickness ranging from 11 ft to 17 ft. The fans and connecting duct to the stack are located near the stack to minimize the length of duct between the stack and the fans.

The interface between the 3039 Stack Ventilation System and the buildings served is either the building isolation valve or, if no isolation valve exists, the point at which the duct penetrates the wall of the building served. However, there are several buildings whose filter systems are located in a separate housing outside the building. In these cases, the external filter system and the building it serves are considered as an integrated unit and the interface with the 3039 Stack Ventilation system is where the duct penetrates the wall of the filter housing. Safe operation of the facilities upstream of the interface with the 3039 Stack Ventilation System is the responsibility of the facility operator. Because of the diversity of the activities carried out in the buildings that the system serves, any gaseous waste stream may contain transuranic radionuclides, fission products, and hazardous chemicals whose usage is controlled by ORNL.

Radioactivity and gaseous emissions can, therefore, enter the 3039 Stack Ventilation System only if it is contained in the process off-gas or the cell-ventilation gaseous waste streams. However, the building operators, as the waste generators, are responsible for keeping the amounts of radionuclides in the gaseous waste streams that discharge into the 3039 Stack Ventilation System to levels that will limit risks to the health and safety of the public and employees. This is accomplished through a combination of administrative controls, input controls, application of health physics procedures, and treatment (usually by HEPA filters) of the gaseous waste stream prior to discharge into the 3039 Stack Ventilation System.

Principal Process

The primary functions of the 3039 Stack Ventilation System are to safely and efficiently collect process off-gas and cell ventilation gaseous waste streams from various ORNL facilities, to monitor the streams for radionuclide and hazardous material contents, and to discharge the combined streams to the atmosphere at a central location. The system is designed to provide continuous, uninterrupted operation by utilizing installed back-up auxiliary fans. Operators of the interfacing buildings are notified when abnormal operation of the 3039 Stack Ventilation System occurs. Supporting services are furnished by various ORNL organizations and safety committees that provide health physics coverage, equipment maintenance, and safety oversight.

The 3039 Stack Ventilation System off-gas and cell-ventilation facilities include various cell-ventilation, off-gas scrubber, air, water, electrical, and waste systems. These are discussed in detail in the subsections that follow. Unless otherwise stated, system components, e.g., ducts and fans, exposed to the weather and/or corrosive gases are fabricated from stainless steel, typically 304-L.

Each collection system is provided with two fans for the air or off-gas transport through the system. The cell/off-gas fan is a direct-drive motor unit and is used as the normal operating unit for the system. The other fan, a steam turbine unit, is employed as a standby. However, each week for a 15-minute period, each electrically driven cell ventilation unit is shut down and the turbine unit put into service. In addition, the electrically driven off-gas unit is shut down and the turbine unit put into service each day for a 1-hr period.

Each system (with the exception of the 3042 system) is instrumented such that a loss of on-site electrical power will activate both the standby fan and a 750 kw diesel engine emergency generator. When the diesel generator reaches normal operating speed, the sequencing relays will automatically restart the electrically driven fans. The steam turbine-driven fans will then automatically reset to their standby condition when the negative pressure at the suction side of the fan returns to normal.

H.1.4 Solid Low-Level Radioactive Waste

Solid low-level waste (SLLW) is waste that contains radioactivity but is not classified as high-level waste, transuranic (TRU) waste, spent nuclear fuel, or by-product material as defined by DOE Order 435.1, "Radioactive Waste Management." SLLW does not contain hazardous waste as regulated by the Resource Conservation and Recovery Act (RCRA) and as defined in 40 *CFR* 260-268 (or State of Tennessee equivalent standards) or polychlorinated biphenyl (PCB)-contaminated or PCB-detectable waste as regulated by the Toxic Substances Control Act (TSCA) and as defined in 40 *CFR* 761. DOE Order 435.1 and the Atomic Energy Act of 1954, as amended, provide the primary regulatory guidance and requirements for the management of SLLW. Waste Acceptance Criteria have been developed to address the storage, treatment, and disposal of SLLW, and an implementing procedure to effect the WAC is in place for SLLW.

SLLW is generated throughout ORNL and is characterized by the generator, with waste certification being accomplished through the combined efforts of the generator, LWS, and the Laboratory Waste Certification Official. SLLW is staged at the generating location until the waste is certified by ORNL and accepted by Bechtel Jacobs Company, LLC. Bechtel Jacobs Company, LLC, determines the most suitable management option for all SLLW generated by ORNL. Based on the characteristics and certification of the waste, Bechtel Jacobs Company, LLC, may (1) store the waste in one of several storage facilities dedicated to SLLW; (2) utilize treatment options such as compaction and incineration offered by commercial treatment, storage, and disposal facilities (TSDFs) or in-house treatment options; or (3) ship the waste to an approved off-site disposal facility such as NTS or Envirocare. The primary goal is to expeditiously disposition newly generated waste from generators to the disposal site.

Use of the Interim Waste Management Facility (IWMF) for on-site disposal of ORNL newly generated SLLW was suspended in 1998 pending completion of the Performance Assessment (PA) and Composite Analysis (CA) for the facility. The IWMF uses tumulus disposal technology to dispose of SLLW. The waste is packaged inside a concrete or steel cask, which is placed inside a tumulus vault, and any void space within the vault is filled with concrete grouting. The vault lid is sealed with a steel-reinforced concrete cover and stacked on a concrete tumulus pad. A drainage system and several monitoring stations test any water running off or beneath the pads. The first pad was constructed to accommodate 324 vaults, and each subsequent pad can accommodate 330 vaults. DOE has decided that operation of the IWMF is no longer tenable. The cleanup of MV, the high cost of the IWMF, and access to NTS are reasons to close the IWMF permanently.

LLW is currently stored in multiple facilities within Solid Waste Storage Area (SWSA) 5 and SWSA 6. By mid-2004, this activity will be consolidated in SWSA 5 North because of the final capping and closure of SWSAs 5 and 6.

H.1.5 Transuranic Waste

TRU waste is waste contaminated with alpha-emitting transuranium radionuclides (atomic number greater than 92) with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. The following radioisotopes meet these criteria and are managed as TRU: Am-241, Am-242m, Am-243, Bk-247, Cf-249, Cf-251, Cm-243, Cm-245, Cm-246, Cm-247, Cm-248, Cm-250, Np-237, Pu-238, Pu-239, Pu-240, Pu-242, and Pu-244. Waste Acceptance Criteria and an implementing procedure are in place for TRU wastes.

TRU waste is generated by a limited number of generators and facilities at ORNL. TRU waste is characterized by the generator, with certification being accomplished through the combined efforts of the generator, LWS, and the Laboratory Waste Certification Official. All TRU waste is currently stored in on-site storage facilities operated by Bechtel Jacobs Company, LLC. Most of these facilities are RCRA-permitted and store some RCRA-contaminated TRU waste, as well as some RCRA-contaminated SLLW that exceeds the dose limits for Bechtel Jacobs Company's other RCRA-permitted storage facilities. A very small quantity of TRU waste is also PCB-contaminated. During FY 2001, ORNL generated approximately 6 m^3 of TRU waste, which was placed in on-site storage.
TRU storage facilities in SWSAs 5 and 6 will be emptied and closed between 2001 and 2008, when the waste stream achieves steady-state. All of the existing inventory will be shipped to the Foster Wheeler processing facilities in Melton Valley.

H.1.6 Hazardous Waste

Hazardous waste is any discarded material that is not excluded by 40 *CFR* 261.4(a) and that is either listed in 40 *CFR* 261, Subpart D, or that exhibits one or more characteristics identified in 40 *CFR* 261, Subpart C. RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), regulates the generation, storage, treatment, disposal, and transportation of hazardous wastes. RCRA also regulates the facilities that conduct these operations. The State Tennessee Department of Environment and Conservation (TDEC) is authorized to administer its own RCRA program in lieu of the federal program, except to the extent of newly issued HSWA provisions. The State program has authorization to regulate mixed waste and RCRA corrective actions as well and is authorized under the Tennessee Hazardous Waste Reduction Act of 1990.

Hazardous waste is a waste or surplus material with negligible value that may cause or significantly contribute to an increase in mortality or to an increase in serious irreversible illness or pose a substantial present or potential hazard to human health or the environment when improperly stored, treated, disposed of, or transported. Hazardous wastes are defined in RCRA by specific source lists, nonspecific source lists, characteristic hazards, and discarded commercial chemical product lists. Characteristic wastes are those which exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined in 40 *CFR* 261.

Hazardous wastes are generated throughout ORNL and are stored in generator satellite accumulation areas or in (90-day) accumulation areas operated by the generator or LWS pending pickup by Bechtel Jacobs Company, LLC. Bechtel Jacobs Company, LLC, determines the most suitable management option for all hazardous waste generated by ORNL. Based on the characteristics and certification of the waste, Bechtel Jacobs Company, LLC, may (1) immediately transport the waste to an off-site commercial TSDF for treatment and/or disposal, (2) store the waste in one of several storage facilities dedicated to hazardous and mixed waste pending off-site treatment or disposal, (3) detonate the waste in the on-site Chemical Detonation Facility, or (4) utilize other on-site treatment. Waste Acceptance Criteria and an implementing procedure are in place for hazardous wastes.

Hazardous waste storage is consolidated at the Bechtel Jacobs Company, LLC, accumulation area in the 7650 series buildings on Melton Valley Access Road. This waste type is considered to be at steady-state, which means that all generated waste is disposed of within one year.

H.1.7 Mixed Waste

Mixed waste is waste that contains both hazardous and radioactive components and must be managed to meet the requirements applicable to both. "Hazardous," in this instance, refers to both those wastes regulated by RCRA and those PCB wastes with concentrations or sources greater than or equal to 50 ppm. Like hazardous wastes, mixed wastes are generated throughout ORNL and are stored in accumulation areas operated by the generator or LWS pending pickup by Bechtel Jacobs Company, LLC. Bechtel Jacobs Company, LLC, determines the most suitable management option for all mixed wastes generated by ORNL. Based on the characteristics of the waste, Bechtel Jacobs Company, LLC, may store the waste in one of several storage facilities dedicated to hazardous and mixed waste, pending determination of suitable treatment, storage, and disposal options. Many of ORNL's mixed wastes are treated in the TSCA Incinerator at ETTP. This incinerator burns mixed wastes from ORNL, the Y-12 National Security Complex, ETTP, the Paducah Gaseous Diffusion Plant, the Portsmouth Gaseous Diffusion Plant, and other sites and facilities as directed by DOE. The resulting ash is treated, as required, and disposed of at Envirocare of Utah.

By 2003, mixed waste storage will be performed in the same facility area as hazardous waste. If additional storage area is required, the waste will be stored at ETTP.

H.1.8 TSCA Waste

PCB Waste. TSCA waste is waste regulated by the U.S. Environmental Protection Agency (EPA) Environmental Protection Division under TSCA. In accordance with 40 *CFR* 761, Subpart D, TSCA regulates PCB materials (wastes/contaminated equipment) based on PCB concentration. PCB materials with <50 ppm are minimally regulated; those with ≥ 50 ppm and < 500 ppm are moderately regulated; and those with ≥ 500 ppm are stringently regulated. TSCA also regulates PCB/radioactive wastes. The majority of ORNL's PCB/radioactive wastes are treated at the TSCA incinerator at ETTP; whereas, other PCB wastes are sent to commercial facilities within a year of generation. ORNL is also governed by the Oak Ridge Reservation/PCB/Federal Facility Compliance agreement. In addition, TDEC regulates the disposal of PCBs >2 ppm in State sanitary landfills.

Asbestos Waste. TSCA also addresses the manufacturing, importing, and processing of asbestos and establishes requirements for asbestos abatement projects performed by government and State employees not covered by (1) the Asbestos Standard of OSHA, 29 *CFR* 1926.58, (2) an asbestos standard adopted by a state as a part of a plan approved by OSHA under Section 18 of the Occupational Safety and Health Act, or (3) a state asbestos regulation which the EPA has determined to be comparable to, or more stringent than, that established in 40 *CFR* 763.120. Since ORNL does not manufacture, import, or process asbestos, and since asbestos activities are covered by an approved Asbestos Standard, any waste with asbestos-containing material (ACM) is not regulated under TSCA. ACM is either managed as sanitary waste, SLLW, transuranic waste, TSCA/RCRA waste, or TSCA/RCRA mixed waste if the ACM has come into contact with such constituents. Accordingly, asbestos will be managed as a TSCA (PCB) waste only if it has come into contact with PCBs.

Waste Acceptance Criteria and implementing procedures are in place for TSCA (PCB) and asbestos wastes. These wastes are initially stored by generators until transfer to Bechtel Jacobs Company, LLC, for either on-site storage or off-site storage or disposal. PCB wastes received, treated, and disposed are routinely included in the totals for hazardous and mixed wastes.

H.1.9 Classified Waste

Classified wastes are discarded materials whose analysis or review could reveal information withheld for reasons of national security. The management of such waste is governed by DOE Order 470. ORNL generates a minute amount of classified waste. Disassociation from source or use is sometimes used to declassify certain materials.

H.2 EFFLUENT MONITORING

Liquid effluents are regulated by ORNL's National Pollutant Discharge Elimination System (NPDES) Permit issued by TDEC. Receiving streams are monitored at designated locations for both radioactive and nonradioactive contaminants. Surface water samples are collected as part of the Clean Water Act (CWA) requirements and DOE orders. In addition, monthly surface water samples are collected to determine background contaminant levels before the influence of ORNL. These samples are collected at White Oak Creek headwaters above the locations of ORNL discharges to White Oak Creek. Figure H.1 shows the locations of the various sampling points. The White Oak Creek Headwaters monitoring was temporarily suspended in 2001 while repairs were made to the Headwaters monitoring site, and monitoring will be resumed in the first part of 2002.

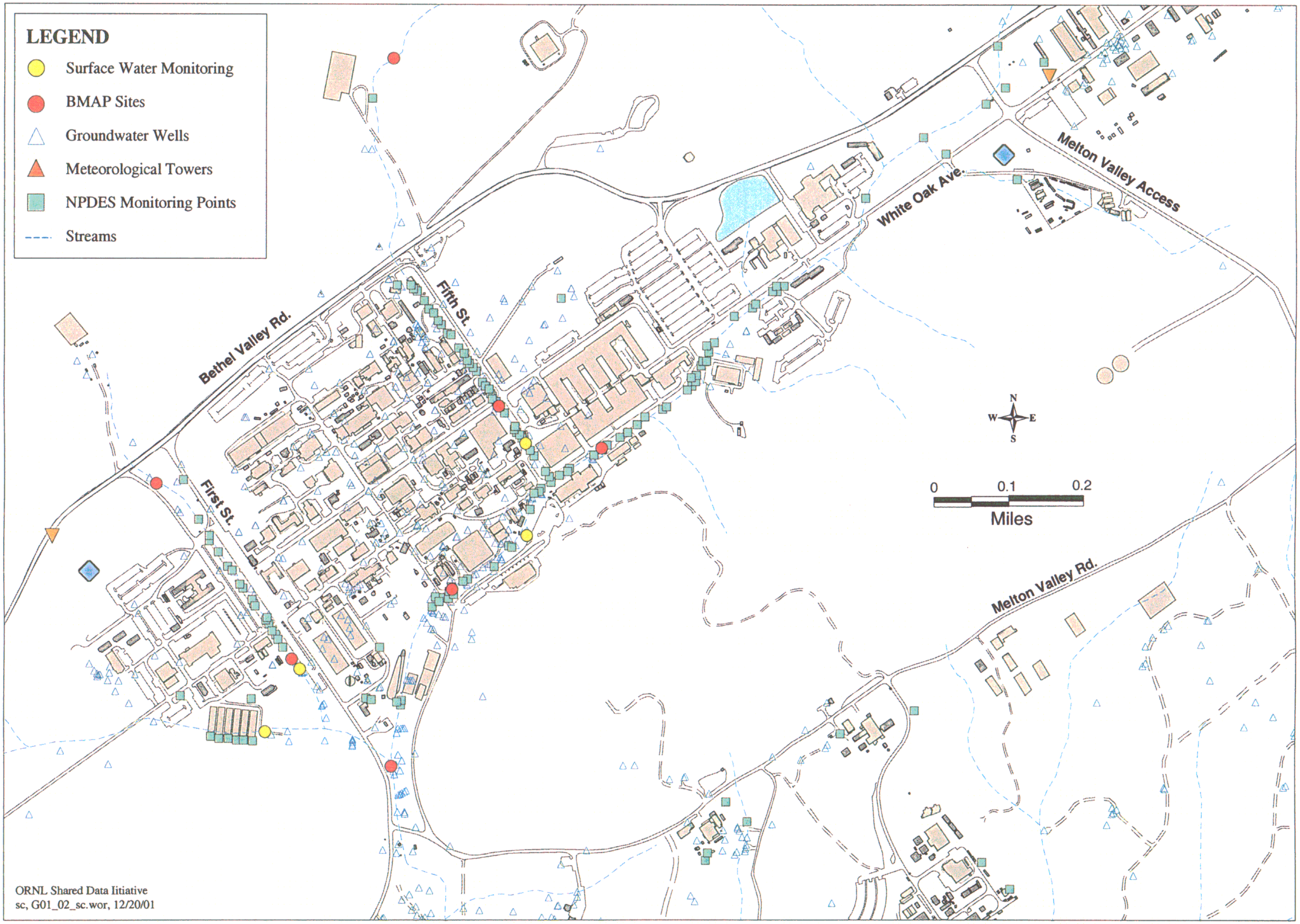

Fig. H.1. Environmental sampling locations.

All process wastewater streams were routed to the Nonradiological Wastewater Treatment Plant (NRWTP) when it began operations in 1990. This made it possible to combine five permitted and monitored NPDES wastewater-discharge points into one monitored point. The NRWTP operated in total compliance with the ORNL NPDES Permit from 1990 to 1998. In 1997–1998, the NRWTP and the Process Waste Treatment Plant (PWTP) were reconfigured and combined to provide the Process Waste Treatment Complex (PWTC), which resulted in more effective, efficient treatment of ORNL process wastewaters. The PWTC has operated in essentially complete compliance with the ORNL NPDES Permit, with only a single permit limit exceedance recorded since 1998, giving an NPDES compliance rate of greater than 99%.

H.3 ENVIRONMENTAL RESTORATION ACTIVITIES AND ISSUES

The Oak Ridge Environmental Restoration Program is being performed by Bechtel Jacobs Company, LLC, as DOE's M&I contractor for environmental management activities in Oak Ridge. ORNL and Bechtel Jacobs Company, LLC, are closely coordinating site activities and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decision-making process related to long-term land use plans for major portions of the ORNL site as records of decision are being finalized and remedial actions implemented.

ORNL has been one of the primary contributors in EM technology development and deployment. Any significant reduction in technology funding will seriously affect the supporting research divisions. Successful execution of DOE's plans for cleanup will be dependent on the use of new and more cost-effective technologies. ORNL is working to maintain DOE support for the continuation of all phases of the EM technology development and demonstration being conducted through the Focus and Crosscut Areas, the EM Science Program, and the Accelerated Site Technology Deployment initiative for getting proven technologies into the field.

For the technology deployment work, Bechtel Jacobs Company, LLC, has been given the leadership role for technologies being deployed on its sites. ORNL principal investigators will need to coordinate with Bechtel Jacobs, LLC, in proposing and implementing field activities.

H.3.1 Record of Decision for Interim Actions in Bethel Valley

The cleanup of Bethel Valley, which includes the main ORNL site, is being conducted under CERCLA. Four regions have been established in the Bethel Valley Watershed based on area hydrology, the level and type of environmental management activities, and the knowledge that the end use of these regions may vary. These regions are

Raccoon Creek Region (West of State Highway 95),
West Region (from Highway 95 to the developed area of ORNL),
Central Region (the originally developed area of ORNL), and
East Region (the 7000 Area of ORNL).

In FY 2001, DOE submitted the Record of Decision for Interim Actions in Bethel Valley (BV ROD) to the regulatory agencies for review and approval as part of the CERCLA decision-making process for environmental remediation of the site. The BV ROD identifies the remediation goals for Bethel Valley and all actions needed to meet these goals. The key issue to be addressed is the environmental restoration strategy for the Central Region, encompassing the initial area of the site, which was developed beginning in 1943. This strategy will address decontamination and decommissioning of inactive laboratory facilities and reactors and disposition of contaminated soils and sediments. A final groundwater remediation decision has been deferred; in the interim, the selected remedy proposes selected plume containment and source actions. Resolution of issues raised during regulatory agency review of the ROD is in progress, with the goal of having a signed ROD in FY 2002.

H.3.2 Gunite and Associated Tanks

The Gunite and Associated Tanks (GAAT) consist of six large tanks of 170,000-gallon capacity each and two smaller tanks of 42,500-gallon capacity. Prior to remediation, each tank contained residual quantities of mixed waste (radioactive and RCRA-characteristic sludges; some tanks contain transuranic mixed waste). Most of the liquid and solid waste was removed in the 1980s, but a heel of sludge and other debris remained in the tanks. Additional contamination is also present in the tank walls and floors. This waste, as well as the equipment, structures, soil, and groundwater in the tank farms, represents a potential threat to human health and the environment. A CERCLA interim remedial action was implemented to remove the waste from the tanks and a CERCLA non-time critical removal action was implemented to stabilize (grout) the tank shells in place. The associated piping, valve pits, contaminated soil, etc., will be addressed in other remedial actions implementing the selected remedy in the BV ROD.

Tank waste removal was completed in FY 2000, and tank shell stabilization was completed in FY 2001. Over 400,000 gallons of waste slurry containing about 87,000 gallons of transuranic mixed waste sludge were transferred to the Melton Valley Storage Tanks where it will be treated in the Transuranic Waste Processing Facility for shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal. Dismantlement of waste removal equipment and platforms has been completed and the site is now available for beneficial reuse.

H.3.3 Corehole 8

The Corehole 8 contaminated groundwater plume (CH8 Plume) is the result of LLLW pipeline leaks at the LLLW Collection/Storage Tank W-1A located in the North Tank Farm at ORNL. The historic pipeline leaks, discovered in the mid-1980s, have contaminated soil and groundwater adjacent to and beneath the tank and created the source for the CH8 Plume, which has spread east and west of the tank site.

Three actions have been taken over the past several years after discovery of radiological contaminant releases into First Creek at the western end of the ORNL plant site. The primary contaminants detected in the creek were Sr-90 and uranium isotopes. In 1995, a CERCLA removal action was initiated to collect and treat contaminated groundwater. A shallow interceptor and sump collection system was installed, with the water being pumped back to a manhole for treatment at the ORNL Process Waste Treatment Plant (PWTP). In early 1998, a shallow french drain collector was installed and two manholes were waterproofed to prevent contaminated groundwater infiltration into the storm drain system and ultimate release into First Creek. In 2000, extraction of contaminated groundwater was initiated from a well (Well 4411) that intercepts a portion of the plume. The extracted groundwater is being treated at the PWTP.

An additional CERCLA removal action was implemented to stop further leaching of contaminants from the plume source into groundwater. The project focused on remediating the contaminated soil, Tank W-1A, and pipelines at the plume source leak site. Tank contents were removed in FY 2001 and 90% of the contaminated soil was excavated. Unexpectedly high concentrations of transuranic contaminants were encountered while excavating soils immediately surrounding the tank. Excavation of this highly contaminated soil was not within the approved scope of the removal action. The tank and approximately

100 cubic yards of highly contaminated soil were left in place to be addressed in a future CERCLA action, and the excavated area was backfilled.

Additional plume management, such as hydraulic control of the plume using extraction wells to control groundwater flow in the plume and slowly remove contaminants from the bedrock zone, will be addressed in the BV ROD.

H.3.4 Metal Recovery Facility Demolition

The Metal Recovery Facility (MRF) was a one-story, metal-sided building used as a pilot and small-scale nuclear fuel reprocessing plant between 1952 and 1960. Associated with the MRF were an exterior concrete canal; a small storage facility; and, interior to the facility, a dissolver pit and seven concrete hot cells. The MRF was used primarily to recover fuel and other nuclear materials. The fuel reprocessing occurred in the building's seven hot cells; fission products were also separated out. A CERCLA removal action was initiated in FY 2001 to remove the surface structure of the facility to the finish floor elevation. The walls of the dissolver pit, small storage building, and canal were demolished to the finish floor elevation of the facility. The dissolver pit and other small pits and sumps were drained, decontaminated, and stabilized with grout. The remaining slab will be stabilized in place in FY 2002.

H.3.5 Surface Impoundments Operable Unit Project

The Surface Impoundments Operable Unit (SIOU) is part of the Bethel Valley Watershed Central Region and consists of four impoundments designated A (3524), B (3513), C (3539), and D (3540). The impoundments received radioactive low-level liquid wastes generated during experiments and materials processing at ORNL. They contain radioactively contaminated sediments with the primary contaminants of concern being cesium, plutonium, cobalt, strontium, and americium. The selected remedy consists of the removal, treatment, and off-site disposal of the sediments and backfilling of the impoundments for beneficial reuse. Impoundments C and D were successfully remediated in 1998. A facility to treat the sediments has been constructed on the backfilled impoundments. Sediment was transferred from Impoundment A to Impoundment B in 2000. Impoundment A was then backfilled with rock and grout and is being used as a staging area for treated waste awaiting shipment for disposal. Treatment system startup with hot and cold testing was completed and treatment of consolidated sediment from Impoundment B was initiated in FY 2001and is scheduled for completion in FY 2003.

H.3.6 Federal Facilities Agreement Tanks Remediation

ORNL has a comprehensive program under way to upgrade the LLLW system to meet the FFA requirements. Those tank systems that do not meet the FFA requirements are required to be removed from service, characterized, and remediated. The FFA Tanks Remediation Project is responsible for sampling and analyzing the inactive tanks' contents, submitting these results in the Waste and Risk Characterization Data Manuals, maintaining the tanks in a safe inactive condition, and remediating the tanks. As of the end of FY 1998, all LLLW tanks not meeting the FFA requirements for active service have been removed from service. The inactive tanks are remediated within the CERCLA framework: tanks with little associated risk are remediated as maintenance actions with regulatory agency concurrence; tanks with more associated risk are remediated as removal actions.

A CERCLA removal action was implemented to remove the contents from 27 inactive LLLW storage tanks located in Bethel Valley and Melton Valley and stabilize (grout) the shells and residual internal contamination in place. Seven tanks were remediated in FY 2000 and 17 tanks were remediated in FY 2001. The remediation of three tanks (i.e., T-1, T-2, and HFIR) was deferred to a future CERCLA action due to the nature of their contents (i.e., resins), which will require a more sophisticated approach to retrieval and treatment.

H.3.7 Cooling Towers Demolition

Six ORNL cooling tower structures [HRE Cooling Tower (7554), Oak Ridge Research Reactor Heat Exchanger (3087), ORRR A/C Cooling Tower (3089), ORRR Cooling Tower #3 (Building 3103), Pool-Water Cooling Tower (3086), and BSR Cooling Tower (3117)] were demolished in FY 2000. Waste generated from demolition of the towers will be dispositioned in FY 2002. The remaining basins and any contaminated soil associated with the towers will be addressed in the BV ROD selected remedy.

H.3.8 Spent Nuclear Fuel Project

The objective of the ORNL Spent Nuclear Fuel (SNF) Project is to safely, reliably, and efficiently manage SNF that is stored on the Oak Ridge Reservation until it can be shipped off-site for disposal. SNF is being retrieved, repackaged, and certified for shipment to the Idaho National Engineering and Environmental Laboratory (INEEL). The final SNF package has been retrieved (KEMA fuel from SWSA 6) and is being repackaged for placement back into safe storage pending shipment to INEEL. A cask loading facility was constructed in FY 2001 to allow packaging of SNF in licensed containers that will be used to ship SNF to INEEL beginning in FY 2003.

H.3.9 Record of Decision for Interim Actions for the Melton Valley Watershed

The cleanup of the Melton Valley portion of the White Oak Creek Watershed, which includes most of ORNL's primary waste disposal units, is being conducted under CERCLA. The Record of Decision for Interim Actions for the Melton Valley Watershed (MV ROD), documenting the selected remedy, was signed by DOE, EPA, and TDEC on September 21, 2000. The Melton Valley (MV) ROD addresses current contaminant releases and potential risk or hazard through a combination of remedial activities such as containment, stabilization, removal, treatment, monitoring, and land use controls.

A Remedial Design Work Plan which summarizes the remedy design and implementation approach for the cleanup of the waste units and other contaminated areas in the watershed was approved by the regulatory agencies in FY 2001. A Land Use Control Implementation Plan that identifies various land use controls (LUCs) that will be utilized for the interim remedial actions was also submitted to the regulatory agencies for review and approval in FY 2001. Since the remedy includes leaving hazardous substances in place within the watershed above unrestricted use levels, the LUCs play an important role in preventing unacceptable exposures and ensuring the selected remedy remains protective of human health and the environment.

H.3.10 Molten Salt Reactor Experiment

The Molten Salt Reactor Experiment (MSRE) facility operated from 1965 to 1969 to test the molten salt concept for commercial nuclear power reactors. During routine surveillance activities in 1994, it was noted that measured radiation levels in various areas throughout the facility were increasing. The source of radiation originated in the two fuel drain tanks and was being distributed throughout the off-gas system. A uranium deposit was also discovered in a charcoal bed that filtered the off-gas from the drain tanks. This condition could have resulted in a criticality accident and possible radiation exposure to the on-site (MSRE) personnel.

Actions have been implemented under CERCLA to reduce and eliminate potential risks of a nuclear criticality accident or a release of reactive gases from the facility. The three activities to remediate these concerns are (1) removal of the migrating gases throughout the facility off-gas system, (2) removal of the uranium deposit from the Auxiliary Charcoal Bed, and (3) removal of the fuel salt itself. Removal of reactive gases was initiated in 1996 as part of a CERCLA time-critical removal action and will continue as appropriate until all remedial actions have been completed. Removal of the uranium deposit for conversion to a stable oxide form and later disposition was completed in FY 2001 as a CERCLA removal action. An Interim Record of Decision for the MSRE Fuel Salt Removal has been approved by the regulatory agencies. Design, procurement, fabrication, and installation of fuel salt removal equipment was completed in FY 2001. The fuel salts, which contain uranium and fission products, will be removed, converted to a stable oxide form, and permanently disposed off-site at DOE's WIPP site in Carlsbad, New Mexico. Fabrication of conversion vessels and installation/checkout of conversion process equipment was also completed in FY 2001. Fuel salt removal will be initiated in FY 2003.

H.3.11 Old Hydrofracture Facility Site

The Old Hydrofracture Facility (OHF) site was used from 1964 to 1979 for permanent disposal of liquid radioactive waste in shale formations at depths > 780 ft. Various facilities were required to support the waste disposal operations, including five underground tanks used for storage of the liquid waste before mixing it with grout; surface structures for storing, mixing, and handling the grout/liquid waste mixture; and an impoundment (OHF Pond) and waste pit (T-4 Waste Pit) for emergency storage of liquid waste due to system failures. Operations were terminated in 1980, leaving approximately 50,000 gallons of transuranic waste in the five underground storage tanks. This waste has been removed and transferred to the Melton Valley Storage Tanks (MVSTs) for processing and disposal. An additional CERCLA removal action was conducted in 2000 that stabilized the OHF Pond, the five storage tanks, and the T-4 Waste Pit. In addition to these actions, the sludge was removed from the Process Waste Sludge Basin (PWSB), placed in the OHF Pond, and stabilized along with the OHF Pond sediment. The PWSB was a PVC-lined basin constructed in 1975 and used between 1976 and 1981 for the storage and settlement of sludge produced by the water-softening processes at the ORNL PWTP. Remedial design for the demolition of the OHF structures and tank stabilization equipment was completed and demolition initiated in FY 2001. Demolition of the structures will be completed in FY 2002.

H.3.12 Hydrofracture Wells Plugging and Abandonment

Between the 1960s and mid-1980s, the process of deep injection of waste was used at ORNL to dispose of radioactive liquids and sludges in mixtures of waste with portland cement-based grout and various additives. Two test, or experimental, injection wells were constructed along with boreholes and wells to observe the behavior of the injected grout in the injection zone bedrock. At these two sites, small quantities (tens of curies) of radionuclides were added to injected grout to make the grout sheets detectable using gamma detectors to log the bedrock to locate the thin grout sheets. The third and fourth injection wells were constructed for large-scale waste disposal. More than 5 million gallons of liquid waste-grout mix containing approximately 1.4 million curies of activity were injected into artificially induced fractures in a shale formation at depths of 300 ft. to 1000 ft. All large-scale disposals were at depths greater than 780 ft. Contamination levels in hydrofracture monitoring wells have been reported as high as 97 million pCi/L gross beta, which could potentially migrate up an unplugged well bore. To prevent this migration, a CERCLA remedial action was initiated in FY 2001 to plug and abandon (P&A) the four injection wells and 107 associated monitoring wells. Thirty-three of the 107 monitoring wells were plugged and abandoned in FY 2001. This remedial action implements the selected remedy for these wells as specified in the MV ROD.

H.3.13 Solid Waste Storage Area 4 Remediation

Solid Waste Storage Area (SWSA) 4 was used for the disposal of SLLW in trenches and auger holes from 1951 to 1959. There are also pipelines on the north side of SWSA 4 that were used for transporting LLLW to waste pits and hydrofracture facilities. The selected remedy for SWSA 4, agreed to by DOE, EPA, and TDEC in the MV ROD, includes the installation of a multilayer cap to facilitate hydrologic isolation of the buried waste in SWSA 4 and Liquid Waste Pit 1. The cap will also cover the Experimental Pilot Pit Area. Excavation of the Intermediate Holding Pond (IHP), also part of the MV ROD selected remedy, is included in this project. Prior to cap installation, existing facilities and equipment located within the cap footprint were demolished to slab. The facilities and equipment included in this task consisted of the Alpha Greenhouse Facility (7833), Decontamination Facility (7819), Pilot Pits Building (7811), and the off-gas hood and structure used during the Waste Pit 1 in-situ vitrification technology demonstration. Demolition of the facilities and equipment was completed in FY 2001. Borrow area development and haul road upgrades were initiated in FY 2001 and will be completed in FY 2002. Excavation of the IHP will be initiated in FY 2002 and completed in FY 2003. Relocation of Lagoon Road will be completed in FY 2003. Capping of SWSA 4 will be completed in FY 2004.

H.3.14 Building 7602 IPDF Highbay Maintenance Action

In the first major cost-sharing collaboration between Bechtel Jacobs Company, LLC, and UT-Battelle, the highbay portion of Building 7602, the Integrated Process Demonstration Facility (IPDF), was "recovered" on a fast-track schedule to make this facility available to support the Spallation Neutron Source program. Building recovery was completed in early FY 2001 and included the removal of radioactively contaminated process equipment and decontamination of the entire facility.

H.4 TRANSURANIC WASTE PROCESSING FACILITY

This project includes designing, constructing, operating, and decontaminating and decommissioning a facility in the Melton Valley area of ORNL for the processing, packaging, and shipment of transuranic wastes collected in the Melton Valley Storage Tanks and solid TRU storage facilities for off-site disposal.

H.5 HAZARDOUS MATERIALS WITHIN THE 500-YEAR FLOODPLAIN

Flooding on the ORNL site has not been a major problem. Brief summer storms have caused short-duration flooding of some parking areas and roads, but have had little impact on plant operations. The level of White Oak Creek governs flooding at ORNL. The creek's level is determined by the level of Watts Bar Lake, and the lake level can be controlled by dams operated by TVA. Thus, TVA can mitigate the consequences of heavy rainfall.

The 500-year flood, that flood expected to occur only once in 500 years or, equivalently, that flood which has a 1-in-500 chance (0.2%) per year of occurring, will have little impact on ORNL facilities. Table H.1 lists those facilities located within the 500-year floodplain. It is important to note that none of the SWSAs lie within the 500-year floodplain. Moreover, none of the facilities designated by the Safety Analysis Report Update Program (SARUP) as posing a moderate or high hazard, nor any of the facilities designated for decontamination and decommissioning (D&D), lie within the 500-year floodplain. The most serious impact would probably result from the flooding of the Sewage Treatment Plant.

Table H.1. ORNL facilities located within the 500-year floodplain

Building no.	Facility name
2521	Sewage Treatment Plant
3518	Process Wastewater Treatment Plant
4500S	Central Research and Administration Building
5500	High Voltage Accelerator Lab
6008	Office/Lab Facility
6011	Computer and Telecommunications Building

Source: Derived from information provided by the TVA Floodplain Protection section, 1992.

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
807	MV	Cesium-137 Erosion/Runoff Study Area (0807)
814	MV	Trailer (814)
816	MV	Cesium Plots Study Area (816)
830	MV	White Oak Creek Embayment Sediment Control Facility (830)
853	MV	White Oak Creek & Tributaries
857	MV	Goat Building (857)
870	BV	Raccoon Creek Monitoring Station (0870)
1001	BV	SWSA 3 (1001)
1554	BV	Contractors' Landfill (1554)
1562	BV	Closed Scrap Metal Area (1562)
2026A	WO	Inactive LLLW Collection Tank 2026A
2032	WO	Manhole 240 Monitoring Station (2032)
2034	WO	Manhole 95 Monitoring Station (2034)
2099	WO	Monitoring Control Station for Bldg. 2026 (2099)
2101	WO	LGWOD Health & Hygiene Change House (2101)
2508	WO	Instrument Trailer for Sludge Mobilization (2508)
2531	WO	Low-Level Waste Evaporator (2531)
2532	WO	HLW Storage Cooling Pumphouse (2532)
2533	WO	Cell Vent Filter Pit for Bldg 2531 & 2537 (2533)
2534	WO	Off-Gas Filter Pit for Bldg 2531 & 2537 (2534)
2535	WO	Cooling Tower #1 for bldg 2531 (2535)
2537	WO	Evap. Service Tanks & Cont. room (Bldg. 2531) (2537)
2539	WO	Cooling Tower #2 for bldg. 2531 (2539)
2568	WO	Cell Vent & Off-gas Filter Fac. for 2531 (2568)
2600	WO	Bethel Valley Storage Tank (2600)
2624	BV	Solid Waste Storage Area (SWSA) 1 - (2624)
2649	WO	Transported Waste Receiving Facility (2649)
2650	WO	Evaporator Chemical Addition Shed (2650)
2651	WO	Emergency Generator for 2600 area (2651)
2657	WO	Manhole 243 Monitoring Station (2657)
2658	WO	F-4005 Monitoring Station (2658)
2660	WD	Waste Operation Support Facility
3001	BV	Graphite Reactor (OGR), Building 3001
3001		3001 Storage Canal
3001/3019		Graphite Reactor Storage Canal Overflow (3001/3019)
3001-3003		Underground Exhaust Ducts 3001-3003
3001B		Inactive LLLW Collection Tank 3001-B
3002	BV	OGR Filter House 3002
3002A	WO	Inactive Filter House Seal Tank 3002-A
3003	BV	OGR Fan House 3003 (Fan Room Only)
3003A	BV	Inactive LLLW Collection Tank 3003-A
3004B		Inactive LLLW Collection Tank 3004-B
3005	BV	Low Intensity Test Reactor (LITR) - (3005)
3009	BV	Pump House for bldg. 3010 (3009)
3010	BV	Bulk Shielding Reactor Facility
3013		Inactive LLLW Collection Tank 3013
3018	BV	OGR Stack (3018)
3019B	BV	High Radiation Level Analytical Facility (3019B)
3023	BV	North Tank Farm (3023)
3026C	BV	Krypton-87 Enrichment Facility (3026C)
3026D	BV	Metal Segmenting Hot Cell Facility

CROET Leased (CR); Watershed Projects (MV and BV); Waste Disposition (WD); Waste Operations (WO)

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
3028	BV	Alpha Powder Facility (3028)
3029	BV	Source Development Laboratory (3029)
3030	BV	Radioisotope Production Laboratory -- C (3030)
3031	BV	Radioisotope Production Laboratory -- D (3031)
3032	BV	Radioisotope Production Laboratory -- E (3032)
3033	BV	Radioactive Gas Processing Facility (3033)
3033A	BV	Radioactive Production Laboratory Annex (3033A)
3037	BV	LLLW Collection/Storage Tank WC-1
3038	BV	Radioisotopes Laboratory (3038)
3038AHF	BV	Alpha Handling Facility
3038E	BV	Isotopes Materials Laboratory
3038M	BV	Radioisotopes Packaging and Handling Facility
3039	WO	Central Radioactive Gas Disposal Facility (3039)
3042	BV	Oak Ridge Research Reactor (3042)
3075	BV	Decommissioned LITR Ponds
3077		LITR Heat Exchangers (3077)
3082	WO	Data Concentrator #2 for WOCC DAS (3082)
3083	BV	ORRR Neutron Spectrometer Station (Neutron Flight Tube Bldg 3083)
3085	BV	ORRR Pumphouse (3085)
3085A	BV	20,000 Gallon Water Tank (3085A)
3085B	BV	20,000 Gallon Water Tank (3085B)
3086	BV	Pool-water Cooling Tower (3086)
3087	BV	Heat Exchangers for ORRR (3042)
3089	BV	ORRR A/C Cooling Tower (3089)
3092	WO	Off-Gas Scrubber (3092)
3093	BV	Krypton Storage Cubicle (3093)
3098	BV	Filter Facility - BSR (3098)
3099	BV	Storage Pad (3099)
3102	BV	ORRR Heat Exchanger Pit (3102)
3103	BV	ORRR Cooling Tower #3 (Building 3103)
3105	WO	LGWOD Health Physics Office (3105)
3106	WO	Cell Vent Filters for 4501, 4506, 4507 (3106)
3107	BV	ORRR 25-meter Target House (Flight Tube Building) (3107)
3109	BV	ORRR POG Filter Pit Off-Gas Filter (3109)
3110	BV	Isotopes Ductwork/3110 Filter House
3116	BV	Nitrogen Cylinder Storage Building (3116)
3117	BV	Cooling Tower - Bulk Shielding (3117)
3117A	BV	Sulfuric Acid Tank (3117A)
3118	BV	Radioisotope Production Laboratory -- H (3118)
3119	BV	BSR Heat Exchanger & Pumphouse (3119)
3125	WO	3039 Stack Area Emergency Generator (3125)
3126	BV	ORRR NOG Filter Pit Charcoal Filter (3126)
3127	WO	PDS Record Storage (3127)
3130	WO	Waste Operation Control Center (3130)
3133	WO	BV Valve Box 1A (3133)
3139	BV	ORRR Cell Vent Filters (3139)
3140	BV	Cell Vent Filters for 3026
3145	WO	LGWOD Storage Building (3145)
3151	WO	Manhole 25 Monitoring Station (3151)
3154	WO	Manhole 112 Monitoring Station (3154)
3155	WO	Manholes 114 & 234 Monitoring Station (3155)

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
3158	WO	North CV Duct Monitoring Bldg. (3158)
3159	WO	South CV Duct Monitoring Bldg. (3159)
3502B	WO	Data Concentrator #4 for WOCC DAS @ 3502 (3502B)
3503		Mercury Contaminated Soil (Bldg. 3503)
3507	BV	South Tank Farm (Gunite Tanks) (3507)
3507 Area		FPDL LLLW Transfer Line
3512	BV	Decommissioned Waste Holding Basin (3512)
3513	BV	Waste Holding Basin (3513)
3515	BV	Fission Product Pilot Plant (FPPP) - (3515)
3517	BV	Fission Product Development Laboratory (FPDL) - (3517)
3517 Area		FPDL Inactive Cells {Cells 4,5,6,7,22} and Service Tunnel - (3517)
3518	WO	Neutralization Facility (3518)
3518A	WO	LGWOD Spare Parts Trailer (3518A)
3524	BV	Equalization Basin (3524)
3535		Filter Enclosure in South Tank Farm (3535)
3539	BV	Process Waste Pond (3539)
3540	BV	Process Waste Pond (3540)
3544	WO	Process Waste Treatment Plant (3544)
3544B	WO	Filter Press Building (3544B)
3547	BV	Cell Vent Roughing Filter for 3517
3548	BV	Cell Vent Filter for 3517
3592		Mercury Contaminated Soil (Bldg. 3592)
3594	WO	Waste Management Storage Bldg. (3594)
3608	WO	Process Waste Treatment Complex (3608)
3613	WO	Diversion Box Monitoring Station (3613)
3614	WO	Manhole 190 Monitoring Station (3614)
3615	WO	Manhole 235 Monitoring Station (3615)
3616	WO	Manhole 149 Monitoring Station (3616)
3617	WO	Manhole 229 Monitoring Station (3617)
3618	WO	Pumping Station, Tanks WC-10, 11, 12, 13, 14 (3618)
3620	WO	Hot Off Gas Collection Tank F2175
4003	BV	Solid Waste Storage Area (SWSA) 2 - (4003)
4501		Mercury Contaminated Soil (Bldg. 4501)
4507	BV	High-Level Chemical Development Lab (4507)
4507 South		Inactive LLLW Collection Tank T-30
4507 South		Inactive LLLW Collection Tank T-30
4508		Mercury Contaminated Soil (Bldg. 4508)
4556	BV	High-Level Chemical Development Lab Filter Pit (4556)
6556A	BV	Contractor Trailer (6556A)
6556B	BV	Contractor Trailer (6556B)
6556C	BV	Contractor Trailer (6556C)
6556D	BV	Contractor Trailer (6556D)
6556G	BV	Contractor Trailer (6556G)
6556J	BV	Contractor Trailer (6556J)
6556K	BV	Contractor Trailer (6556K)
6556L	BV	Contractor Trailer (6556L)
6556M	BV	Contractor Trailer (6556M)
6556R	BV	Contractor Trailer (6556R)
6556ST1	BV	Contractor Trailer (6556ST1)
6556ST3	BV	Contractor Trailer (6556ST3)
6556ST4	BV	Contractor Trailer (6556ST4)

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
6556ST5	BV	Contractor Trailer (6556ST5)
6556ST6	BV	Contractor Trailer (6556ST6)
6556ST7	BV	Contractor Trailer (6556ST7)
6556ST8	BV	Contractor Trailer (6556ST8)
6556ST9	BV	Contractor Trailer (6556ST9)
6556T	BV	Contractor Trailer (6556T)
7002A	BV	Abandoned Underground Waste Oil Storage Tank 7002A
7002W		Waste Oil Storage Tank (7002W)
7019	BV	Thorium Storage Wells
7025	BV	Tritium Target Preparation Facility (7025)
7075		Waste Oil Storage Tank (7075)
7078A	BV	Contractor Trailer (7078A)
7078B	BV	Contractor Trailer (7078B)
7078C	BV	Contractor Trailer (7078C)
7078D	BV	Contractor Trailer (7078D)
7078E	BV	Contractor Trailer (7078E)
7078F	BV	Contractor Trailer (7078F)
7500	MV	HRE Reactor Building 7500
7502	MV	Radioactive Waste Evaporator for Bldg. 7500
7503	MV	MSRE Reactor Building (7503)
7503A	MV	Inactive LLLW Collection Tank 7503A
7505	WO	Contractors Headquarters
7506	WO	Contractor Shop
7507	WD	Hazardous Waste Storage Facility (7507)
7507W	WD	Mixed Waste Storage Pad (7507W)
7509	MV	MSRE Office Building (7509)
7511	MV	MSRE Filter Pit [Off-Gas Filter House (7511)]
7512	MV	MSRE Stack 7512
7513	MV	MSRE Cooling Tower 7513
7514	MV	MSRE Supply Air Filter House Bldg. 7514
7516		Field Service Shop (7516)
7554	MV	HRE Cooling Tower 7554
7555	MV	MSRE Diesel Generator House 7555 Former Storage Area
7556	MV	Homogeneous Reactor Experiment (HRE) Pond (7556)
7557	MV	HRE Charcoal Absorber Pit 7557
7558	MV	HRE Waste Evaporator Loading Pit (7558)
7559	MV	HRE Charcoal Absorber Valve Pit 7559
7560	MV	LLLW Collection and Storage Tank 7560
7561	MV	HRE Decon Pad/Shed 7561
7562	MV	LLLW Collection and Storage Tank 7562
7563	MV	Circulator Pump Pit for Bldg. 7500 (7563)
7567	WO	Central Pumping Station (Tanks T1 & T2) (7567)
7569	WO	Inactive LLLW Tank WC-20
7572	WD	CH-TRU Waste Storage Facility, 7572
7574	WD	NFS Waste Storage Facility
7576		7576
7577		7577
7578		7578
7579		7579
7580		7580
7582	WO	LGWOD Spare Parts Storage Facility (7582)

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
7602	MV	Integrated Process Demonstration Facility (7602)
7651	WD	Mixed Waste Storage Facility (7651)
7652	WD	Hazardous Waste Storage Facility (7652)
7653	WD	Chemical Waste Storage Facility
7654	WD	Long-Term Hazardous Waste Storage Facility (7654)
7658	MV	Closed Contractors' Landfill (7658)
7659	WD	Leaking Gas Cylinder Area
7659B	MV	Reactive Chemicals Disposal Area (7659B)
7659C	MV	Soil Injection of Radioactive Gas (7659C)
7661	WD	Electrical Distribution Building (7661)
7662	WD	7662 Emergency Generator
7666	WD	Environmental Emergency Response (transfer effective 2/1/00)
7666A	WD	Haz. Waste Area Support Trailer (7666A)
7667	WD	Explosive and Shock-Sensitive Waste Detonation Area
7668	WD	Mixed Waste Storage Facility, Building 7668
7670	WD	HWOG Equipment Storage (Tent) Fac. (7670)
7700A	MV	Tower Shielding Facility
7700B	MV	TSF Outside Source Storage Area (7700B)
7711	MV	Process Waste Basin for Bldg. 7709 (7711)
7716	CR	Filter Pump House Main Pool (7716)
7720	MV	Civil Defense Facility (7720)
7759	MV	Cesium-137 Forest Research Area (7759)
7800	MV	SWSA 4 (7800)
7802	MV	SWSA 5 South (7802)
7802A	MV	Seep C Collection and Treatment System (7802A)
7802B	MV	Seep D Collection/Treatment System (7802B)
7802C	MV	Deep Monitoring Well #1 (7802C)
7802D	MV	Deep Monitoring Well #2 (7802D)
7802E	WO	Sludge Removal Test Tank (7802E)
7802F	MV	Radiation Monitoring Equipment Storage (7802F)
7802N	WD	SWSA 5 North TRU Trenches Disposal Area
7805	MV	Pit 1 (7805)
7806	MV	Pit 2 (7806)
7807	MV	Pit 3 (7807)
7808	MV	Pit 4 (7808)
7809	MV	Trench 5 (7809)
7810	MV	Trench 6 (7810)
7810A	WD	Interim Non-regulated Waste Storage Facility (7810A)
7811A	MV	Pilot Pits 1, 2 (7811)
7813	MV	White Oak Creek Dam (7813)
7818	MV	Trench 7 (7818)
7821	MV	Emergency Waste Basin (7821)
7822	MV	SWSA 6 (7822)
7822		Augured Holes SWSA 6 Area (7822)
7822A	WD	High Range Disposal Wells (7822A)
7822B	MV	Fissile Disposal Wells (7822B)
7822C	MV	Low Range Silos (7822C)
7822D	MV	High Range Silos (7822D)
7822E	MV	Hill Cut Disposal Test Facility (7822E)
7822F	MV	TUMULUS I (7822F)
7822G	MV	TUMULUS II (7822G)

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
7822H	MV	Asbestos Silos (7822H)
7822J	WD	Radioactive Solid Waste Staging & Storage Pad (7822J)
7823	WD	PCB Storage Area (7823 Waste Storage Building)
7823A	WD	Underground Storage Facility Wells TT1-TT8 (7823A)
7823B	WD	Temporary Waste Storage Facility (7823B)
7823C	WD	Temporary Waste Storage Facility (7823C)
7823D	WD	Temporary Waste Storage Facility (7823D)
7823E	WD	Temporary Waste Storage Facility (7823E)
7823F	WD	SWSA-5N Storage Shed (7823F)
7824	WD	Waste Examination and Assay Facility (7824)
7824A	WD	WEAF Support Facility (7824A)
7826	WD	Retrievable Waste Storage Facility (7826)
7827	WD	High Level Alpha Waste Storage (7827)
7829	WD	Peach Bottom Storage Wells (7829)
7830	WO	Melton Valley Storage Facility (7830)
7830A	WD	Hazardous Waste Storage Tank
7831	WD	Field Office & Compactor Facility (7831)
7831A	WD	SLLW Storage Building (7831A)
7831C	WD	SLLW Storage Shed (7831C)
7831D	MV	SWSA 5 Storage Pad (7831D)
7834	WD	Retrievable Waste Storage Facility (7834)
7835	MV	Process Waste Sludge Basin WAG 5 (7835)
7841	WD	Equipment Storage Area (7841)
7841A		RAD Waste Storage Area Office Support Trailer (7841A)
7842	WD	SWSA 6 Waste Storage Facility (Building 7842)
7842A	WD	LWSP II Solid Waste Storage Pad
7842B	WD	SWSA 6 Temp Storage Facility
7842C	WD	SWSA 6 Temp Storage Facility
7846	MV	White Oak Lake and Embayment
7847	WD	Vehicle/Personnel Monitoring Station (7847)
7853	WO	OHF Storage Building (7853)
7855	WD	RH-TRU Retrievable Concrete Cask Storage Facility (7855)
7855A	WD	SWSA 5 Equipment Tent (7855A)
7856	WO	MVST Capacity Increase Project (7856)
7857	WO	IWMF Drainage & Collection Sys. & Biol. Freezers (7857)
7859		WAG6 MS1 Monitoring Shed
7860	WO	New Hydrofracture Facility
7863	WO	General Storage for Bldg. 7860 (7863)
7863A	WO	LGWOD General Storage Shelter
7863B	WO	LGWOD General Storage Shelter
7863C	WO	LGWOD General Storage Shelter
7876	WD	Health Physics Office Trailer (7876)
7877	WO	LLLW Solidification Facility (7877)
7878	WD	SWSA 6 Staging Facility (7878)
7878A	WD	Temporary Waste Storage Facility (7878A)
7878B	WD	Equipment Storage Facility
7879	WD	TRU Waste Staging Facility (7879)
7881	MV	Security Post #24 (7881)
7882	WO	Emergency Generator for Building 7877 (7882)
7883	WD	RH-TRU Bunker (7883)
7886	WO	Interim WM Facility Storage Pad 1 (7886)

Table H.2. Management and Integration (M&I) contractor facilities
As of July 19, 2002

Facility no.	Program	Bechtel Jacobs Company, LLC, contract facility
7887	WO	Solid Liquid Separations Unit
7892		Storage Building for Bldg. 7856 Operations (Industrial)
7894		WAG6 MS3 Monitoring Shed
7906	MV	HFIR/TRU Waste Collection Basin (7906)
7907	MV	HFIR/TRU Waste Collection Basin (7907)
7908	MV	HFIR/TRU Waste Collection Basin (7908)
7919	WO	HFIR, TRU, and TURF Manhole Monitoring Station (7919)
7922A	WO	Data Concentrator #6 for WOCC Das (7922A)
7934	WD	CH-TRU Waste Storage Facility
7935	WO	Equipment Cleaning Facility Tank T-100
7935		Equipment Cleaning Facility (Industrial)
7952	WO	Melton Valley Process Waste Pumping Station (7952)
7961	WO	Melton Valley Collection Tank Facility (7961)
7966	WO	LLLW Collection Tank for 7920 & 7930 (7966)
13822	BV	Tank 13822 - Helium Tank (13822)
HF-S1		Hydrofracture Experimental Site 1 (HF-S1) Grout Sheets
HF-S1		Hydrofracture Experimental Site 2 (HF-S2) Grout Sheets
HF-S1A		Hydrofracture Experimental Site 1, Soil Contamination (HF-S1A)
HF-S2A		Hydrofracture Experimental Site 2, Soil Contamination (HF-S2A)
SF-1226		Municipal Sewage Sludge Application Site (XF1226)
XG1404		Variable Dose Rate Irradiation Facility (VDRIF)
XG1410		Low Dose Rate Irradiation Facility (LDRIF)

APPENDIX I

Detailed Descriptions of Utility Improvements

Electricity

Electrical power needed to operate ORNL facilities at both the X-10 and Y-12 Sites is supplied by high-voltage transmission lines from the Tennessee Valley Authority (TVA) power grid. The 161-kV primary power system serving the Oak Ridge Reservation (ORR) is an integral part of the TVA power grid; therefore, system design, operation, and maintenance must be compatible with the rest of the TVA system. Currently, the Power Operations Group located in the Y-12 Facilities Maintenance Organization has responsibility for coordinating operations and activities on the distribution grid and for operating and maintaining the main substations serving each individual site. ORNL is assessed a portion of the total power operations charge based on the percentage of the total power used by all three sites in Oak Ridge to pay for the service provided by the Power Operations Group. ORNL remains responsible for providing any additional funding that is necessary for major maintenance to the substation, as well as monies needed for capital improvements. Electrical power used at ORNL is fed from the TVA network through two feeders. One feeder is approximately 8 miles long and extends from the K-27 substation at the East Tennessee Technology Park (ETTP) Site; the other is about 6 miles long and feeds from the Elza Substation located at the Y-12 Site. Each line is rated at 161 kV and is capable of supplying ORNL with approximately 110 MW. Transformers at the main substation at Building 0901 reduce the 161 kV to 13.8 kV. Current capacity of the feeders is sufficient to accommodate virtually any facility or program that may be located at ORNL, but the substation will need to be upgraded if total energy usage at the Laboratory increases significantly.

Eight 13.8-kV feeders distribute power to facilities throughout the Laboratory, where transformers further reduce the voltage to usable levels. Five secondary 2.4-kV substations, a 2.4-kV distribution system, switchgear, and numerous facility transformers complete the primary electrical distribution system that provides power to ORNL facilities. Fig. I.1 is a diagram of the primary electrical distribution system. The Spallation Neutron Source (SNS) construction site continues to expand, as does the need for temporary construction power. ORNL forces constructed a temporary electrical feeder into the construction area last year and continue to be called upon to extend the service and add new transformers and switches.

The electrical system includes 32 miles of overhead distribution lines, 4 miles of underground cable, 20 medium-voltage distribution switchgear assemblies, and over 200 facility transformers. Transformer installations vary in size from 10 to 7500 kVA and range from 1 to 55 years old. The system has a maximum capacity of 80 MW, but practical guidance limits current capabilities to approximately 40 MW. The present electrical load averages less than 20 MW for much of the year.

Many of the most critical operations and facilities are equipped with gasoline- or diesel-powered generators. These standby generators automatically start up to provide essential power to allow functions associated with environment, safety, health, quality, and infrastructure (ESHQ&I) to continue unaffected during power outages. They are a key component of safety systems designed to protect the public from the materials and hazards present on ORNL grounds.

Critical Infrastructure Condition and Needs

The oldest sections of the ORNL electrical system were built in the early-to-mid-1940s, and the age of the system is rapidly becoming a major problem. A number of projects have been completed that have greatly improved the safety and operability of the electrical distribution system. Currently, work is progressing on the Electrical Systems Upgrade Line Item. This project is correcting identified deficiencies and problems on a long overhead feeder, installing redundancy at the 4509 Substation, reworking bus-ties in the research complex, and installing additional meters to allow for improved efficiency. A second project, currently being proposed as an FY 2005

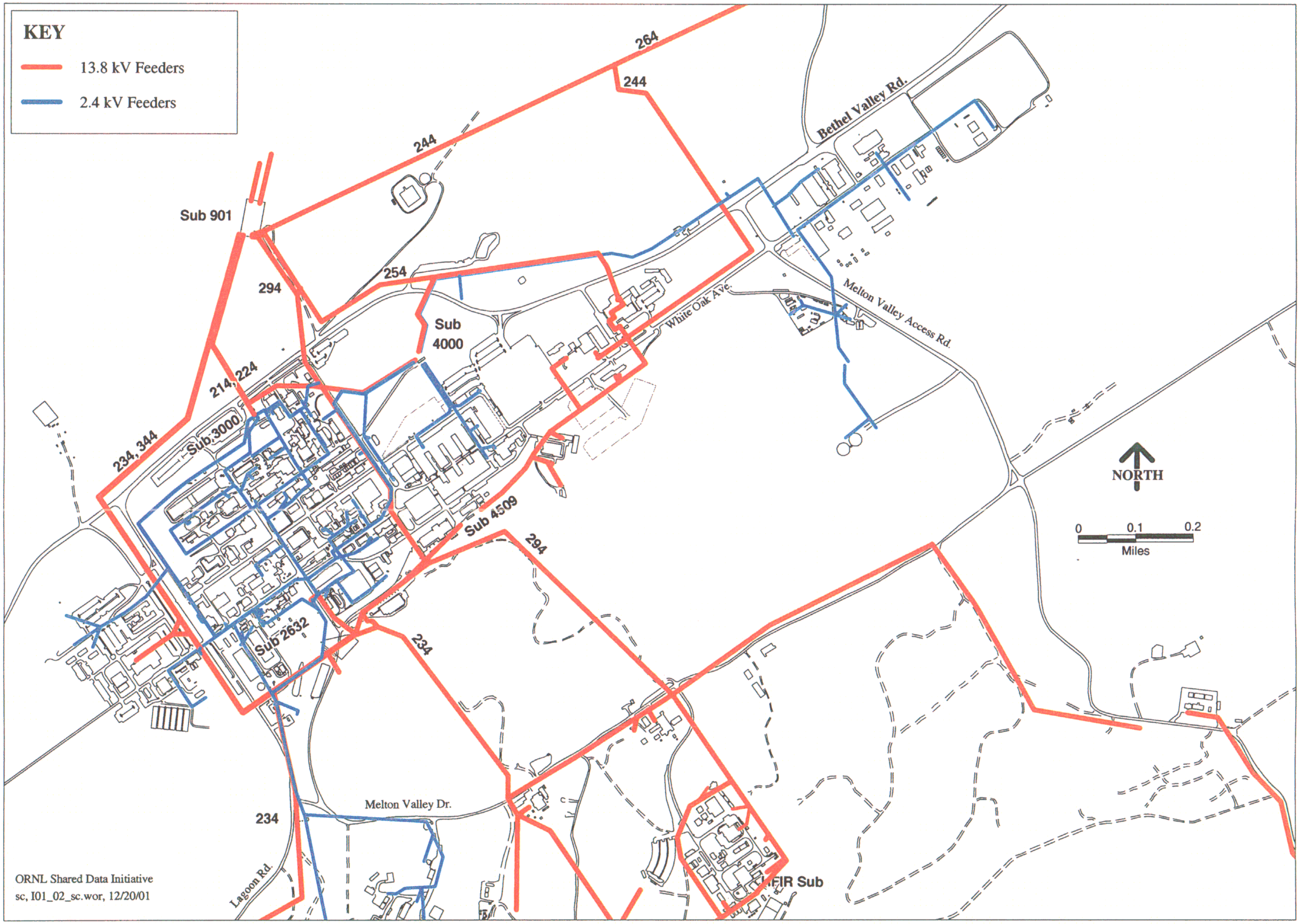

Fig. I.1. Primary electrical distribution system.

Line Item, will upgrade the existing 2400-V distribution grid to 13,800 V and will address fire safety deficiencies and reliability issues at the 0901 main substation. The improvements to the primary electrical distribution system will result in a distribution system capable of serving the needs of the ORNL research community in the future.

General plant project (GPP) and general-purpose equipment (GPE) needs have also been identified and are in the planning base. The projects involve replacing oil-filled circuit breakers in the main substation with new SF6 units obtained from reindustrialization efforts at ETTP, replacing and rebuilding facility service entrances, changing out old unsafe switchgear, and replacing transformers at substations throughout ORNL. The electrical distribution system, while beginning to show signs of age, continues to provide reliable service to all customers in the Laboratory. If recommended improvements are completed, the system will easily support ORNL operations and facilities safely and reliably well into the next century.

Compressed Air

Compressed air powers all of ORNL's major pneumatically operated control systems. Loss of the air supply would disable many experimental programs and processes, as well as many building ventilation systems. Safety-related systems that are actuated or controlled using compressed air are designed to fail in the safe shutdown mode upon loss of air pressure. Safety-related systems may also have backup air compressors or large accumulators to provide a sufficient volume of compressed air to complete a safe shutdown of operations.

Clean, dry, instrument-quality, 100 pounds per square inch gage (psig) compressed air is produced at the Steam Plant for customers in the Bethel Valley area by one or more of six air compressors. In addition, a single diesel-powered air compressor is used in emergency situations such as power outages or when maintenance or breakdowns on the other compressors require their use. Four air receiver tanks, three prefilter units, and two air dryer systems operate in conjunction with the air compressors to provide a clean, reliable supply of compressed air to ORNL. Compressors 1 and 2 are old electric reciprocating piston air generators acquired for use when the Laboratory was built in 1943. The No. 1 air compressor is a late 1930s model, and the No. 2 air compressor has been dated to 1917. Each compressor can provide 900 cubic feet per minute (ft^3/min) of compressed air at the nominal delivery pressure of 100 psi. The No. 3 air compressor is an 1100-ft^3/min rotary piston unit that was installed at the plant in 1960. It has a dual-drive capability using either electricity or steam to provide power. The Nos. 5 and 6 air compressors are newer, oil-free, rotary-screw-type compressors. The No. 5 compressor is rated at 2000 ft^3/min and was installed in 1987, totally rebuilt in 1994, and underwent a slightly less intensive overhaul in the summer of 1997. Although operating hours are approaching 100,000, the machine has been well maintained and is considered to be in good condition. The No. 6 air compressor was installed in 1991 and can produce 900 ft^3/min. A 3000-scfm oil-free air compressor and a 400-kW diesel-powered generator were installed in FY 1999 and has now logged over 18,000 hrs. This unit is the primary air producer for the Laboratory, with the other, older units assuming a backup position. It is capable of providing all of ORNL's current compressed air needs without help from other units and has allowed the removal of the two oldest reciprocating compressors from service. ORNL's compressed air load typically runs between 2400 and 2800 ft^3/min, day and night, and the various compressors are operated to suit the demand and to allow for maintenance on the equipment.

A 1000-kW diesel generator was added in 1996 to provide emergency backup power to the Nos. 5 and 6 air compressors. The generator gives the Steam Plant added capabilities by being able to supply compressed air to customers during electrical outages.

The compressed air produced at the plant is distributed to customers in the Bethel Valley area through an arterial-looped underground and aboveground piping system (Fig. I.2). The compressed air distribution system in the eastern area of the Bethel Valley complex was replaced in conjunction with the replacement of the steam distribution system in 1989. The steam lines and compressed air lines were placed in concrete trench ducts with easily removable concrete lid sections. The outward appearance of the new trenches is like that of sidewalks and, in fact, some of the trenches actually replaced sections of sidewalks in some areas. Replacement of the west end distribution system was completed in 1998. Sections of the steam and air distribution systems were placed in concrete trench ducts to enhance overall Laboratory appearance, improve system reliability, and provide for easy access should maintenance be required.

Underground compressed air and steam lines in the old central section of the Bethel Valley site will not be replaced in the same manner because (1) many facilities in the area are inactive with only small portions of the buildings supporting operations, (2) plans are in place to decommission many of the facilities, and (3) much of the soil in the area is contaminated with chemical and radioactive materials which would make trenching a complicated and expensive activity.

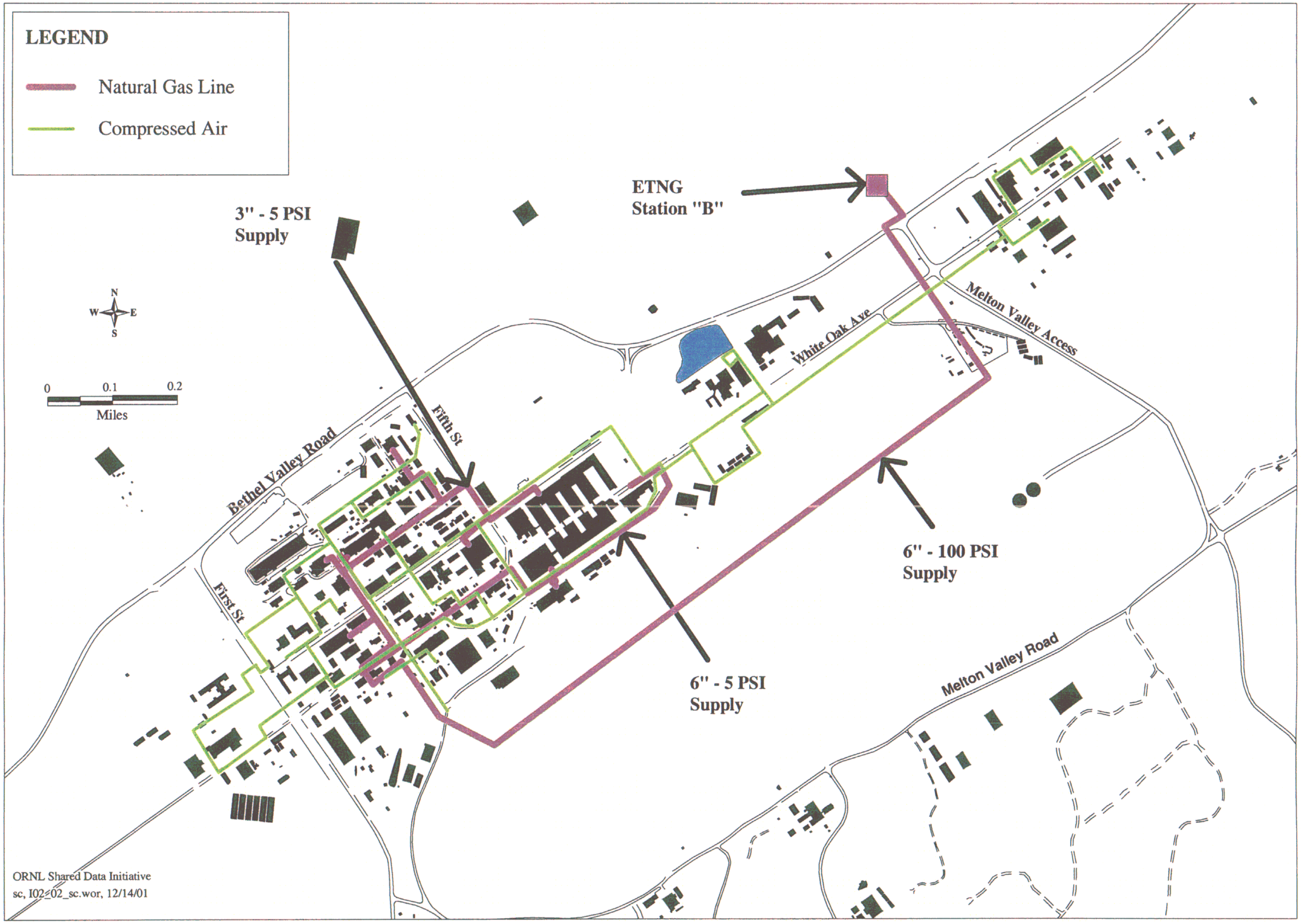

Fig. I.2. Natural gas and compressed air distribution systems.

Critical Infrastructure Condition and Needs

Clean, dry compressed air is used in many research, operation and maintenance activities in the plant and has long been considered one of the key infrastructure components. A significant investment over the last 15 years has upgraded the air production capability at the Steam Plant. The primary air producers at the plant are less than 5 years old and have proven themselves to be reliable air producers. While production of air is not considered a problem, being able to dry the air to a level that is needed by customers is becoming questionable. The air-drying system in the Steam Plant consists of two separate air-drying units. Both are C. M. Kemp units that have been in service for almost 40 years. At 38 years, the #1 Unit is the oldest and can now only provide marginal performance. It is used in a back-up position to the #2 Dryer, which is 35 years old. Both units need to be replaced, as a breakdown on either unit seriously affects the plant's ability to produce a usable air product. Distributing "wet" air is not an option and attempting to do so would cause operating and system control problems throughout the Laboratory. Moisture, even in minute quantities, will clog HVAC system control lines and, where it is used in research projects, would introduce undesirable contaminants into the experiment. A new, 4000 scfm dryer unit is identified in the infrastructure plan to replace the #1 Unit. The addition of this new dryer will further enhance the Steam Plant's ability to continue to provide clean and dry compressed air to its Laboratory customers. Compressed air is crucial to many activities at ORNL, and the replacement of both these older units is needed to support future projects and activities.

Natural Gas

The Duke Energy Company supplies natural gas to ORNL. This company owns, operates, and maintains the main line and the three pressure-reducing stations that make up the supply system to the ORR. DOE has delegated managing responsibility for this commodity to the Power Operations Department located at the Y-12 National Security Complex. This responsibility includes maintaining flow conditions within the supply contract limitations. No current supply limitations impact ORNL operations, as the system is designed with more capacity than is now demanded. However, contractual agreements do limit the amount of gas ORNL can demand. Under the current contract, ORNL can demand 1500 decatherms (1500 mcf) without incurring a penalty charge.

The ORNL natural gas tap is at Metering Station B, located north of Bethel Valley Road at the Melton Valley Access Road intersection. Natural gas from the East Tennessee Natural Gas Company (ETNGC) main is reduced to 100 psi at the metering station and passes through an orifice flange, where ORNL responsibility begins. Fig. I.2 is a diagram of the natural gas distribution system. The 6-inch ORNL supply line runs south to a tee where a 2-inch line branches off to supply gas to the 7000 Area reducing station. Gas pressure is reduced at the station to 10 psi for distribution to user facilities in the 7000 Area. Pressures are further reduced at each individual user facility according to the needs of that facility.

The gas supply for the remainder of ORNL runs southward from the tee for approximately 1000 feet before emerging from the ground. It then turns west and runs aboveground for approximately 7500 feet along the north side of Haw Ridge until it reaches the Steam Plant.

At the Steam Plant, there are seven pressure reducers at Reducing Station 2. Five of these reduce the 100-psi natural gas to 10 psi for use in the boilers in the Steam Plant. The other two reducers drop the pressure to 5 psi to supply the distribution grid which supplies gas to facilities located in the main ORNL Bethel Valley complex. The 5-psi distribution grid consists of approximately 3500 feet of 6-inch, 3-inch, and 1.5-inch steel pipe. Eleven buildings are connected to the distribution grid in Bethel Valley and, of these, only 8 currently use natural gas for any purpose.

The natural gas system at ORNL was constructed in 1948, with the only significant improvement coming in 1969, when the 100-psi main line was relocated to the north side of Haw Ridge to remove it from highly populated research areas. This aboveground line is in good condition, having been sandblasted and recoated in 1987; it should be able to continue to provide safe and reliable service for the next 15 to 25 years if the protective coating system is maintained. The underground portions of the line in the main plant area are in fair condition. Cathodic protection on these lines has prevented corrosion of the pipe. Only two leaks have developed on this underground section in the last 19 years, but due to the increasing line age, more frequent leaks can be expected in the future.

The SNS will be installing a tee off of the ORNL 6-inch, 100-psi line in Pit 1 located just south of Metering Station B. Natural gas service will be extended into the site to provide fuel for package boilers and other operational purposes.

The third-party development of the new campus will also need high pressure natural gas for activities in the Engineering Technology Facility and, possibly, for building heat. As proposed, there will be another 3-inch tap into the ORNL Metering Pit, and a new line will be extended down Bethel Valley Road into the development site. The challenge in the next few years will be in demand management. With more than one user on the system, it must be ensured that usage is monitored closely and that, when a demand charge is incurred, the user, whether it is the SNS, ORNL, or the third-party developer, pays the premium involved. Contract demand will need to be established to allow all three entities to operate, but should be low enough to provide the incentive to burn fuels efficiently.

Critical Infrastructure Condition and Needs

The aboveground section of the ORNL natural gas line was constructed in 1969 and was sandblasted and re-coated in 1987. This coating system remains in good condition, with only a few areas requiring a small touch-up to provide protection to the underlying steel line. A new coating will probably need to be applied in the next 5 years. It is expected that operating money will be used for this maintenance task. The underground portion of the Laboratory's natural gas distribution system was installed in 1948 and is now 54 years old. It is a coated, cathodically protected system that still appears to be in good condition. There have only been a few leaks on the line in the last 20 years, despite the line having surpassed its design life expectancy. The underground section of the gas system currently serves very few customer facilities and, as the facilities deactivation efforts increase, many of the facilities with natural gas service will be demolished or will be mothballed to await demolition. A new or rehabilitated natural gas system located in these older areas of the Laboratory is not needed, given the prospects for facilities in the service area. Those facilities that remain in the area, or new facilities proposed for the area, that require natural gas may need to look to bottled systems instead of the central system. It will be much more economical to provide a manifold and/or bottled gas system to these few users than to excavate and rebuild the existing system.

Potable And Process Water

Water for ORNL is taken from the Clinch River south of the eastern end of the Y-12 National Security Complex and pumped to the water treatment plant located on the ridge northeast of the Y-12 Plant. The treatment plant is owned and operated by the City of Oak Ridge and can supply water at a potential rate of 24 million gal/day (Mgd) to two storage reservoirs with a combined capacity of 7 million gallons. Water from the two reservoirs is distributed to the Y-12 Plant, ORNL, and the City of Oak Ridge.

Water to ORNL is provided via a single 24-inch line extending from the water plant and running approximately 7.5 miles across Chestnut Ridge into the ORNL plant site. This 24-inch line feeds the ORNL reservoir system, which consists of one 3-million-gallon capacity concrete reservoir and a new, 1.5-million-gallon capacity steel reservoir on the south slope of Chestnut Ridge and two 1.5-million-gallon steel reservoir tanks on Haw Ridge. These reservoirs provide the reserve capacity necessary to support ongoing day-to-day activities in ORNL facilities located in the Bethel and Melton valley areas. From these reservoirs, water flows by gravity into the plant distribution grid. The water is used for domestic, sanitary, fire protection, and process purposes. Water usage is approximately 2.5 Mgd on a winter day and 4 Mgd during the summer, though on a very hot day, water usage can approach 5 Mgd. A flow of 7 Mgd can be accommodated by the ORNL supply system under current operating conditions. Loss of the single supply line from the water plant, or any activity that would cause loss of the reserve capacity of one of the reservoirs, could impact ORNL operations within a short period.

The 3-million-gallon water storage reservoir on Chestnut Ridge is constructed of reinforced concrete and is in poor condition. Major spalling has occurred inside the reservoir on the roof and support beams, and steel reinforcement is exposed and decaying. Minor exterior cracks have developed and have been healed by calcium deposits. The reservoir underwent a thorough internal and external inspection in 1997, and the evaluator recommended that extensive repairs be performed to ensure that the reservoir can remain functional. A new, 1.5-million-gallon steel reservoir was completed in 2001 that will allow work to be initiated on rehabilitation of the concrete reservoir. Plans are currently being formulated that propose to remove it from service in the early spring of 2002 to identify and repair the leak(s) and to undergo an internal inspection by a team consisting of individuals from ORNL Engineering, the Utilities Complex, and a subcontract engineering firm that specializes in concrete design and construction. It is hoped that this team can use visual observations to develop a rehabilitation plan that will allow for an orderly, progressive repair of identified deficiencies over a period of 1 to 3 years to minimize the impact on the total ORNL utility cost.

The steel reservoir tanks on Haw Ridge were constructed in 1963 and are configured to normally provide reserve water capacity for ORNL operations located in Melton Valley (e.g., HFIR). Corrosion within the tanks necessitated replacing the steel roofs with aluminum dome-type structures in 1986. At that time, the tanks were also thoroughly sandblasted, and corrosion-resistant coatings were applied to both the interior and exterior surfaces. These reservoirs were inspected internally and externally in 1997 and were judged to be in good condition. The only deficiency noted was a breakdown in the external coating system that was causing rust "blisters" to develop. Maintenance personnel stripped, wire brushed, and pressure washed the tanks in the summer of 2000 prior to applying a new polyurethane/epoxy paint that should prevent corrosion from recurring for at least the next 10 years.

A third reservoir serves facilities in a remote area of ORNL. A small 30,000-gallon steel storage tank provides water to facilities in the area previously known as the Health Physics Research Reactor site. While the mission has changed in this area, the facilities continue to be occupied. This tank was inspected in 1997 and was judged to be in poor condition. Internal corrosion has occurred despite cathodic protection, and a new coating system is needed. Discussions with fire protection and operations personnel indicate that this reservoir capacity is no longer necessary because the reactor has been shut down and moved. Plans are to continue to use the tank until it is no longer serviceable and then replace it with a smaller, 3,000- to 5,000-gal/day tank to serve the needs of buildings in the area. Water supply to this tank is provided from a booster pump station. At the station, there are two electrically driven pumps and one gasoline-engine powered pump. The gasoline pump is the source of concern from a fire protection standpoint because of its age. If capital funding can be obtained, the Fire Department has strongly advocated replacing this old pump and driver with a new diesel driven model.

The water distribution system at ORNL (Fig. I.3) consists of approximately 100,000 ft of cast iron and steel pipe and 900 valves ranging from 2 to 24 inches in diameter, of which the process water segment constitutes a relatively minor part. Contamination of the potable water system is prevented by backflow preventers at the major take-off points and near the points of use on the process system. During the 1970s, the piping in the 7000 Area was upgraded from steel to cast iron.

Critical Infrastructure Condition and Needs

Considering its age, the general condition of the water system is good, but some areas need improvement. Funding is needed to replace and upgrade the four major backflow preventer stations that supply water to the process water system. These stations are over 35 years old, and repair and replacement parts are difficult to obtain. Cross-connection control regulations prohibit the use of nonstandard parts when rebuilding backflow preventer valves; hence, the fabrication of unavailable parts for such units is not an option. Once current vendor inventories of parts are exhausted, the units will need to be removed from service when they fail to pass the annual inspection test. A few years ago, a GPP installed new motorized valves in the older sections of the system, but some older motorized valves and operators still exist and will need to be replaced with operating funds. The main line running east and west through the center of the Bethel Valley site has become brittle, and a major failure occurred in 1981 that was attributed to this embrittlement. Several improvements have been identified that would provide improved reliability, especially for fire protection, and would reduce the risk of flooding due to line breaks in low-lying areas. The Fire Protection Upgrade project design has been completed, and construction should begin in the spring of 2002. In addition to addressing a number of fire protection issues, the project will address the issues surrounding potential flooding of research facilities in the 6000 Area as a result of a failure of the 16-inch line passing through the site, as well as provide for a number of new water supply loops in the area to improve water supply for both fire protection and programmatic purposes.

Two other Line Item projects are in the outyear planning base. These two projects address legacy-type problems associated with water lines running through the older process areas within the plant. The soil there is known to be contaminated with radioactive nuclides. Leakage *from* the pipes could leach radioactive material into groundwater and surface water. Leakage *into* the pipes could contaminate the potable water supply itself. A number of studies have been performed on these projects, and risk assessments resulted in the installation of additional valves to allow quick isolation of leaks in these areas. These two projects remain in the planning stages because of the necessity to consider all plausible scenarios to ensure a safe water supply to employees at ORNL. These projects propose to replace the underground water system in contaminated areas with an aboveground water system. This is not considered to be a feasible option for a number of reasons, including the fact that it would be unsightly, difficult to operate, and would not address all the issues surrounding the problem. Any construction activity in these contaminated areas is extremely expensive, and the proposed projects still cannot guarantee with a high degree of certainty that a leak will not occur. It is hoped that, with advances in trenchless technology, new methods of rehabilitating or replacing these lines will become available in the next few years, allowing these areas to be addressed with a reasonable, cost-effective approach.

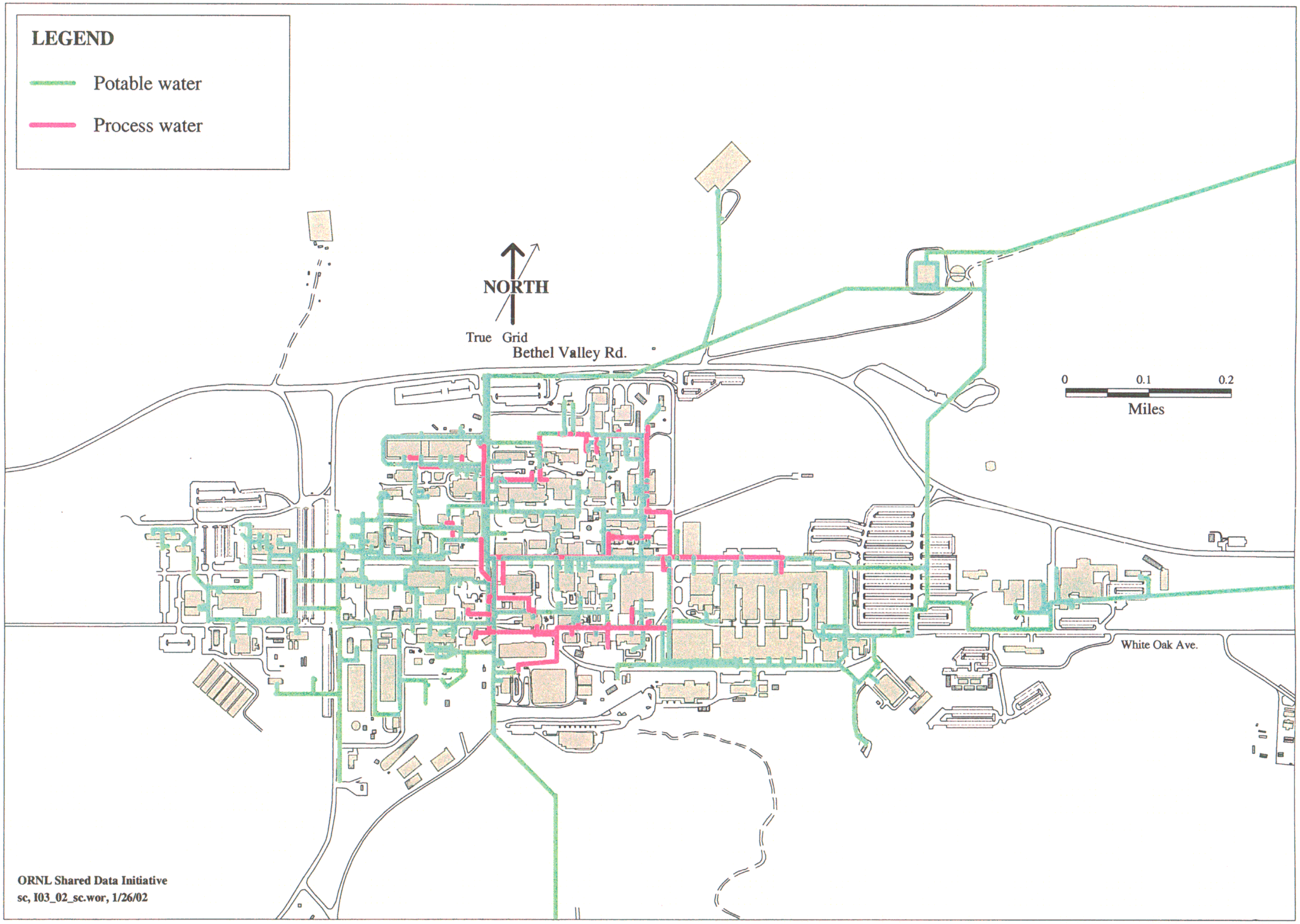

Fig. I.3. Water distribution system.

Potable And Process Water (cont'd)

Additional changes to the ORNL water distribution system will become necessary due to the third-party, State of Tennessee, and DOE facilities that will be constructed in what is now the east parking lot. A 24-inch, a 16-inch, and a smaller 8-inch water line will need to be moved for the 5 new facilities to be located in the area. As currently envisioned, the new piping configuration will move the existing lines north and south of the development area to allow the third-party contractor a clear site for construction. This work will precede the 6000 Area water system improvements by a few months, but when both are completed, the new system configuration should support any future development in the area.

Industrial Gases

Industrial gases used at ORNL facilities are provided in refillable containers by vendors from the local area. These gases include nitrogen, argon, helium, acetylene, and other specialty or high-purity gases required for laboratory and industrial-type uses. Gas cylinders are received at Central Stores and are distributed to the various user stations as requested. Many facilities have gas manifold systems which allow distribution of the gases to many users throughout the facility, while other facilities rely on a system whereby individual users are responsible for their own gases. Liquid nitrogen is an important resource to many facilities throughout ORNL. Bulk liquid nitrogen is delivered to the Laboratory by a vendor and transferred to a bulk storage tank which delivers it to individual users, either into bulk storage tanks or transportable Dewars.

ORNL maintains a storage facility for compressed gas cylinders which is physically removed from adjacent buildings. Safety assessments have been performed on this facility which helped determine stocking levels of hazardous and flammable gases. Stocks of these types of materials are maintained in the facility at these minimum levels to help ensure minimal impact in the event of an accident.

Chilled Water

The Central Chilled Water System (CCWS) centered at Building 4509 provides chilled water used in the air-conditioning systems of 13 buildings in the central portion of ORNL (Fig. I.4). The five branches of the system serve (1) Buildings 4500N (less Wing 5), 4501, and 4505; (2) 4500N (Wing 5), 5500, 5505, and 5507; (3) 5510, 5510A, and 6010; (4) 4515; and (5) 3500, 4508, and 4500S. The system is comprised of 9 chiller units with an aggregate capacity of 8600 tons, 9000 feet of piping, 3 cooling towers, 324 fans, 47 chilled water pumps, and 10 tower water pumps. The chilled water system serves approximately 1 million square feet of floor area, including offices, laboratories, computers, and accelerators. Many of these applications require cooling, regardless of the weather.

ORNL has 34 additional, self-contained chilled water systems, which are located within the individual buildings they serve (i.e., 2026, 2033, 6000, and 7900). These systems include 36 chillers, totaling 3958 tons capacity, with 13 cooling towers. Twenty-seven of ORNL's 45 chillers are less than 15 years old and utilize non-CFC refrigerants. Three CFC chillers have been converted to non-CFC refrigerants using operating funds, one has been abandoned, and four CFC-refrigerant chillers remain operational.

Critical Infrastructure Condition and Needs

The CCWS is in good condition, with a few exceptions. Five of the nine CCWS chillers are less than 5 years old and utilize non-CFC refrigerants. They represent 5800 tons, or 67%, of the cooling capacity available. One 1000 ton CFC chiller is out of service, but effort is under way to secure funding to replace this chiller. Three other units located in the 4500N basement have a combined total capacity of 1800 tons and are primarily used for backup of the newer chillers. Currently, the limiting variable is the capacity of the cooling towers. The Building 4510 cooling tower was rebuilt in 1997 and has a capacity of 4800 tons. The Building 4521 cooling tower was constructed in 1989 and has a 2000-ton capacity. A third tower, Building 4511, was built in 1959, is in extremely poor condition, and cannot be used. The two operating towers have a 6800-ton maximum capacity, which is less than the total available cooling capacity of 7600 tons. An extended outage on the Building 4510 tower will impair the ability to reliably provide cooling to all 13 buildings in any season other than winter. Once the 1000-ton chiller is replaced and the 4511 cooling tower rebuilt, sufficient capacity should be available to meet the needs of existing facilities into the future. Should additional facilities be tied into the central system, additional capacity should be added to ensure that sufficient cooling is always available to support the Laboratory's programs.

An ongoing CFC chiller replacement project has been in process since it was initiated in FY 1994. Thus far, this project has funded the replacement of 15 large CFC chillers with general-purpose equipment (GPE) funding. Additional funds have been earmarked for this program through FY 2003, with the intent to replace the remaining CFC chillers and non-CFC chillers that are deteriorated or have leak rates exceeding the allowable U.S. Environmental Protection Agency (EPA) limits (i.e., 3047E, 7910, 7603).

Five of 13 self-contained cooling towers serving individual facilities are less than 15 years old and most of the others, while old, are still considered to be in good condition because of an effective chemical treatment program that has been in existence since the late 1960s. The most prominent exception to this is the cooling tower serving operations in Building 6000. This tower is considered to be in poor condition and is considered to be somewhat undersized for current and future programs in the area. Funding is being sought to replace or repair this tower as soon as possible.

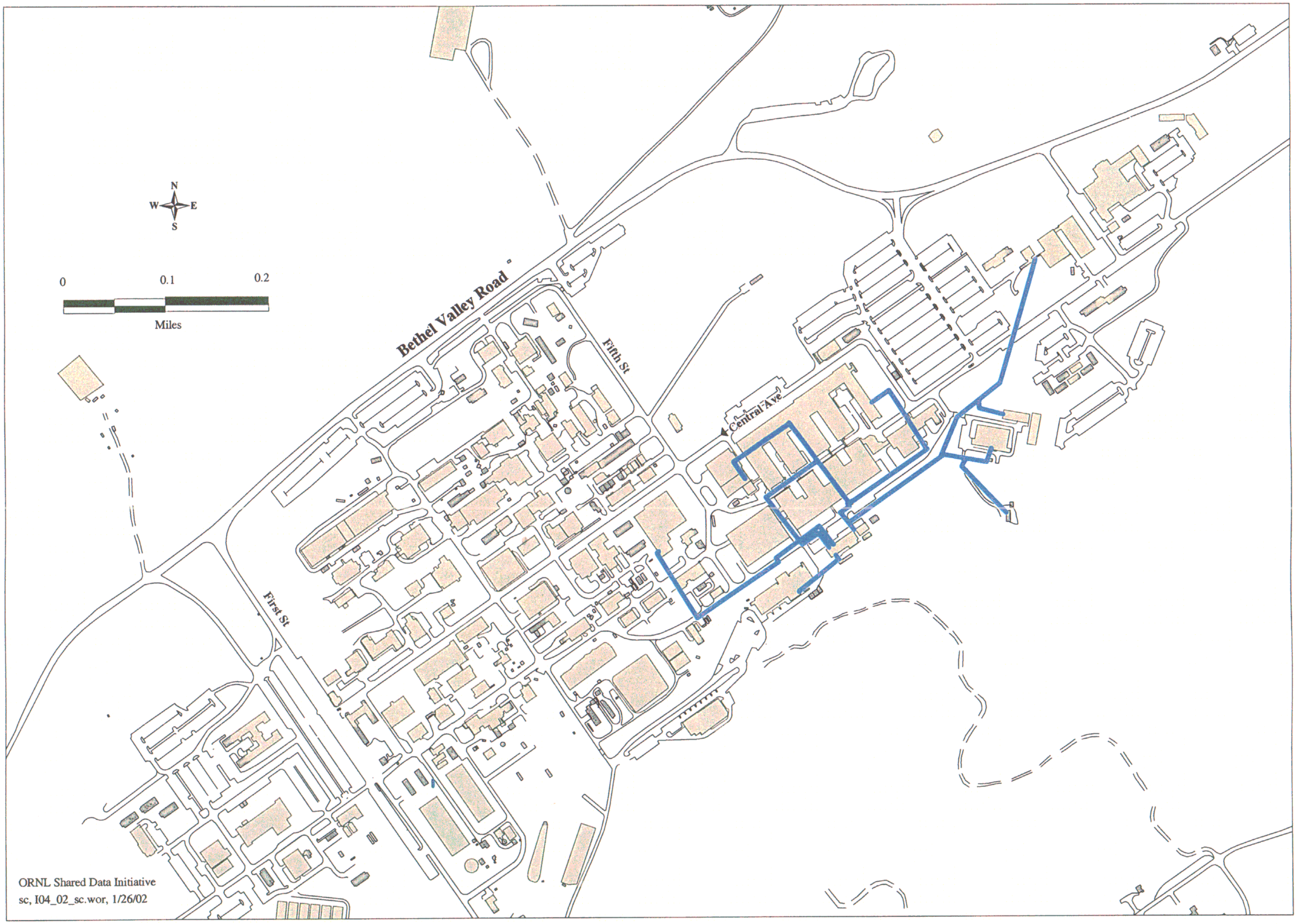

Fig. I.4. Chilled water system.

Chilled Water (cont'd)

An FY 2001 Laboratory Facilities HVAC Upgrade Line Item is under way to improve the chilled water system distribution and extend a new chilled water header to Building 4501. Work on this project is progressing with an expected completion in mid 2003.

The Facilities Management Division maintains an active database of projects and equipment needed to maintain cooling systems at the Laboratory. Funding has been requested from the various sources available, including Energy Saving Performance Contracting. The importance of maintaining this valuable infrastructure component is recognized by Laboratory Management, and adequate funding should be in the pipeline in the coming years to ensure its reliable performance.

Steam

The steam production system consists of four boilers and two package-type boilers, all of which are housed in the Steam Plant (Building 2519). The total capacity of the six boilers is slightly over 300,000 lb/h of saturated steam at 250 psig when firing on either natural gas or fuel oil. The Steam Plant supplies steam to the Bethel Valley facilities and the 7500 and 7900 Areas in Melton Valley. The Steam Plant also houses the necessary auxiliaries, such as boiler feedwater pumps, induced- and forced-draft fans, water-softener systems, the fuel oil pumping system, and the natural gas pressure-reducing station. The coal-handling system and the ash disposal system have been shut down, and various components are being demolished and removed from the facility as resources and conditions allow.

The Steam Plant was constructed in 1948 and underwent conversion from coal to natural gas/fuel oil in the early 1950s, and from natural gas/fuel oil back to coal in the late 1970s. The addition of the #6 Boiler two years ago allowed, once again, conversion of the plant back from a coal/natural gas plant to a natural gas/fuel oil plant. Much of the coal-handling equipment on the boilers has been removed and the coal storage yard has been closed and capped. The 2001 heating season is the first winter in 24 years that the Steam Plant has not been fired, at least partially, on coal. Natural gas and fuel oil are now the only fuels that can be used in the plant.

The 2001 boiler overhaul effort concentrated on trying to improve the firing efficiency of the older boilers by sealing air leaks into the boiler fire boxes. The moving grates in each boiler were covered with fire brick and refractory and insulation were added throughout the fire box. The result has been boilers that appear to be firing more efficiently and fewer boiler problems with combustion air and hot spots. Efforts to further improve the plant's efficiency will continue in FY 2002 as boiler controls for the #5 Boiler are upgraded and as more coal-related equipment is removed from each boiler, further allowing a tighten-up of the fireboxes.

About 90% of the steam produced is used primarily for heating approximately 135 buildings, and the remainder is used for process steam. The process steam drives the emergency off-gas turbines in the 3039 stack areas if there are power outages. Other uses include heating water and drying clothes in the Decontamination Laundry; dish, pot, and pan washing in the cafeteria; and processes to support R&D activities throughout ORNL.

The steam distribution system (Fig. I.5) is sized to handle the total capacity of the six boilers. The system includes approximately 27,000 feet of piping and involves approximately 360 major valves, 50 steam-regulating stations, and 70 steam pits. Steam is produced at 240 psig and routed from the northeast and southeast corners of the Steam Plant through an 8-inch line along Central and White Oak Avenues to form a loop around the Building 4500 complex. Steam lines to the 7000 Area are connected to the loop near Building 5505. A project to replace the steam and compressed-air lines in the eastern portion of the Bethel Valley complex, with new lines in concrete trench ducts, was completed in 1989. These trench ducts have easily removable concrete lids and, because they were set below grade in most areas, have the outward appearance of sidewalks. Work was essentially completed in 1998 on a similar upgrade of the western portions of the steam and air distribution system. New lines were installed in the below-grade pipe trenches, and 18 buildings were tied into the new looped system. Some additional minor demolition work on the old system remains to be done and will likely be performed using operating funds when resources allow.

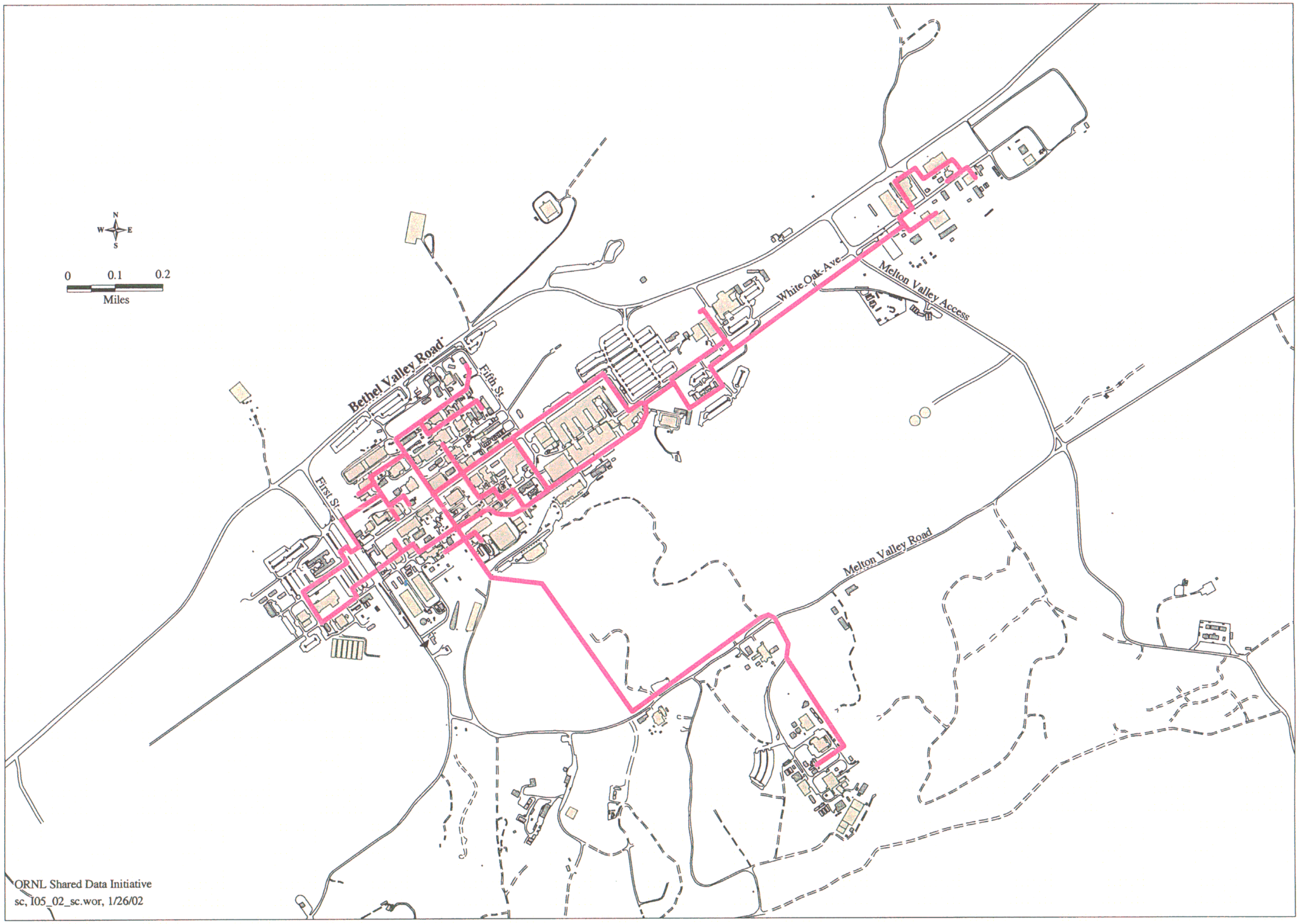

Fig. I.5. Steam distribution system.

Critical Infrastructure Condition and Needs

While the Steam Plant remains reliable, the major equipment systems, including the boilers, have exceeded useful design life. A Steam Plant study was completed that identifies replacement and upgrade projects that will be necessary if the plant is to continue to operate reliably and efficiently. It is doubtful that funding will be available in the foreseeable future to finance the construction of a new steam plant to make any type of wholesale improvements to the steam generation system. Because of this, it appeared that a master plan needed to be developed to determine the least costly means to ensure continued operations. Many pieces of major equipment and a number of critical systems will need to be replaced in the next 10 years. The plan identifies these needs and will allow funding to be allocated to these projects in manageable portions. The result should be (1) relatively stable steam costs after the first few years of equipment and system close-out costs and (2) significant capital cost avoidances from not having to repair and replace major coal-related systems.

A number of other projects are also under way or will be in the upcoming years. Funding will be allocated within the next couple of years to replace the economizers on Boilers 1 and 4, after completion of a successful project which replaced the same components on Boilers 2 and 3 during the summer of 1998.

The East End Water Softener System softens boiler feedwater and serves as a backup to the primary West End Softener System. This old system was installed in 1963 and desperately needs upgrading. Currently designed to treat boiler feedwater to produce up to 100,000 lb/h of steam, its performance has degraded steadily over its years of use. The system needs to be replaced with a new unit designed to accommodate the normal maximum winter steam output in order to be an effective backup system.

The Boiler No. 6 project that was completed in September 1999 provided the key component in the coal-to-natural-gas-conversion strategy. Its addition gave the Steam Plant the capability to produce year-round steam loads without using coal. With this capability, ORNL will be able to rehabilitate the old coal boilers, one at a time, and convert them from coal stoker boilers to natural gas and fuel oil firing. The rehabilitation effort will include installation of new steam tubes and drums, replacement of all refractory brick and insulation, and removal of all coal-handling equipment and replacement with a new fuel manifold system to allow maximum output from gas or fuel oil. Projects have been proposed to perform this upgrade over a span of years to ensure that the Steam Plant remains viable well into the future.

No improvements are currently planned for the steam supply to facilities in the Melton Valley area, including the HFIR. If future funding allows, and programmatic requirements dictate, an additional feed line will be run from the Steam Plant and tied into the existing Melton Valley line at a point just north of the HFIR Area. The addition of this new feed will allow maintenance outages to occur on the supply lines without affecting HFIR or other facility operations.

Stormwater

The stormwater collection system consists of drainage ditches, catch basins, manholes, and collection pipes which convey stormwater, condensate, and cooling water flows to the receiving streams. White Oak Creek traverses the site and ultimately receives all the discharges from ORNL, as well as normal flows from the four tributaries which feed it. Rainfall, snow-melt, and other authorized flows are directed to the gravity-drainage system which conveys the water from buildings, parking lots, streets, and roofs to specific outfalls. The collection system itself was installed in an unplanned manner over the years as ORNL developed and matured, which has resulted in the existence of 146 National Pollutant Discharge Elimination System (NPDES)- Permitted stormwater outfalls discharging into the receiving streams. To comply with current stormwater regulations and ORNL's NPDES Permit, each of these outfalls must be periodically sampled and characterized to determine the makeup of the discharge stream and to ensure that it complies with permit requirements.

Significant effort must be expended to keep up with compliance-related issues associated with these outfalls and their discharges. During the last few years, three liquid-feed dechlorinators have been installed on outfall pipes that carry large volumes of once-through cooling water. Smaller, tablet-feeder dechlorinators have also been installed on numerous outfalls that convey smaller continuous or periodic flows of cooling water. Due to the strict in-stream chlorine concentration limits imposed on ORNL by the NPDES Permit, it is imperative that these wastewater streams are chlorine-free prior to their discharge.

A comprehensive storm drain survey was completed at ORNL in the summer of 1997. This survey was mandated by a court order that resulted from the Friends of the Earth vs DOE lawsuit. It consisted of a comprehensive survey of all pipes, sinks, and other connections to the storm drain system. Facility managers, subject matter experts, and members of the support services staff walked-down and dye-checked all the drains in 846 facilities, buildings, and other structures located within the ORNL Complex. The results of this survey are maintained in a central database, updated annually, and continue to be used to eliminate inappropriate discharges into the stormwater system and to identify sources of once-through cooling water that can be treated, rerouted, or eliminated. Both the liquid-feed and smaller, tablet-feed dechlorinators are being used to treat chlorinated discharges, but because of the costs involved in the maintenance and upkeep of these units, substantial efforts are being made to eliminate the sources of the discharges. Through these efforts, it is hoped that compliance can be consistently achieved with a minimum of expense and effort.

In all areas, ORNL has adopted a "best management practices" approach as an economical and practical way to achieve compliance. A *Stormwater Pollution Prevention Plan* describing these practices is in place and serves as a guidance document to help identify potential problem areas and to recommend possible mitigating actions that can be taken to avoid permit noncompliances. Its emphasis is on prevention, and members of the compliance staff actively participate in project development and oversight activities to ensure that every possible effort is taken to prevent stormwater-related problems.

Construction activities at the Spallation Neutron Source continue, and contractors working on the project have instituted a proactive stormwater management approach. The entire 125-acre site has been ringed with silt fencing and straw bales, with special emphasis on drainage swales and runoff corridors. To assist in the long-term management of stormwater flows from the facility, two new stormwater retention ponds have been constructed. These ponds collect stormwater flows and allow solid particles to settle out before the water is discharged. Thus far, they have been very effective in preventing the carry-over of silt into the surrounding watershed.

Critical Infrastructure Condition and Needs

Despite its somewhat haphazard and undocumented installation, the condition and performance of the stormwater collection system is very good. Under all but the worst of conditions, the system removes storm flows from the Laboratory grounds without flooding or causing other damage. The issues related to the stormwater system have to do with the widespread use of once-through cooling water and the need to dechlorinate those flows. Maintenance and upkeep of the dechlorinators, particularly the tablet-feed type is intensive and time consuming. During rainy periods, keeping them supplied with tablets can become a near full-time job. A second issue relates to the chemical used to dechlorinate. It is a toxin as well as an oxygen scavenger and, if it becomes too concentrated in the creeks, it can cause fish kills and other problems. The problems related to the stormwater system have nothing to do with the system itself, but rather with how the system is used. If the Laboratory can pursue the installation of recirculating cooling systems to eliminate the once-through flows, many problems associated with the stormwater collection system, as well as the pollution prevention program in general, will be eliminated.

Conventional Waste

Conventional wastes include sanitary/industrial wastes, sanitary sewage, process wastewater, and stormwater. Solid conventional wastes are regulated by the Tennessee Solid Waste Management Act.

Sanitary/Industrial Wastes

Sanitary/industrial waste consists of paper, garbage, wood, metal, glass, plastic, demolition and construction debris, sanitary and food wastes from cafeteria operations, sludge from water and air treatment, and other special wastes. The Y-12 National Security Complex Centralized Sanitary Landfill II is used for disposal of nonhazardous materials such as construction debris and most other sanitary wastes.

Sanitary Sewage Collection and Treatment

Sewage Collection. The sewage collection system (Fig. I.6) consists of over 32,000 ft of clay, cast iron, and polyvinylchloride (PVC) pipe ranging in size from 4 to 12 inches. Access to this system is obtained through 194 brick and concrete manholes. The system itself has grown as ORNL has grown. The early parts of the system, located roughly between First Street and Fifth Street, were constructed in 1943 when ORNL was built and consists primarily of vitreous clay pipe with packed joints and manholes constructed entirely of brick. The rest of the collection system was constructed as the Laboratory grew and developed. The construction methods used in these areas reflect construction practices used when they were built, with some collection grid lines constructed from vitreous clay, concrete, cast iron, and PVC. Manhole construction also reflects this diversity, as some are built entirely from brick, others are part brick and part concrete, some are poured-in-place concrete, and the newer manholes reflect the current practice of using precast units.

In the early 1980s, a leak test was performed on the system which indicated areas where illegal taps had been made and where infiltration was a problem. The illegal taps were removed and restrictions placed to help prevent the recurrence of the problem. The survey also was used as the basis for the first GPPs in the mid-1980s directed at lessening infiltration into the system. During 1984 and 1985, approximately 60% of the sewage collection grid lines 6 inches and larger were rehabilitated using a then-new process called Insituform. The Insituform process installs a new, joint-free liner inside the existing pipe, creating a slick, leak-free system. The success of this effort was immediate, with daily average flows falling from the 250,000 gpd range to the 150,000 gpd range.

This proved not to be the ultimate solution to infiltration problems. Within a year after these lines were rehabilitated, volumes began to slowly increase. Investigation of the problem indicated that the groundwater flow which previously had been entering the pipe through open joints, cracks, and breaks was now flowing along the outside of the pipe and entering the system either through the manholes or through a section of pipe which had not been lined.

Because of this problem and other weaknesses identified in the sewage collection system, a Line Item project to upgrade the sanitary sewage collection system was initiated in the late 1980s and funded in 1993. This project successfully upgraded most of rest of the collection system by installing cured-in-place lining in all sewer lines 6 inches and larger, sealing all manholes with a high-build polyurethane, and making other improvements. There are currently only a few short sections of the main collector lines, as well as the individual building service laterals, that could not be rehabilitated. Developments in the trenchless technology industry that would allow further sealing of the collection system with a minimum of excavation are being monitored.

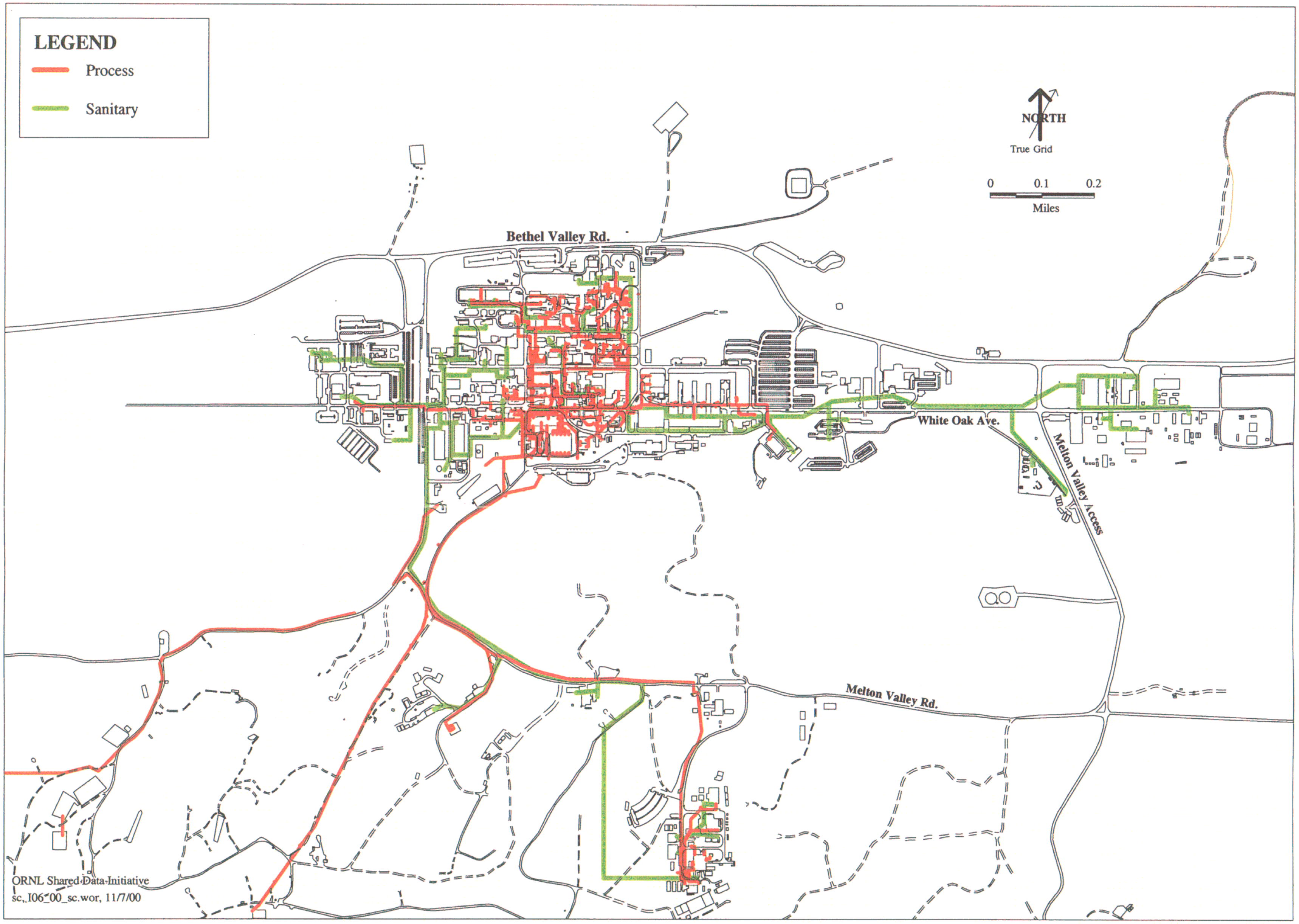

Fig. I.6. Sanitary and process sewage system.

Sewage Treatment. The ORNL Sewage Treatment Plant consists of a DAVCO 300,000-gpd packaged, extended aeration plant which provides primary and secondary treatment and a sand/gravel filter and disinfection chamber to provide tertiary treatment. The plant was constructed in 1985 and has performed continuously since that time. Treated flows averaged 182,841 gpd during FY 1999; 190,215 gpd in FY 2000; and dropped slightly to 186,458 gpd in FY 2001.

Efforts aimed at improving overall operations at the Sewage Treatment Plant continue with some notable successes. A tank has been procured and is being installed that will allow easier disposal of the plant's digested sludge at the City of Oak Ridge's West End Treatment Plant. Sampling and analytical uncertainties are greatly reduced by having a static volume of sludge to handle. By using the tank, 15,000 gallons of digested sludge can be accumulated over time and then sampled and analyzed prior to being taken to the City. Previously, sampling occurred in the sludge digester tank at the Sewage Treatment Plant, which was constantly receiving additional sludge. The analytical results only provided a snapshot in time. The new tank will allow greater confidence in the sampling and analytical process and will allow greater accuracy in determining whether the sludge meets the acceptability requirements established with the City.

The ozonator system installed at the Sewage Treatment Plant has been in operation for over a year and is operating satisfactorily. The back-up chlorinators were removed and chlorine is no longer stored or used at the Sewage Treatment Plant. The use of this system has helped reduce the amount of chlorine being released into the receiving streams resulting in a reduction in the amount of dechlorination chemicals needed. Dechlorination chemicals are a problem because of the tendency to deplete oxygen levels in the creeks.

The Spallation Neutron Source (SNS), the Life Sciences Complex, the new third-party campus, and their associated processes will generate new flows into the Sewage Treatment Plant. Planning is under way to ensure that their needs will be accommodated in both the construction and operational phases of these projects. A computer model of the sanitary sewage collection system has been created, and the new flows from these and other facilities have been modeled. Some potential problem areas have been identified in the pumping stations at 4512 and 3501. Pumps at the stations are not currently operating at their rated capacity, and plans are being made to determine the cause of these problems. The model indicates that, while these stations are currently able to accommodate the flows from the new facilities with their present level of operating performance, there are some peak loading scenarios that could cause surcharge conditions. The system underwent smoke testing during the summer of 2001 to determine possible problem areas and potential sources of infiltration and other unauthorized inflows. A number of areas where infiltration could possibly occur were identified. Most were broken or missing clean-out plugs, but there are a few areas where it appears a line may be broken that could allow rainfall or runoff to enter the collection system. Plans have been made to repair all of the deficiencies.

Critical Infrastructure Condition and Needs

The only deficiency currently identified within the sewage collection and treatment system is an improvement needed to the east end of the collection system to accommodate the new flows generated by the SNS and the population shift brought about when the third-party facilities are occupied. The computer model of the system indicates that this is a non-critical problem that may manifest itself during periods of heavy flow brought about by inclement weather. The proposed improvements have not been thoroughly defined, but will likely include the upgrading of the sewage pumping stations and possibly enlarging a short section of line in the 6000 Area.

Conventional Waste (cont'd)

The remainder of the collection system, with the exception of the 4-inch- and smaller-diameter service laterals, is in excellent condition. Improvements and upgrades made by the 1993 Line Item project were successful in providing a relatively tight, leak-free system that is impervious to root infiltration. The exception, as noted previously, is with the small-diameter service laterals. These are the lines that run from the main collector trunk lines back up to the individual buildings. Access to both ends of these pipes is impossible without excavation within the buildings themselves. Plans are to continue to monitor developments in trenchless technologies that will allow rehabilitation of these service lines with a minimum of excavation and disruption of service.

The Sewage Treatment Plant is a package unit with a 25-year design life. The plant is currently 17 years old, meaning that, in about 5 years, planning should begin to replace the plant. This time window works well with current plans in the Laboratory. In 5 years, the SNS should be operational, the new campus facilities occupied, and the other facilities to be built by the State and DOE should be functional. The plant population shifts will have stabilized as employees move from the older facilities into the new structures. Likewise, the flow characteristics of the sewage collection system will have changed and stabilized, allowing for accurately determining the baseline information needed to begin specifying a new treatment plant.

A pollution prevention project is also planned for the Sewage Treatment Plant. A denitrification system has been identified that will remove most of the nitrates from the plant's effluent stream. A portion of the Laboratory's toxic release inventory consists of the nitrates released from the Sewage Treatment Plant. The removal of this waste stream, while not compliance driven, will reduce pollutant discharges into the environment and will help the Laboratory achieve its waste reduction goals.

Transportation Infrastructure

ORNL main site locations are accessible only by road. The southern areas of the Laboratory's environmental research areas border the Clinch River, but no barge facility has been developed. Such a facility could be developed if future needs arise that will require moving large, heavy objects. ORNL has access to and has used two different barge facilities in the past; one at the East Tennessee Technology Park (ETTP) and the other at the Tennessee Valley Authority's Bull Run Steam Plant. Rail access is limited as well, as no tracks run to the ORNL site. Access to rail service can be made either at the ETTP or at the Y-12 National Security Complex, both of which are served by a rail spur.

Motorized vehicle circulation at ORNL may be divided into two sectors: off-site and on-site. Off-site circulation consists of staff movements to and from work and between the various other Oak Ridge installations and offices for work assignments and for material pickup and delivery. Off-site roads include State Route 95 (White Wing Road), located approximately 1 mile to the west of the Laboratory's main complex, and State Route 62 and Scarboro Road, which provide access to the Laboratory and ORNL facilities at Y-12 from the east. Bethel Valley Road extends between Highways 95 and 62 by running approximately 8 miles through the center of the Oak Ridge Reservation (ORR) and is the main artery serving the Laboratory. Though Highways 95 and 62 run through the ORR, maintenance and emergency services on these roads is provided by the State of Tennessee and the City of Oak Ridge. Bethel Valley Road, on the other hand, is owned by DOE, and maintenance services are subcontracted. Security and emergency services are provided along Bethel Valley Road by Wackenhut Services, the City of Oak Ridge, the State of Tennessee, or, as is often the case, a combination of these three entities. The State of Tennessee is considering routing a west interstate bypass around the Knoxville metropolitan area. A number of alternative routes are being considered, including one route across the ORR (Fig. 2.16).

On-site motor vehicle circulation consists of employee movement between and among work sites within ORNL and the delivery and pickup of materials, tools, and equipment used to support routine operations. In addition to walking, employees use cars, trucks, golf carts, and bicycles to move among the widely dispersed facilities at the Laboratory. A paved bicycle trail extends from the west end of the plant to provide a safe and efficient way for cyclists to move about Laboratory facilities.

Principal roads serving ORNL's Bethel Valley Site are shown in Fig. 3.1. The main road is Bethel Valley Road, an east-west thoroughfare that provides access to the site and leads to all of the main parking lots. The road was resurfaced in 2001, from the ORNL 7000 Area to the main entrance and from the First Street intersection westward approximately 3/8 mile. The need for improved security at ORNL and along Bethel Valley Road has brought about a change in the vehicle access to ORNL. Beginning in December 2001, vehicle access to Bethel Valley Road and the use of Bethel Valley Road is restricted to those who have official business with the Laboratory. There are manned guard portals at either end of Bethel Valley Road to check badges or review cargo manifests to ensure that vehicles traveling on Bethel Valley Road have a need to do so. It will no longer be used as an east-west shortcut for vehicles to avoid the City of Oak Ridge or the Interstate system around Knoxville. This restricted access will be beneficial to the Laboratory in a number of ways. Most importantly, a greater degree of security can be provided to all Laboratory facilities and employees if vehicles traveling within a few hundred feet of the plant have passed through a security checkpoint. By extending the security envelope to the edge of the reservation, ORNL can also pursue its goal of becoming a more open facility without compromising the safety or security of its facilities or employees.

Completion of several construction and expansion projects has alleviated chronic parking problems experienced at the Bethel Valley facilities over the last couple years. Parking lot conditions, in general, are good. Most asphalt lots are holding up well but could stand a general re-striping to delineate parking spaces.

Transportation Infrastructure (cont'd)

Gravel lots typically serve to provide parking under overflow conditions, such as during the heavy guest and visitor months in the summer. These lots are well constructed and provide safe parking for employees, but should be paved to meet the intent of ORNL's Stormwater Pollution Prevention Plan. Rains cause erosion and rutting in the gravel lots and the sediment picked up during rains is carried into the area's receiving streams.

A number of proposals for new facilities have them located in what are now parking lots. The "Mouse House" is conceptually sited in the parking lot immediately west of Building 1000. Parking spaces displaced by this building will be relocated to a gravel lot located north and west of the building. The new research campus is proposed for different areas of what is now the East Parking Lot. Vehicles displaced from this lot will need to find spaces in two recently paved lots in the 6026 Area, in a new lot that will be constructed south of the 6000 Area of the Laboratory, or in the expanded 4500N Flag Pole Lot. Other construction projects will also affect parking in existing lots. Because of this, additional parking has been provided in a new Sixth Street Lot, a new lot at the east end of Southside Drive, a new parking area above what used to be the Gunite Storage Tanks, as well as in smaller lots located along White Oak Avenue and other smaller areas yet to be developed. The gravel lots at the HFIR Complex will also be paved in FY 2002.

On-site transportation is provided by an arterial grid system of streets running through ORNL. North-south access is provided by numbered streets, starting with First Street at the west end of the plant and ending with Eighth Street in the east. The main east-west corridors are Central Avenue and White Oak Avenue. Most main routes have sidewalks running parallel to them to ease employee accessibility and improve safety. Sidewalk conditions throughout ORNL are considered good, with only small sections needing repair or replacement each year. Vehicles used for casual transport, as well as those used to haul materials and make deliveries, utilize the same traffic grid, though traffic volumes and such problems are rare.

The main roads in Melton Valley are Melton Valley Drive, Ramsey Drive, Melton Valley Access Road, Lagoon Road, and HPRR Access Road (Fig 3.2). These roads lead to the principal experimental facilities, including the High Flux Isotope Reactor (HFIR), Robotics and Process Systems Complex, and the Radiochemical Engineering Development Center, as well as to the numerous Solid Waste Storage Areas (SWSAs) and waste processing sites in the valley. Road conditions need to be improved on both Melton Valley Drive and Lagoon Road. Both roads predate ORNL and were designed only to provide access to the farm community that was in the area prior to 1943. Melton Valley Drive east of the HFIR entrance has not been paved or upgraded since the 1960s and has deteriorated significantly. The old asphalt surface has many cracks and irregularities, and subsurface drainage systems show signs of failing, causing areas of undermining of the base material. Traffic volumes, both vehicular and pedestrian, dictate that the road be realigned and leveled to provide a safe driving surface for employees and guests who must use it. Lagoon Road is similarly affected. Age and use, coupled with a poor initial design, make this road dangerous, particularly in wet weather. The road has many hills and curves and needs to be straightened and leveled to improve safety. The northern section of the road, extending from the Chemical Waste Area Access Road to Melton Valley Drive, runs adjacent to ORNL's SWSA 4. This section of the road will be rebuilt and relocated while construction forces install a new cap and seal over the old burial ground area.

Copper Ridge has one main route, Gravel Hill Road, which connects the old DOSAR Facility and the Tower Shielding Facility to State Route 95. The road is a single-lane, unimproved gravel access road running along a power line right-of-way. Since the Tower Shielding Facility has been turned over to CROET for reindustrialization, access into the area by anyone other than a small group of utility service providers is being discouraged. The road will continue to be adequate for these users if properly maintained.

Transportation Infrastructure (cont'd)

By far, the largest portion of off-site traffic circulation is generated by ORNL personnel commuting to and from work. The average commute of an ORNL employee working in Bethel Valley is about 35 miles. Peak traffic occurs between 6 and 8 a.m. with the arrival of workers at the site and between 3:30 and 5 p.m. with their departure. Minimal traffic delays are experienced during these peaks since work shifts are staggered, car and van pooling are practiced, and most deliveries to and shipments from ORNL are timed to avoid the rush hour. Road maintenance and the movement of heavy equipment or escorted shipments typically occur during the workday after traffic flow has subsided.

Critical Infrastructure Condition and Needs

- Parking Lot Construction
- Bethel Valley Road Improvements
- Melton Valley Road Improvements
- On-Site Transportation Initiatives

APPENDIX J

Detailed Description of Security Improvements

Detailed Description of Security Improvements

The ORNL Laboratory Protection Division (LPD) has the overall responsibility for providing classified matter protection and control, a foreign national visits and assignments program, a foreign travel program, nuclear materials control and accountability, nuclear materials management, personnel security, physical security, security program management and planning, and visitor services to all ORNL organizations and operations. The objective of the LPD is to implement appropriate security measures needed to protect against events that may cause adverse impacts on national security, the environment, and the health and safety of Laboratory employees and the public, while maintaining an environment conducive to the conduct of scientific research and development and the efficient operation of the installation.

Under a prime DOE Oak Ridge Operations Office contract awarded in September 1999, Wackenhut Services, Inc. - Oak Ridge (WSI-OR) started providing ORNL with selected security services on January 10, 2000. Although WSI-OR provides some select security services to the laboratory, overall management responsibility for ORNL's multi-faceted security programs remains with UT-Battelle. WSI-OR, however, does have programmatic responsibility in two specific areas: ORNL Protective Force (PF) operations and the Personnel Security Assurance Program (PSAP).

J.1 ORNL PROTECTION STRATEGY

ORNL protection strategies are dependent upon the establishment of concentric layers of increasing security measures, starting at the Laboratory's outer boundary and moving inward toward the site's and DOE's specific security interests, to include special nuclear material and classified matter storage and handling facilities. Under this concept of layered security, the probability of deterring or detecting hostile acts, as well as increasing difficulty and delay in perpetrating these acts as a potential adversary approaches the site's interior target areas, increases progressively. Conceptually, this requires reliance upon a graded approach in protecting four fundamental types of security areas:

Material Access Area (MAA): Area where Category I and II quantities of special nuclear material are processed, used, or stored. MAAs are located within a Protected Area, have additional access controls and intrusion detection, and are defined by physical barriers. Unescorted access to an MAA requires a "Q" clearance and special approval. MAAs exist within the National U-233 Repository, in Building 3019.

Protected Area: Security area utilized to protect Category I and II quantities of special nuclear material and protected by physical barriers, such as walls and fences, and equipped with intrusion detection and access control systems. Unescorted access to a Protected Area requires a "Q" clearance and special approval. The Laboratory's sole Protected Area is situated within Building 3019.

Limited Area: Security area established for the protection of classified matter and/or Category III quantities of special nuclear material. An "L" or "Q" clearance is required for unescorted access within these areas, which are generally located within buildings. The Laboratory has a number of different Limited Areas at disparate locations.

Property Protection Area (PPA): Security area having boundaries identified with barriers and access controls established to protect government-owned property. Uncleared personnel with proper identification (a DOE photo-identification badge or ORNL Visitor Identification) may have unescorted access. Most areas at the laboratory are designated as PPAs.

Activation of intrusion detection alarm systems in security areas at ORNL which house special nuclear material will result in a tactical response from the ORNL Protective Force within a predetermined period. Special nuclear material located in ORNL facilities is provided a level of security commensurate with its safeguards quantity and attractiveness level.

Classified matter is stored and processed in Limited Areas at ORNL. Access to these areas is limited to "L"- or "Q"-cleared individuals with appropriate need-to-know or to personnel accompanied by authorized escorts. Classified areas have been developed, when required, to support various classified projects using the "security island" concept. This concept ensures that only the physical space required for the classified work receives the necessary additional restrictions and increased level of protection.

Access Control. Most of ORNL is designated as a PPA. To enter a PPA, employees and visitors must wear identification badges, but they do not have to possess a security clearance. No classified matter may be stored in these areas, nor may classified subjects be discussed. PPAs are generally defined by either chain-link fences or building perimeters. Access points are controlled by the ORNL PF or proximity card-reader (automated access control) doors, gates, and/or turnstiles, or, alternatively, are administratively controlled via receptionists or restrictive signage. Construction of new access control portals along Bethel Valley Road was completed during FY 2002. The new portals provide a more efficient and effective control mechanism for maintaining authorized staff and visitor access to the site. Vehicular access to the main campus area during other-than-normal work hours is further restricted.

Fencing and Other Barriers. The most common perimeter security barrier currently used at ORNL is chain-link fencing; however, in concert with an "open" campus policy for areas of the Laboratory where the principal focus is "science", there are some areas which are not enclosed by fencing. When fencing is used without intrusion-detection devices, it has limited ability to detect unauthorized entry and serves more as a psychological barrier. A more effective physical barrier can be the walls of a building. Most wall materials are more solid and difficult to penetrate than the fence fabric; however, these materials must be carefully selected and properly designed when used as a barrier for a Limited Area or higher.

Lighting. Protective illumination is provided to enhance the ability of observers to detect and assess potential adversaries and to reveal the presence of unauthorized persons.

Signs and Other Postings. Security signage is posted as required by DOE M 5632.1C-1, "Manual for Protection and Control of Safeguards and Security Interests," at portals and along the defined site perimeter. Signage includes No Trespassing, Prohibited Articles, Subject to Search, and the Nuclear Material Rewards Act signs.

During both FY 2001 and 2002, steady progress has been and will continue to be made on reconfiguring the security posture of the Laboratory. This reconfiguration has led to a migration of personnel access controls to the building level rather than relying solely on site perimeter boundary access controls. This reconfiguration of site access control policy, coupled with a DOE-approved move to take control of Bethel Valley Road, will result in improvement of overall site security and in an enhancement of the layered approach to protecting assets needing the most protection. New access control measures will improve the Laboratory's ability to better control the specific area access of foreign national visitors and guest assignees and will result in enhanced protection of unclassified sensitive information.

Security Improvements. Planning for continuous improvement of ORNL security will continue to focus on applying the right mix of security measures to (1) assure the protection of DOE security interests and the site populace against events that may cause adverse impacts on national security, the environment, and personnel health and safety, while continuing to (2) maintain a work environment most conducive to ORNL's science mission. Full implementation of an Integrated Safeguards and Security Management (ISSM) program in FY 2002 will result in increased line management accountability and responsibility for security and will lead to enhanced overall site security.

J.2 ORNL AT THE Y-12 NATIONAL SECURITY COMPLEX

The Y-12 National Security Complex also operates under a graded safeguards approach and defense-in-depth, or layered, security concept. All of the ORNL facilities at the Y-12 National Security Complex, with the exception of Building 9204-3, are located in the PPA. This access area comprises the eastern and the extreme western portion of the Y-12 Complex and contains security fences, gates, and portals that control access and prohibit movement of unauthorized persons into areas with higher levels of security. The Life Sciences Complex, which is situated in the same valley as the Y-12 National Security Complex, is a separate ORNL facility which falls under the ORNL security program.

Building 9204-3 is located within the Y-12 National Security Complex Protected Area. In this area, Security Police Officers from the Y-12 Protective Force and other internal controls are used to prevent access to classified matter and special nuclear material by unauthorized persons. A "Q" clearance is required for unescorted access to this area.

Infrastructure Needs

- CCTV Replacement Project ($1.3M)
- Hardened Central Alarm Station (CAS) ($1.5M)
- Upgrade Intrusion Detection Alarm System Infrastructure ($100K)
- Upgrade Automated Access Control System and Infrastructure ($300K)

APPENDIX K

Candidates for Disposition and Space Management Plan Summary

Table K.1 Candidates for disposition (as of July 19, 2002)

Site Location	Facility Number	Facility Name	Responsible D&D Program	Gross Sq Ft	Year Built	Year Targeted for Deactivation
Y-12	9105	ENGINEERING OFFICE BUILDING	DP	7,400	1977	FY01
Y-12	9207	BIOLOGY BUILDING	EM	247,500	1945	FY01
Y-12	9211	CO-CARCINOGENSIS	EM	76,600	1945	FY01
Y-12	9220	MOLECULAR BIOLOGY FACILITY	EM	22,350	1967	FY01
Townsite	XC1402	AMSE MUSEUM	SC	55,000	1974	FY02
X-10	0964	WASTE INSPECTION BUILDING	SC	200	1996	FY02
X-10	2000	SOLID STATE ANNEX	EM	22,660	1948	FY02
X-10	2001	INFORMATION CENTER COMPLEX	EM	25,338	1948	FY02
X-10	2013	WEST MAINTENANCE SERVICE CENTER	SC	11,969	1943	FY02
X-10	2017	EAST RESEARCH SERVICE SHOP	EM	228	1943	FY02
X-10	2029	OFFICE TRAILER	SC	1,173	1974	FY02
X-10	2030	OFFICE TRAILER	SC	720	1976	FY02
X-10	2087	STORAGE I-E	EM	187	1948	FY02
X-10	2088	EMERGENCY GENERATOR BUILDING FOR 2000	EM	161	1948	FY02
X-10	2092	STORAGE	EM	114	1959	FY02
X-10	2506	P&E MAINTENANCE SHOP & SUPPORT BUILDING	SC	10,620	1943	FY02
X-10	2647	CONSTRUCTION ENGINEERING TRAILER	SC	2,160	1965	FY02
X-10	3508	I&C METROLOGY AND CALIBRATION	EM	13,863	1951	FY02
X-10	3531B	TRAILER	SC	666	1996	FY02
X-10	3534	STORAGE BUILDING	SC	180	1961	FY02
X-10	3534A	HEALTH PHYSICS TRAILER	SC	320	1970	FY02
X-10	3534B	HEALTH PHYSICS TRAILER	SC	320	1970	FY02
X-10	3537	HYDROGEN & OXYGEN DISTRIBUTION	SC	3,000	1961	FY02
X-10	3541	ENGINEERING DEVELOPMENT LAB	EM	870	1965	FY02
X-10	3550	RESEARCH MATERIALS PREPARATION FACILITY	EM	14,036	1943	FY02
X-10	3550T	INTERCOMPARISON STUDY DILUTIONS LAB.	SC	480	1965	FY02
X-10	3592	COAL CONVERSION FACILITY	EM	694	1952	FY02
X-10	4005	SENTRY POST 8C, 5TH ST. PORTAL	SC	80	1995	FY02
X-10	5506	SENTRY POST 1B, EAST PORTAL	SC	544	1963	FY02
X-10	5553	SENTRY POST 1E, WHITE OAK E. P	SC	60	1964	FY02
X-10	6003	PHYSICS OFFICE BLDG.	SC	6,552	1976	FY02
X-10	6026A	OFFICE TRAILER	SC	1,728	1990	FY02
X-10	6026B	OFFICE TRAILER	SC	1,728	1990	FY02
X-10	6026C	OFFICE TRAILER	SC	1,728	1990	FY02
X-10	6026D	OFFICE TRAILER	SC	1,728	1990	FY02
X-10	6026E	OFFICE TRAILER	SC	1,728	1990	FY02
X-10	6026F	CONFERENCE AND OFFICE SUPPORT TRAILER	SC	1,728	1990	FY02
X-10	6026G	OFFICE TRAILER	SC	1,728	1990	FY02
Y-12	9102-1	ENGINEERING TECHNOLOGY OFFICE BUILDING	DP	6,250	1964	FY02
Y-12	9102-2	ENGINEERING TECHNOLOGY OFFICE BUILDING	DP	6,200	1976	FY02
Y-12	9108	ENGINEERING TECHNOLOGY OFFICE BUILDING	DP	7,510	1981	FY02
Y-12	9201-3	ENGINEERING TECHNOLOGY ADMIN. AND LAB BLDG.	DP	187,300	1944	FY02
Y-12	9610-3	ENG. TECH. FLAMMABLE MATERIAL	DP	512	1990	FY02
Y-12	9720-39	COLD STORAGE BUILDING	DP	8,000	1984	FY02
X-10	0942	ESD TRAILER	SC	160	1970	FY03
X-10	0961	ORNL VISITOR OVERLOOK	SC	3,596	1983	FY03
X-10	2011	ELECTRIC & AC SERVICE CENTERS	EM	5,618	1943	FY03
X-10	2024	QUALITY ASSURANCE INSPECTION OFFICE BLDG.	EM	10,300	1969	FY03
X-10	2093	ENVIRONMENTAL STORAGE BUILDING	SC	420	1953	FY03
X-10	2102	PCM TRAILER	SC	128	1990	FY03
X-10	2652A	TRAILER, RADIOLOGICAL SURVEILLANCE	SC	1,728	1990	FY03
X-10	2652B	TRAILER, RADIOLOGICAL SURVEILLANCE	SC	1,728	1990	FY03
X-10	2652C	TRAILER, RADIOLOGICAL SURVEILLANCE	SC	1,464	1990	FY03
X-10	3013	ENERGY DEVELOPMENT STORAGE BUILDING	SC	616	1946	FY03
X-10	3503	HIGH RAD. LEVEL CHEM. ENG. LAB	EM	13,716	1948	FY03
X-10	6556E	FOREST MANAGEMENT TRAILER	SC	980	1989	FY03
X-10	6556Q	FOREST MANAGEMENT TRAILER	SC	648	1989	FY03
X-10	6556S	FOREST MANAGEMENT TRAILER	SC	128	1989	FY03
X-10	7964B	RESEARCH REACTORS OFFICE TRAILER	SC	2,088	1987	FY03
X-10	7964D	RESEARCH REACTORS OFFICE TRAILER	SC	672	1988	FY03
Y-12	9204-1	ENGINEERING TECHNOLOGY	EM	196,700	1944	FY03
Y-12	9401-1	ENGINEERING TECHNOLOGY LABORATORY FACILITY	EM	12,000	1945	FY03
Y-12	9743-2	PIGEON QUARTERS	EM	2,200	1949	FY03
Y-12	9770-02	RADIATION SOURCE	EM	155	1945	FY03

Table K.1 Candidates for disposition (as of July 19, 2002) (cont'd)

Site Location	Facility Number	Facility Name	Responsible D&D Program	Gross Sq Ft	Year Built	Year Targeted for Deactivation
Townsite	1060COM	1060 COMMERCE PARK DRIVE	SC	54,365	1990	FY04
Townsite	111UNV	111 UNION VALLEY ROAD	SC	9,629	2000	FY04
X-10	1000	ENGINEERING OFFICE BUILDING	SC	59,503	1946	FY04
X-10	2019	LASER LABORATORY	SC	800	1951	FY04
X-10	3037	CHEMICAL TECHNOLOGY OFFICES	EM	8,008	1951	FY04
X-10	3504	GEOSCIENCES LAB	EM	3,952	1951	FY04
X-10	3523	RIS SENSOR DEVELOPMENT, SOUTH ANNEX	EM	1,170	1954	FY04
X-10	3542	STORAGE BLDG. FOR 3506 & 3517	EM	576	1965	FY04
X-10	3587	INST LAB ANNEX & CLOTHING STOR	SC	5,473	1950	FY04
X-10	3605	TSD STORAGE BUILDING	SC	416	1985	FY04
X-10	3610	STORAGE BUILDING	SC	400	1989	FY04
X-10	5000	MAIN PORTAL BUILDING	SC	4,360	1952	FY04
X-10	7600	CONTAINMENT BUILDING	EM	72,891	1960	FY04
X-10	7609	STACK MONITORING HOUSE	EM	780	1965	FY04
Y-12	9201-2	FUSION ENERGY ADMINISTRATION & LABORATORY BLDG.	EM	257,200	1944	FY04
Y-12	9210	MAMMALIAN GENETICS	EM	65,700	1945	FY04
Y-12	9224	MOLECULAR BIOLOGY FACILITY	EM	10,100	1968	FY04
Y-12	9422	LCTF COMPRESSOR	EM	2,500	1980	FY04
Y-12	9610-2	FLAMMABLE MATERIALS STORAGE	EM	683	1990	FY04
Y-12	9983-FX	ESD TRAILER	SC	680	1991	FY04
Y-12	9999-1	MOTOR GENERATOR	EM	500	1986	FY04
Y-12	9999-3	ELECTRICAL SWITCHGEAR AND RECTIFIER	EM	2,400	1978	FY04
Y-12	9999-4	ELECTRICAL EQUIPMENT	EM	300	1979	FY04
Other	XE1451	BARN B	SC	5,120	1971	FY05
Other	XF1301	BARN D	SC	8,025	1965	FY05
Other	XF1303	BARN E	SC	8,025	1964	FY05
Other	XF1304	SILO E	SC		1964	FY05
Other	XF1401	TWIN I	SC	4,160	1964	FY05
Other	XF1576	SHED D	SC	2,000	1961	FY05
Other	XF1577	SHED W	SC	1,440	1999	FY05
Other	XF1578	SHED E	SC	1,440	1999	FY05
Other	XF1579	NEW SWINE BARN	SC	9,805	1984	FY05
Other	XF1580	TWIN 1 BARN	SC	5,120	1971	FY05
Other	XF158X	SOLWAY BARN	SC	5,120	1902	FY05
Other	XG1401	FREELS BEND LOG CABIN	SC	1,490	1825	FY05
Other	XG1402	FREELS BEND, MACHINE STORAGE SHED	SC	245	1966	FY05
Other	XG1403	FREELS BEND, VAN GILDER BARN	SC	4,356	1949	FY05
Other	XG1404	FREELS BEND, VARIABLE DOSE IRRADIATION FACILITY	SC	3,623	1968	FY05
Other	XG1405	FREELS BEND, SHED	SC	1,008	1970	FY05
Other	XG1406	FREELS BEND, EXPOSURE FIELD CONTROL ROOM	SC	190	1958	FY05
Other	XG1407	FREELS BEND BLOCK BUILDING	SC	128	1958	FY05
Other	XG1408	FREELS BEND ALUMINUM BUILDING	SC	80	1958	FY05
Other	XG1409	FREELS BEND PUMP HOUSE	SC	80	1958	FY05
Other	XG1410	FREELS BEND DONKEY ARENA	SC	2,375	1958	FY05
Other	XH1326	FREELS BARN	SC	5,120	1958	FY05
Other	XH1327	DONKEY BARN	SC	880	1958	FY05
Other	XH1401	SHEEP BARN	SC	3,000	1958	FY05
Other	XH1402	FREELS WHITE BARN	SC	12,500	1958	FY05
Other	XH1403	LAGOON (2) FREELS	SC	14,400	1958	FY05
Other	XH1404	UNDERGROUND SILO	SC	3,800	1958	FY05
Other	XH1405	SILO, 14 X 41	SC	574	1958	FY05
X-10	2008	ORNL WHOLE BODY COUNTER	SC	4,368	1946	FY05
X-10	2009	CAFETERIA WAREHOUSE	SC	4,368	1943	FY05
X-10	2010	ORNL CAFETERIA	SC	13,099	1951	FY05
X-10	2517	HRDP/TRAINING	SC	2,880	1943	FY05
X-10	3003	SURFACE MODIFICATION & CHARACTERIZATION FACILITY	EM	10,806	1943	FY05
X-10	3017	CHEM TECH DIVISION ANNEX	SC	10,140	1952	FY05
X-10	3036	RADIOISOTOPE MATERIAL SHIPPING & PACKAGING	EM	1,529	1951	FY05
X-10	3080	SUPERCONDUCTIVITY LABORATORY	SC	1,872	1953	FY05
X-10	3100	SOURCE & SPECIAL MATERIAL VAULT	EM	1,686	1960	FY05
X-10	3115	SOLID STATE OFFICES	SC	2,792	1970	FY05
X-10	3136	EQUIPMENT TEST FACILITY-3019	EM	600	1984	FY05
X-10	3543	MACES STORAGE BUILDING	SC	651	1968	FY05
Y-12	9204-3	ISOTOPE SEPARATIONS	EM	216,200	1945	FY05

Table K.1 Candidates for disposition (as of July 19, 2002) (cont'd)

Site Location	Facility Number	Facility Name	Responsible D&D Program	Gross Sq Ft	Year Built	Year Targeted for Deactivation
X-10	7953A	RESEARCH REACTORS OFFICE TRAILER	SC	1,416	1996	FY06
X-10	7953B	RESEARCH REACTORS STORAGE TRAILER	SC	1,416	1996	FY06
X-10	7953C	CONSTRUCTION TRAILER AT HFIR	SC	1,344	1993	FY06
X-10	7957	OFFICE TRAILER FOR 7920	SC	500	1976	FY06
X-10	7964A	RESEARCH REACTORS OFFICE TRAILER	SC	2,088	1987	FY06
X-10	7964C	RESEARCH REACTORS OFFICE TRAILER	SC	2,124	1988	FY06
X-10	7964E	RESEARCH REACTORS OFFICE TRAILER	SC	2,400	1980	FY06
X-10	7964F	RESEARCH REACTORS OFFICE TRAILER	SC	1,288	1988	FY06
X-10	7964G	HFIR OPS/CHANGE HOUSE	SC	1,440	1992	FY06
X-10	3019A	RADIOCHEMICAL DEVELOPMENT FACILITY	EM	37,191	1944	FY08
X-10	7964H	SOLID STATE OFFICE TRAILER	SC	1,970	1970	FY08
X-10	7964I	SOLID STATE OFFICE TRAILER	SC	1,970	1970	FY08
X-10	7965A	CHEMICAL TECHNOLOGY OFFICE TRAILER	SC	1,620	1988	FY08
X-10	7965B	CHEMICAL TECHNOLOGY OFFICE TRAILER	SC	1,620	1992	FY08
X-10	7965C	CHEMICAL TECHNOLOGY OFFICE TRAILER	SC	1,620	1992	FY08
X-10	7968	TRAILER	SC	192	1990	FY08
		Total		2,006,638		

Table K.2. Space Management Plan summary
(as of July 19, 2002)

FY-Qtr	Facility/action	New/reuse location	Comments
02-Q2	Building 3550 - Deactivate	Buildings 3504 and 5500	FY 03-1Q - Transfer to EM
	Building 2506 - Deactivate	Buildings 2518, 4500S, and 7002	FY 02-4Q - Demolish
	Building 5510 - Modernize and reuse	Building 4500S	Occupancy TBD
	Building 5510A - Modernize and reuse	Building 4500S	Occupancy TBD
	Building 9769 (Y-12) - Vacate	Building 4500S	Complete
	Building 2013 - Deactivate	Buildings 5500 and 3013	FY 02-4Q - Demolish
	Building 6003 - Deactivate	Building 6011	FY 02-4Q - Demolish
02-Q4	Building 2011 - Deactivate	Building 2525	FY 03-1Q - Cheap to keep
	Building 9401-1 (Y-12) - Partial vacate	National Transportation Research Center	FY 03 - Transfer to DP
03-Q1	Building 9204-3 - Vacate	Building 5510	FY 05-1Q - Transfer to DP
	Building 2024 - Deactivate	Building 4500S	FY 03-2Q - Cheap to keep
03-Q3	Building 6010 - Partial vacate	Computational Sciences Building	Physics Division reuse
	Building 6011 - Partial vacate	Computational Sciences Building	Reuse
	Building 6012 - Partial vacate	Computational Sciences Building	Reuse
	Building 6025 - Partial vacate	Computational Sciences Building	Physics Division reuse
	Building 4500N computer rooms - Modernize and reuse	Computational Sciences Building	Reuse
	Building 9210 (Y-12) - Deactivate	Laboratory for Comparative and Functional Genomics	Demolish
03-Q4	Building 9104-1 (Y-12) - Vacate	Research Office Building/Engineering Technology Facility	Vacate
	1060 Commerce Park - Vacate	Research Office Building	Terminate lease
	111 Union Valley - Vacate	Research Office Building	Terminate lease
	Building 3546 - Vacate	Research Office Building	Reuse
	Building 7601 - Designated personnel moves for reuse	Research Office Building	Reuse
	Building 6010 - Vacate	Research Office Building	Physics Division reuse
	Building 6011 -Vacate	Research Office Building	Reuse
	Building 6012 - Vacate	Research Office Building	Reuse
	Building 6025 - Partial vacate	Research Office Building	Physics Division reuse
	Building 9201-2 (Y-12) - Vacate	Research Office Building and 7600 Area Buildings	FY 05 - Transfer to DP
	Building 9201-3 (Y-12) - Vacate	Engineering Technology Facility	FY 02 - Transfer to DP
	Building 9204-1 (Y-12) - Vacate	Research Office Building/Engineering Technology Facility	FY 04 - Transfer to DP
	Building 9401-1 (Y-12) - Vacate	Engineering Technology Facility	FY 03 - Transfer to DP
	Building 7606A - Personnel	Research Office Building	Reuse
04-Q1	Building 5500 (M&C Division personnel) - Vacate	Advanced Materials Characterization Laboratory	Reuse
	Building 3605 - Deactivate	Building 3500	Demolish
04-Q2	Designated UT and guest personnel	Joint Institute for Computational Sciences	N/A
	Designated UT and guest personnel	Oak Ridge Center for Advanced Studies	N/A
	701 Scarboro/SNS - Vacate	Central Laboratory and Office Building	Terminate lease
	115 Union Valley/SNS - Pending	Pending	N/A
	Building 5000 - Deactivate	Research Support Center	Demolish
04-Q4	Building 9224 (Y-12) - Vacate	Building 4500S	FY 05 - Transfer to DP
05-Q1	Building 2517 - Deactivate	Research Support Center	Demolish
05-Q2	Building 3003 - Deactivate	Central Campus Research Building	Demolish
	Building 3036 - Deactivate	Central Campus Research Building	Demolish
	Building 3080 - Deactivate	Central Campus Research Building	Demolish
06-Q1	Buildings 3017 and 3013 - Deactivate	Buildings 5500 and 5510	Demolish
06-Q2	Designated UT and guest personnel	Joint Institute for Biological Sciences	N/A
	Trailer 7953 - Vacate	7900 Area Office Building I	Salvage trailer
	Trailer 7964 - Vacate	7901 Area Office Building I	Salvage trailer
07-Q2	Designated personnel from existing facilities	Center for Nanophase Materials Sciences	N/A

APPENDIX L

Nuclear Facilities
Descriptions and Infrastructure Needs

Reactor Nuclear Facilities

The High Flux Isotope Reactor (HFIR) is among the world's most important research reactor facilities. At its current operating power of 85 MW, it has a peak thermal neutron flux of 2.6 x 10^{15} neutrons per square centimeter per second, the highest in the world. This gives the HFIR unique capabilities for producing important radioisotopes and providing facilities for neutron scattering, materials irradiation, and neutron activation analysis.

The SNS will serve many of the needs of the neutron scattering research community and provide significant improvements over existing beam scattering facilities worldwide for many experiments. However, the HFIR will remain the facility of choice for important classes of scattering experiments requiring steady-state beams and for radioisotope production, materials irradiation, and neutron activation analysis.

To continue these missions, upgrades are needed at the HFIR to modernize some of its instruments and components, to add new capabilities, and to maintain or improve the availability of neutrons to researchers. The HFIR has been in operation for more than 30 years, and many of its control instruments and components are increasingly difficult to repair. Spare parts are scarce and sometimes impossible to find, and vendors no longer manufacture some components. In some cases, new technologies have led to more reliable, more accurate components that could reduce error margins and thereby enhance reactor safety and efficiency. Although many major components have been (or will soon be) replaced or refurbished, remaining instruments and components are based on technology that is now more than 30 years old. Therefore, replacing some of these instruments and components is both desirable and cost-effective.

The complete HFIR upgrade package would improve the HFIR infrastructure for continued operation at high reliability; increase the size and intensity of existing neutron beams; add a cold neutron source and an experimental guide hall; add several neutron beam guides, a second neutron guide hall, and new instrumentation; add a neutron radiography/tomography facility; improve user access; and improve isotope production, materials irradiation, and neutron activation analysis capabilities.

The DOE-SC Office of Basic Energy Sciences has provided funds for the new cold neutron source and its installation in the HB-4 beam line on the HFIR and for the necessary modifications to the HFIR to support the neutron beam guides. Coupled with the steady upgrading of instrumentation over the last few years, these changes will make the HFIR the most intense source in the world for thermal neutron research and will make its cold neutron source capabilities competitive with the world's best. These improvements have been coordinated with the routine replacement of the HFIR beryllium reflector, which was completed during FY 2001. As part of this upgrade, the HFIR cooling tower has been replaced, and two hydraulic access tubes have been added.

The capabilities resulting from the addition of the cold neutron source will support world-class fundamental and applied research programs and could provide the key to new discoveries and applications for polymers, plastics, alloys, and biochemical systems. As a complement to the capabilities of the SNS, they will address important needs of the neutron scattering research community.

The thermal neutron scattering upgrade, to be completed in FY 2002, will include enlarged beam tubes, new monochromator drums, and extension of the HB-2 beam line into the existing HFIR beam hall. The HB-2 extension will provide space for existing neutron scattering instruments displaced by the cold neutron source.

Reactor Nuclear Facilities (cont'd)

A large neutron guide hall, extending the HB-2 beam line to as many as 15 spectrometers using neutron guides, has also been proposed. This hall would provide more space for instruments in a low-background area outside the reactor building. It would also increase the number of users that could be accommodated by increasing the number of beams and instruments. Office and laboratory space would be provided in the new hall for outside users and for ORNL researchers. Other proposed changes would improve access for radioisotope production and enhance the neutron activation analysis mission.

With these improvements, the HFIR will continue to provide a unique resource for neutron-based science for the next 30 years or longer.

Non-Reactor Nuclear Facilities

Three Laboratory divisions, Nuclear Science and Technology, Chemical Sciences, and Metals and Ceramics, currently manage the ORNL non-reactor nuclear programs and facilities. Responsibility for management of the facilities is as follows:

Facility	**Division Currently Managing Facility**
2026	Chemical Sciences Division
3019	Nuclear Science and Technology Division
3025E	Metals and Ceramics Division
3027	Nuclear Science and Technology Division
3047	Nuclear Science and Technology Division
3525	Metals and Ceramics Division
4501	Nuclear Science and Technology Division
5505	Chemical Sciences Division
7920	Nuclear Science and Technology Division
7930	Nuclear Science and Technology Division

The facilities are each operated as separate facilities, with a management structure in place that typically includes a Group Leader (responsible for one or more facilities) and a Facility Manager (responsible for each facility). These individuals are responsible for both program and facility responsibilities. Staffing has been established so that each facility administers the ORNL programs on a facility basis. This section provides a brief overview of each of the subject facilities.

Facility, Programs, Organization, and Infrastructure Issues

Building 2026 (Radioactive Materials Analytical Laboratory). This facility is operated by the Chemical Sciences Division and is located on the west end of the plant next to the cafeteria. The two-story 22,600- square-foot facility was constructed in 1964, with additions in 1985 and 1996. The liquid waste system has also been modified. The facility has six analytical hot cells, a storage cell, a cask loading cell, and a decontamination cell.

The hot cells are designed for use in analytical chemistry applications with light-weight manipulators, pass-through pipes for instrument wires, easy access, etc. The cells were designed for work on spent nuclear fuel samples. The facility has supported work on nuclear process development, HFIR support, REDC programs, Isotopes Programs, environmental monitoring, underground storage tank (UST) activities, and waste characterization. This facility has also provided support for the Weapons Material Disposition Program, Naval Reactors fuel development, and Non-proliferation programs. Future work on Naval fuels is anticipated. There are also fourteen chemical laboratories and glove boxes in the facility. There are offices for 15-20 staff, and personnel from this facility are also located at other places within the ORNL, such as the REDC, to provide on-site support.

Infrastructure Issues:

- Ventilation System Capacity Upgrades
- Electrical System Improvements for Feed and Distribution Center
- Cell Structure: Replace Cell 4 Window

Non-Reactor Nuclear Facilities (cont'd)

Building 3019 (Radiochemical Development Facility and Radiochemical Processing Plant). This facility was built in 1943 on the ridge above the cafeteria on the northwest end of the plant. It has seven large alpha-beta-gamma processing cells and has been operated by the ORNL Nuclear Science and Technology Division. Uranium-233 is stored in this facility and DOE has been considering a strategy to outsource the operations and shut down and decommission this facility. There are security concerns associated with this facility, which is solely funded by the DOE Nuclear Energy Program.

Infrastructure Issues:

- Ventilation System Upgrades
  - VOG (Vessel Off Gas) HEPA filtration in penthouse
  - GBOG (Glove Box Off Gas) system replacement
- System Improvements for Obsolete Equipment

Building 3025E (Irradiate Materials Examination and Testing Facility). This facility has been operated by the ORNL Metals and Ceramics Division. The building is located in the center of the ORNL campus and was constructed in 1950 with a remote storage facility added and Cell 6 enlarged in 1958. Sealed storage wells were installed in 1985, and a major upgrade to the Liquid Low Level Waste system was completed in 1998.

This facility has state-of-the-art physical and mechanical properties test equipment and is important in supporting the Metals and Ceramics Division's Fracture Mechanics Group surveillance of the HFIR pressure vessel coupons. This facility also supports the Office of Fusion Energy Systems Advanced Materials Program, DOE Basic Energy Sciences (BES) Materials Development Program, and DOE support for the US NRC Heavy Section Steel Irradiation (HSSI) Program. Work in this facility is restricted to beta-gamma contaminated materials. The facility has six hot cells and a storage area.

Infrastructure Issues:

- Cell Structure
  - Replace cell windows
  - Rebuild manipulators
- Baseline: Update Facility Drawings for Defense-in-Depth SSCs
- Hot Cells and Hoods Ventilation System Upgrades

Building 3047 (Radioisotope Development Laboratory). This facility was built in 1962 and has been operated by the Nuclear Science and Technology Division primarily to support the DOE Isotopes Program (NE-40). The facility is located in the center of the ORNL campus in Isotopes Circle. About 80–85% of the funding for the facility comes from the DOE Isotopes Program, with the remainder coming from support for other Nuclear and Environmental Programs. It is a three-story building housing five hot cells, one of which is an alpha hot cell. The facility also contains seven laboratories and a decontamination room.

Hot Cell operations include transfer of radioactive materials into DOE-approved shipping casks in a contamination-free environment. Shipping casks weighing as much as 7 tons and measuring up to 4 feet in diameter can be inserted in the load-out cell through top access. Bottom load/discharge casks can utilize a 6-inch penetration in the top of the hot cell shield block to transfer sources into and out of the hot cell. A lead- shielded cubical with custom-designed glove box manipulators offers the capability to process radioisotopes where close visual observation or intricate manipulations are required but where hand exposure would be problematic if glove box operations were utilized. The alpha portion of this facility houses a laboratory with four glove boxes and a small hood. A second lab with existing glove box manifold and a water-shielded hot cell capable of operating under an inert atmosphere are available.

Infrastructure Issues:

- Ventilation System Upgrades
  - o Exhaust system
  - o Secondary confinement
  - o Fan systems
- Waste Management
  - o Complete a partially installed system for LLLW collection and transportation
  - o No method for disposal of high-range radioactive waste
- Replace/Upgrade Three of the Four Beta-Gamma Area Hot Cell Windows

Building 3525 (Irradiated Fuels Examination Laboratory). This facility has been operated by the Metals and Ceramics Division since the late 1980s and was operated by the Nuclear Science and Technology Division before that. The facility is located in the central part of ORNL on the main road through the Laboratory. It was built in 1963 to examine irradiated fuels and has three large hot cells on the first level that are interconnected from a ventilation and access perspective. The facility also contains three individual stand-alone cells (IMGA, SEM, and CCCTF). The glove box maintenance area is upstairs above the hot cells and is used for remote maintenance of in-cell equipment.

This facility is capable of irradiated fuel examination, metallurgical examination, radiography, source preparation, capsule disassembly, metallography, and some analytical chemistry. The facility is also capable of examining the HFIR core. The facility has supported the HFIR, the Spent Fuel Repackaging Program for the Environmental Management Program, and some isotope production programs. The Nuclear Programs at ORNL depend on this facility capability to obtain new programs; however, the facility is presently significantly underfunded.

There have not been major renovations to this facility, and it does not have a liquid low-level waste tank or a connection to the ORNL liquid low-level waste system. The Safety Analysis Report for this facility needs to be completed and an estimate for that work has been prepared.

Infrastructure Issues:

- Waste Management: No LLLW System currently installed
  - o No method for disposal of high-range radioactive waste
- Ventilation System Upgrades
  - o Facility containment instrument upgrade
  - o Exterior duct insulation replacement
  - o Charging area exhaust fan replacement
- Cell Structure: Refurbish cell windows

Building 4501. This building historically has been owned and operated by the Nuclear Science and Technology Division Chemical and Energy Research Section and was formerly called the High Level Radiochemical Laboratory. The Building was built in 1952, is located next to Building 4500 North, and has four hot cells, all of which have had some form of renovation in the last five years. The four hot cells are used for various chemical operations and experimental procedures, primarily those concerned with radioactive waste treatment and immobilization technologies, and the recovery of uranium from the MSRE cleanup processes. Current operations in the facility support the management of the MSRE fuel conversion project.

Recent projects include ion-exchange studies in conjunction with the Melton Valley Cesium Removal project, support for Savannah River tank projects, MSRE fuels projects, and sludge immobilization studies using grout and glass waste forms.

Infrastructure Issues:

- Ventilation System Upgrades
  - Upgrade/redesign hoods and ductwork filtration system
  - Replace underground concrete exhaust ductwork

Building 5505 (Transuranium Research Laboratory). This 20,000-square-foot facility was constructed in 1967 on the east end of ORNL, just southeast of 4500N, to support the HFIR/REDC TRU programs. The facility has been operated by the Chemical Sciences Division. It does not contain hot cells and is classified as a Category III facility. The building contains 20 chemistry research laboratories that contain glove boxes, fume hoods, and specialized scientific equipment. The Motor Control Center was upgraded in 1998 and the roof replaced in 1999. Current programs include transuranium element chemistry and inorganic mass spectrometry support for HFIR, IAEA, International Safeguards, Pu-238 and Navy Fuels.

Unique capabilities of this facility include Cf and Es metal preparation, high-temperature and high-pressure x-ray diffraction; transplutonium metals sample preparation, and differential thermal analysis. The building also has a Class 100 clean-room built in 1997 and a storage vault that was added in 1973.

Infrastructure Issues:

- Ventilation System Upgrades of Exhaust Fans and Motors
- Process Pump Replacement/Upgrades

Building 7920 (Radiochemical Technology Development Center - REDC). This facility has been operated by the Nuclear Science and Technology Division. It is located in Melton Valley next to the HFIR, was built in 1963, and began operation in 1966. The facility contains nine hot cells and has been used primarily as the production, storage, and distribution center for the heavy-metal research program for DOE. Major activities include the recovery and purification of transuranium elements, which are primarily alpha emitters of high specific activity; and the development of processing and separations flowsheets. During the 1970s and 1980s, some uranium fuel cycle development was maintained in specially designed equipment in one of the hot cells. Solvent extraction flowsheets for processing irradiated fuels from commercial light water reactors and fast breeder reactors were developed and tested, and plutonium recovery schemes were demonstrated.

In addition to the nine hot cells, this facility has two shielded caves. There is also a transfer and decontamination facility, which is a small, crane-portable, water-shielded cell. All hot cells are currently operable and are used for target manufacturing, chemical processing, and analytical work. Solid waste is handled in one of the cells. The facility contains a chemical makeup area for the preparation of reagent chemicals used in hot cell operations. There is also a standard cold chemistry laboratory, a photographic dark room, and six laboratory rooms with alpha glove boxes for radioactive materials handling.

Infrastructure Issues:

- Ventilation System Upgrades
  - Replace VOG scrubber
  - Replace back draft dampers, supply and exhaust systems
- Waste Management:
  - No method for disposal of high-range radioactive waste
- Electrical System replacement of supply and distribution systems
- Steam System Upgrades and Replacements

Building 7930 (Radiochemical Engineering Development Center). Built in the mid-1960s for nuclear fuels work, this facility has not been operated to support its original purpose. Modifications were completed in 1987 related to the expansion of the Californium-252 sales/loan program. This building is a heavily shielded hot cell facility designed for remote operation using electro-mechanical and master-slave manipulators. From 1970 through 1984, the equipment and facilities for handling and processing Californium-252 constituted the TURF Californium Facility in Cell G. In those operations, the Cf that is separated in Building 7920 is transferred to Building 7930 for additional purification prior to fabrication and distribution of sources. Preliminary work has been done to evaluate using this facility in support of the Pu-238 program. More than $40 million would need to be spent on modifications to add glove boxes for processing the materials and for modifications inside the hot cells to handle this alpha-producing material.

Infrastructure Issues:

- Ventilation System Upgrades
- Electrical System Assessment and Improvements

Nuclear Facilities Documentation

ORNL has a number of unique experimental and production facilities that involve nuclear or other hazardous materials. These facilities utilize design features for safety and implement administrative controls to minimize the probability and consequences of an accidental release of hazardous material to on-site and off-site receptors. DOE-STD-1027-92 provides guidance for the categorization of these facilities based primarily on that facility's nuclear material inventory. Using this guidance, ORNL has one hazard Category 1 nuclear facility (i.e., HFIR), six hazard Category 2 facilities, and four hazard Category 3 facilities. Safe operation of these facilities is ensured by implementing the safety systems and operating within the limits established by DOE-approved Safety Analysis Reports (SARs) or Basis for Interim Operations (BIOs) and Technical or Operational Safety Requirements (TSRs/OSRs) developed in accordance with DOE Orders 5480.22 and 5480.23. As part of the ORNL Project Management Plan for Enhancing Non-Reactor Nuclear Facility Operations, efforts are underway to upgrade the existing Safety Basis documentation to meet 10 *CFR* 830, Subpart B, "Safety Basis Requirements," by April 2003.

SARUP has used a graded approach to categorize facilities and upgrade facility safety documentation. Initial SARUP efforts were developed in accordance with DOE Order 5481.1B, which has subsequently been canceled and superseded by DOE Orders 5480.23 and 5480.22. The first phase, completed in 1989, conducted hazard screening evaluations of all hazards present in all ORNL facilities. Facilities containing inventories of materials that exceeded the hazard screening threshold values required additional evaluation in accordance with 5481.1B. The hazard screening process resulted in the "classification" of facilities according to the potential consequences of their hazards. Initially, there were four facility hazard classifications: "generally accepted" (no hazard or standard industrial hazards), low, moderate, or high. Nuclear Categories 1, 2, and 3 and the "radiological" classification for facilities were eventually added. Information from these evaluations resulted in the need for facilities to upgrade current safety documentation, primarily existing Operational Safety Requirement (OSR) documents and to generate interim safety documentation for facility operations.

DOE Orders 5480.23 and 5480.22, issued in 1992, required the development and implementation of Safety Analysis Reports (SARs) and Technical Safety Requirements (TSRs) for all facilities classified as "nuclear." DOE-STD-1027-92 was issued to provide guidance to categorize a facility as nuclear based primarily on that facility's nuclear material inventory. The results of the 1027-92 evaluations determined the initial nuclear facility hazard category for all identified facilities. SARUP efforts focused on developing Basis of Interim Operations (BIOs) documents as the safety basis for the continued operations at designated nuclear facilities in the interim until final SARs could be developed. Existing OSRs were upgraded and were often included as part of the BIO. Each BIO and updated OSR has been submitted to DOE and has received approval. These documents are designated as Facility Authorization Basis (FAB) documents and will serve as the safety basis until DOE approves the final hazard classification presented in the detailed final SARs and TSRs. BIOs and OSRs are reviewed annually and updated as necessary.

SARs and TSRs are being prepared for the ten nuclear facilities for which ORNL has responsibility. Of these ten facilities, eight have approved SARs and TSRs/Technical Specifications. Efforts are underway to upgrade all Safety Basis documentation to meet requirements in 10 *CFR* 830, Subpart B, "Safety Basis Rule," by April 2003. ORNL has one Category 1 nuclear facility (i.e., HFIR), six Category 2 facilities, and four Category 3 facilities.

Changes and modifications to a nuclear facility or to the existing FAB documentation will be evaluated to determine if DOE approval is required using the Unreviewed Safety Question Determination (USQD) process as required by DOE Order 5480.21. All FAB changes evaluated by USQDs become part of the FAB documentation and are incorporated into the FAB during the annual review and update.

Hazard categorization did not identify any ORNL facilities with chemical hazards which exceed threshold levels that would require implementation of the OSHA Process Safety Management Rule (29 *CFR* 1910.119) or the EPA Risk Management Plan Rule (40 *CFR* 68).

APPENDIX M

Master Plan Projects

Project Descriptions by Master Plan Phase

M.1 PHASE I PROJECTS (FY 2002–06)

M.1.1 Line Items – Phase I

Spallation Neutron Source (ADS S97D0046, FY 1999 Landlord LI)

The SNS is a new world-class experimental facility designed to meet the national need for neutron scattering and related research. The facility will be available to scientists from universities, from industry, and from other federal laboratories. The SNS will be equipped with an initial complement of advanced instruments for neutron beam research.

The facility will be built around a spallation neutron source. Combining the higher source power with improved experimental facilities will create a useful neutron flux significantly higher than is now available at any facility in the world. There will be beam lines for neutron scattering instruments or other neutron research equipment in experimental halls. The potential also exists for the development of entirely new lines of scientific research based on the enhanced capabilities that will be available in the SNS facilities.

The primary objectives in the design of the site and buildings for the SNS are to provide the optimal facilities for utilization of neutron beams and to address the mix of needs associated with the operating facility and the user community.

The objectives stated above are being met with a group of major structures which include an ion source, a linear accelerator, a klystron building, an accumulator ring, beam transport, an experimental hall that includes detectors and instrumentation, and capabilities for remote servicing of the spallation targets. Also included on the site are facilities to support the needs of operations staff, technical support staff, and users.

In a related project, ORNL, The University of Tennessee (UT), and the State of Tennessee have initiated plans for a Joint Institute for Neutron Sciences (JINS). This facility will enhance the utility of the SNS and the High Flux Isotope Reactor (HFIR) by providing meeting facilities, offices, laboratories, a communication center, and housing for scientists and engineers from universities, industries, and the international research community. It will also be a focus for expanding neutron science R&D with UT, other regional universities, and industrial collaborators and will serve as an interface and economic development gateway for outside access to ORNL's neutron science facilities.

Electrical Systems Upgrade (ADS C97D0106, FY 2000 Landlord LI)

The ORNL electrical distribution system requires significant restoration and expansion to assure the continued operation in support of the research and operation missions of the Laboratory. Electrical components throughout the Laboratory are obsolete and increasingly dangerous to operate. Specific funded activities associated with this LI include the following:

- *Overhead Feeders 244 and 264 Upgrade*. The 13.8-kV overhead feeders run from the ORNL Primary Substation to the 7600 Area Robotics and Process Systems Division facilities. The feeders serve the 6010 Oak Ridge Electron Linear Accelerator, the 6011 Computing and Telecommunications Facility, the 6012 Computer Science Research Facility, and the 5510 Analytical Mass Spectrometer Laboratory; they also serve as a dual-feed to the 4509 and 2632 major 2.4-kV secondary substations within the Laboratory. The feeders will be completely rebuilt to ensure reliable continuation of service.

- *Electrical Metering System Installation.* A computerized electrical metering system will be installed in the ORNL electrical distribution system. Electrical meters will be installed on major distribution feeders and on significant facilities throughout the Laboratory.

- *Building Electrical Service Entrance Upgrades.* Obsolete and inadequate switchgear, transformers, and conductors will be replaced at the main service entrances of Buildings 2519, 4501, 4500S, and 5500. New switchgear and cabling will be added to the bus ties in Buildings 4500N and 4500S.

- *Substation 4509 Improvements.* Secondary Substation 4509 will be upgraded by installing two new 13.8/2.4-kV, 7500-kV transformers, and new 2.4-kV switchgear to form a 13.8-kV primary selective arrangement and a 2.4-kV transformer and switchgear double-ended arrangement. Existing 13.8-kV switchgear "A" will be reinsulated and refurbished. A 13.8-kV primary selective system arrangement will be provided for two internal Building 4509 service transformers.

Laboratory for Comparative and Functional Genomics (ADS S97D0043, FY 2001 Programmatic LI)

This project will construct the Laboratory for Comparative and Functional Genomics, housing about 50,000 mice. The laboratory employs expertise in mouse genetics mutagenesis to generate and analyze mutations that add functional information to specific human DNA sequences. These mutant stocks are a matchless resource for advancing understanding of the complex mechanisms underlying the development and functioning of biological systems. In addition to space for 50,000 mice, the facility will provide ancillary laboratories for experimental breeding and necropsy activities, a specific pathogen-free design, a 100% fresh air facility with 12 to 15 air changes per hour, temperature and humidity control, variable intensity lighting, an emergency power supply, a loading dock, "silent" low-frequency fire alarms, and vermin-proofed caulking and sealing.

The facility will be located on the ORNL reservation at the west end of the site, which will be convenient to researchers and guests without concern over restricted access. The laboratory will be adjacent to the new Environmental and Life Science Laboratory, Building 1060, Life Sciences Division Buildings 1061 and 1062, and will be convenient to the Environmental Sciences Division for cooperative research collaborations.

Fire Protection Systems Upgrade (ADS A99D0018, FY 2001 Landlord LI)

The following projects/tasks of the proposed upgrades are in support of the ORNL fire protection systems:

- Extend automatic, wet-pipe sprinklers throughout offices, corridors, and under the attic floor slabs in Wings 1-4 of the Central Research and Administration Building (4500N). These specific areas are not currently protected with a fire suppression system.

- Replace numerous fire alarm control panels with modern fire alarm equipment and modify alarm device/evacuation horn circuits to utilize the full capability of the new control panels. Many fire alarm control panels and annunciators at ORNL are 30 to 40 years old and operate via antiquated technology (springs and shunts) which do not permit interface with modern fire detection and fire alarm initiation devices. These older panels also do not perform self monitoring of fire alarm and evacuation horn circuits as required by mandated National Fire Codes, and replacement parts are not available to facilitate timely maintenance/repairs.

- Upgrade the Central Fire Alarm Receiving Station at the ORNL Fire Department Headquarters to replace antiquated equipment currently performing this vital function. This 20-year-old equipment monitors the condition of fire alarm systems and provides notification of fire alarm system activation for more than 200 buildings at the ORNL main site. It is imperative that this equipment remain highly reliable and that replacement parts be readily available. As the equipment ages, replacement parts are more difficult to procure and maintenance costs increase, resulting in questionable reliability.

- Upgrade fire alarm system for Building 4505. The fire alarm upgrade includes the following: replacement of the shunt-trip type fire alarm annunciator panel, elimination of heat-actuated devices throughout the facility and replace with water flow switches for zone annunciation, and replacement of the horn panel in the east stairwell controlling all evacuation horns in the building.

- Upgrade fire alarm system for Building 4501. The fire alarm upgrade includes the following: elimination of one of two master fire alarm boxes (MFAB) which serve 4501, replacement of two shunt-trip type fire alarm annunciator panels adjacent to the two existing MFABs and an auxiliary annunciator panel near the sprinkler system risers in the basement, elimination of heat-actuated devices throughout the facility to be replaced with water flow switches for zone annunciation, and replacement of the horn panel in the east stairwell controlling all evacuation horns within the building.

- Replace the 55-year-old, 16-inch underground water main in the 6000 Area of ORNL with approximately 7000 feet of new lines. Associated isolation valves, pressure reducing valves, hydrants, and valve pits will be installed with the new water main.

Laboratory Facilities HVAC Upgrade (ADS A99D0017, FY 2001 Landlord LI)

This project will upgrade HVAC systems that serve most of ORNL's major multiprogram research and related support facilities that have been in service for over 30 years and are in need of renovation, upgrade, or replacement due to age. This deteriorated condition is resulting in a growing number of repeated operational interruptions, prolonged equipment downtime, and increasing maintenance cost. Repair is often complicated by difficulty in finding replacement parts for units that are now obsolete. The interruptions are affecting experimental quality assurance for a significant number of the laboratories and are causing problems for supporting computer systems and service shops.

The scope of work will include (1) installation of the primary/secondary central chilled water plant pumping system in 4509; (2) installation of a 4501/4505 chilled water tie-in; (3) installation of a chilled water coil inside 3500E air handler; (4) replacement of 4501 and 5500 air handlers; and (5) replacement of the 4500S reheat system.

SANS Guide Hall, HFIR (ADS AA0D0050, FY 2001 AIP LI)

This small angle neutron scattering (SANS) Guide Hall will provide space for new SANS instruments on cold beam guides from the HB-4 beam port of the DOE High Flux Isotope Reactor (HFIR) at ORNL. The scope of work will involve the relocation of utilities and the construction of the following: foundations and a reinforced concrete slab, metal building structure with overhead crane, electrical services, HVAC system, rest rooms, and limited sample preparation space. This new facility will house two SANS machines and some small laboratory spaces. Additional instruments, including spectrometers from Brookhaven, SNS, and other facilities, can also be accommodated.

Center for Nanophase Materials Science (ADS AA1D0002, FY 2002 Programmatic LI)

The Center for Nanophase Materials Science (CNMS) will consist of a new multistory, multipurpose building of approximately 80,000 square feet. It will be located near the Spallation Neutron Source Complex and will house the core support facilities, offices, and laboratories necessary to ensure the mission of the CNMS. The location and synergy of the functions planned for this facility will provide valuable support and services to a broad user base of educational, industrial, and research organizations.

Since the late 1980s, there has been a recognized need to enhance U.S. capabilities and ensure leadership in the synthesis of materials. The CNMS will integrate nanoscale research with neutron science, synthesis science, and theory/modeling/simulation, bringing together four areas in which the United States has clear national research needs. The CNMS will play an important role in elevating the U.S.-based neutron science R&D community to levels found elsewhere in the world and helping it assume a scientific leadership role in emerging research on nanoscale materials and processes. ORNL will become a world-class leader in CNMS-based research.

Research Support Center (ADS A99D0056, FY 2002 Landlord LI)

The Research Support Center will consist of a new multistory, multipurpose building of approximately 50,000 square feet. It will be located north of the Central Research complex and will house the core support service facilities required in support of the effective operation of a national research laboratory. The Research Support Center will serve as the cornerstone and focal point of the East Research Campus envisioned in the Facilities Revitalization Project. This building will be an attractive state-of-the-art facility with easy visitor access, reflective of the Laboratory's stature and as functionally flexible as possible. The location and synergy of the functions planned for this facility will provide valuable support and services for the nationally respected ORNL research community, visitors and guests, and DOE. This building will include an auditorium and conference center, cafeteria, visitor reception and control area, and support offices for approximately 50 occupants. Sustainable design features will be incorporated where practical. The estimated payback period for this project is two years.

4500 North and South Modernization Upgrades (ADSs – AA0D0056, AA0D0057 Multiyear Landlord LI)

The proposed projects are integral parts of the new Facilities Revitalization Project (FRP) for revitalization of ORNL's research capabilities and infrastructure in support of the DOE-SC initiative to modernize their national laboratories. Consistent with DOE's approved Institutional Plan for ORNL, new laboratories, supporting offices, and the necessary support facilities are being proposed for construction as part of an integrated new campus environment in the area north and east of the 4500 North and South Buildings complex. The 4500 North and South complex will be modernized to provide laboratory, office, and support functions. The overall goals of this facilities revitalization initiative are to reduce the burdensome costs of maintaining the current inventory of facilities 50 years and older, provide a safer environment for current staff activities, and ensure ORNL's ability to conduct world-class science in the 21st century, including attracting and retaining world-class research scientists. The payback period is approximately six years. There are eight separate upgrade projects in these two facilities. 4500N (Wing 4) and 4500S (Wings 1 and 4) are in Phase I.

Radioactive Ion Beam (RIB) Upgrade (ADS A99D0043, FY 2002 AIP LI)

This project will provide for improvement of the Oak Ridge Isochronous Cyclotron (ORIC) and the associated tandem electrostatic accelerator. The proposed project is located in the Holifield Radioactive Ion Beam Facility (HRIBF), Building 6000, at ORNL.

ORIC's light-ion primary beams are used to produce radioactive atoms from fusion reactions in thick targets on a Radioactive Ion Beam (RIB) Injector. Ions from the RIB injector are mass analyzed, accelerated with the 25-MV tandem electrostatic accelerator, and used for the RIB experimental program. RIB intensity is proportional to the ORIC light-ion beam intensity, and accelerated RIB energy and quality are determined by the tandem electrostatic accelerator. The number of hours of beam-on-target per year is impacted by reliability of both accelerators and ORIC component activation.

Major ORIC improvements are needed to reduce activation and radiation exposure to operations personnel and to assure reliable, high-intensity operation. Similarly, tandem electrostatic accelerator improvements are needed to assure reliable, high-availability operations and the ability to efficiently accelerate and transport very low intensity RIBs. Expected benefits include increased upper limits on ORIC beam intensity, reduced ORIC activation, improved ability to handle activated components consistent with ALARA principles, improved operation efficiency, reduced down time, and reduced operating costs.

Energy Reliability and Efficiency Laboratory (ADS AA1D0041, FY 2004 Programmatic LI)

This project will construct a new multistory building of approximately 52,000 square feet, the Energy Reliability and Efficiency Laboratory (EREL). The EREL will be located at the north entrance of ORNL and will provide facilities for research and development activities in support of DOE's Office of Energy Efficiency and Renewable Energy (EERE) program initiatives in distributed energy resources, electricity transmission and distribution, and net zero energy building systems. The EREL will be an attractive state-of-the-art facility designed to operate as a demonstration of energy efficiency technology. Energy Star® certification will be sought for applicable portions of the building, which will include on-site power generation, virtual laboratory capabilities, and built-in flexibility to incorporate new research and development and next-generation technologies. Approximately 80% of the building's net usable space will be dedicated to research facilities including highbay space for large equipment and integrated systems demonstration. Two 2-ton cranes will be provided. The remainder of the space will contain offices for approximately 40 occupants, conference/meeting room(s), and break rooms. The building structure will be steel and will be clad with an aesthetic low-maintenance exterior. An advanced heating, ventilating, and air-conditioning (HVAC) system will provide cost-effective, energy-conserving space conditioning utilizing the waste heat from on-site power generation. Land improvements will include service drives, walkways, drainage, and landscaping. Utilities will be extended from the existing distribution systems adjacent to the site and upgraded as required. The EREL will be a showcase for sustainable energy technologies and design practices. It will be designed and engineered to achieve a silver rating based on the Leadership in Energy and Environmental Design (LEED™) rating system developed by the U.S. Green Building Council.

ORNL Primary Substation Upgrades (ADS AA0D0094, FY 2004 Landlord LI)

The ORNL Primary Substation Upgrades project will replace and restore components of the ORNL Primary Substation. It will replace an aged and inefficient power transformer and regulating transformer, and will replace the Bus No. 1 13.8-kV Oil Circuit Breakers (OCBs) with new metal-clad switchgear-containing vacuum-insulated circuit breakers. The project will replace existing mechanical relays with advanced microprocessor-based protective relay systems. Grounding improvements will be provided to improve the safety of the substation. Other aged and deteriorated components of the substation will also be replaced. This project is part of a phased infrastructure upgrade to restore the electrical distribution system serving ORNL. The ORNL primary substation is the only source of electrical power to the ORNL site. Most of ORNL's electrical distribution system was installed in the early 1940s and the mid 1960s. A phased upgrade of deteriorated and deficient electrical systems was started in the 1980s. Estimated return on investment for this project is 25.8%, with a simple payback period of approximately 10 years.

Proteomics and Protein Complex Analysis Laboratory (ADS AA2D0115, FY 2004 Programmatic Landlord)

The Proteomics and Protein Complex Analysis Laboratory will consist of a 130,00-square-foot, $150M laboratory /office complex. This building would house facilities for cell growth, molecular biology, protein chemistry, mass spectrometry, protein analysis, and computational biology. To meet the needs of the Genomes to Life (GTL) program, these facilities would be highly automated to permit high-throughput analysis of proteins and protein complexes. An important part of this facility is the development of new biological, analytical, and computational tools to improve sample throughput and information content required for the GTL program. This research will take advantage of multi-disciplinary teams comprised of biological, physical, engineering, and computational scientists from across ORNL and outside laboratories. The Proteomics and Protein Complex Analysis Laboratory will be designed to be a unique national resource to provide critical information on proteins and protein complexes to the biological community and to be a focal point for development of new analytical and computational capabilities in support of the GTL program.

Manipulator Repair Facility (ADS AA0D0017, FY 2005 Landlord LI)

The Manipulator Repair Facility will provide a consolidated facility for hot cell manipulator repair and refurbishment in support of all of the ORNL hot cell operations. It will consist of approximately 20,000 square feet of clean and contaminated manipulator wash areas, a boot fabrication shop, and all necessary support facilities to support the repair and decontamination of master/slave and electromechanical manipulators. The facility will be sited to best service the primary users of manipulators and will include process and liquid low-level waste line tie-ins and HEPA filtration systems for contamination control.

Potable Water System Upgrade Phase I (ADSs C97D0061, FY 2005 Landlord LI)

The Potable Water System Upgrade, Phases I and II, will replace or refurbish aged water lines serving the primary research and support facilities in the central campus area of the Laboratory. The main lines running along Central Avenue and the north side of the Building 3508/3517 Area will be replaced in the first phase of the project with the Laboratory facilities north of Central Avenue in the vicinity of First Street and the 3047 Isotopes Area. Because of the subsurface contamination concerns within the central campus, multiple technologies are being evaluated for this project, including standard below-grade pipe replacement, above-grade insulated piping, and in-situ lining of existing lines where appropriate and feasible. A preliminary estimate of return on investment (ROI) is 10% with a payback period of seven years.

Laboratory Facility Ventilation System Upgrade, Phase I (ADS A98D0007, FY 2005 Landlord LI)

The Laboratory Facility Ventilation System Upgrades, Phases I and II, are projects that will modernize ventilation and exhaust systems in approximately ten ORNL facilities, totaling over 200,000 square feet of space. Ventilation and exhaust systems in many ORNL facilities are in serious need of upgrade to continue service at any level. Some laboratory areas are not used for research because of a lack of proper ventilation. Systems feature 35-year-old equipment applied in a 35-year old design concept. In many systems, the exhaust ducting and filter housings are seriously corroded and have only a marginal future life expectancy. New exhaust fans, ducts, hoods, and an EPA-compliant stack are needed for compliance with regulations. The majority of these duct/housing units are contamination zones that will require closely controlled work conditions. A preliminary estimate of a payback period for this project is seven to nine years.

M.1.2 State of Tennessee Funded Facilities – Phase I

Joint Institute for Computational Sciences and Oak Ridge Center for Advanced Studies (ADS AA1D0039, FY 2002)

This 45,000-square-foot state-funded building will house the following:

The Joint Institute for Computational Sciences (JICS), a user- and visitor-oriented facility to provide access to high-performance computers, inspire collaborations and outreach between ORNL and partnering universities, facilitate enhanced high-speed networking systems, and facilitate auxiliary technologies. This facility will house computing system laboratories, offices, and meeting space for collaborations.

The Oak Ridge Center for Advanced Studies (ORCAS), a theoretical and applied R&D-oriented facility to explore grand queries, big thoughts, and major potentials for long-term program development for ORNL and core universities. This facility will house state-of-the-art collaboration meeting rooms with teleconferencing and computing networking, offices, and an information resource center.

Joint Institute for Biological Sciences (ADS AA0D0085, FY 2004)

The Joint Institute for Biological Sciences will be a State-funded center for the promotion and development of collaborative education and research in the biological sciences of functional genomics, structural biology, and computational biology and bioinformatics. This 60,000-square-foot facility will house office, laboratory, process, and meeting space for collaborations.

Joint Institute for Neutron Sciences (ADS AA0D0088, FY 2005)

ORNL, The University of Tennessee (UT), and the State of Tennessee have initiated plans for a Joint Institute for Neutron Sciences (JINS). This facility will enhance the utility of the SNS and the High Flux Isotope Reactor (HFIR) by providing meeting facilities, offices, laboratories, a communication center, and housing for scientists and engineers from universities, industries, and the international research community. It will also be a focus for expanding neutron science R&D with UT, other regional universities, and industrial collaborators, and will serve as an interface and economic development gateway for outside access to ORNL's neutron science facilities.

M.1.3 Private Sector Funded Facilities – Phase I

Computational Science Building (ADS AA0D0091, FY 2002)

The Computational Science Building will provide over 82,000 net square feet of state-of-the-art computer labs, offices, and a petascale climate-controlled supercomputer machine room to provide research space for the fastest-growing mission area at ORNL. This facility is essential to accommodate the anticipated 50% staff and funding annual growth, as well as to maintain ORNL's standing as one of

DOE-SC's premier computational facilities. The building will allow for consolidation of almost 300 research staff from six existing ORNL facilities and will result in over 50,000 square feet of usable space being made available for ORNL-wide staff consolidation. Return on investment (ROI) is anticipated to exceed 15% annually, with a payback of less than 10 years.

Engineering Technology Facility (ADS AA0D0092, FY 2002)

The Engineering Technology Facility (ETF) will allow for the consolidation of staff and research operations from the ORNL facilities at the Y-12 National Security Complex to the main ORNL campus. Almost 170 staff will be housed at the ETF, with a net reduction of over 300,000 square feet of high-cost, 40-year-old legacy facilities. State-of-the-art engine testing labs, wet/dry research labs, a clean room, and high-bay space will provide continued growth opportunities for this important research division. Due primarily to the elimination of expensive Y-12 space, an ROI of almost 20% is expected, with a payback period of six to seven years.

Research Office Building (ADS AA0D0090, FY 2002)

The Research Office Building will provide over 80,000 net square feet of space for consolidation of research and support staff from substandard space at ORNL and from various off-site leased buildings. A total of over 450 staff will be housed in this office-only building, with approximately 25% of that space reserved for staff from the 4500N and 4500S complex who will be temporarily dislocated from their offices during that multi-year laboratory rehabilitation. Considering the value of maintaining efficient operations during these renovations and the elimination of over 125,000 square feet of substandard space at ORNL, the ROI for this facility is expected to be in the 10 to 15% range, with a payback period of less than 10 years.

M.1.4 Major GPP Projects – Phase I

Laboratory Expansion for Nanoscience Metrology and Instrumentation (ADS A99D0020, FY 2000 Landlord GPP)

An upgrade to laboratory space in Building 3500 is proposed. The modifications in the east wing of Building 3500 will provide approximately 3000 square feet of additional usable modular clean room laboratory space and reconfigurable office space for the proposed Laboratory Expansion for Nanoscience Metrology and Instrumentation.

Rooms 7, 8, 9, and 10, located on the east side of Building 3500, currently house a small conference room, laboratories, and shop/storage areas. Modifications to these rooms will create usable space to accommodate a modular clean room and its associated services. The modifications will include replacement of the room's west wall, removal of the room's ceilings, and relocation of existing services. In addition, Room A-19 in Building 3500 will be converted from laboratory space to an electron microscope facility. The conversion will require modifications to the room HVAC system and possible foundation modifications for vibration isolation.

Fire Protection Systems Upgrade (ADS C97D0071, FY 2001 Landlord GPP)

Fire protection systems at facilities within ORNL are increasingly demonstrating lack of reliability and degradation of system components relative to age and exposure to corrosive conditions. This project will provide the following improvements:

- Upgrade of fire sprinklers in the Central Research and Administration Building (4500S). This upgrade will include the extension of fire sprinklers into some areas not currently protected and interface modification between the sprinkler systems and the fire alarm systems.

Future year projects:

- Replace identified aged and failure-prone automatic preaction sprinkler system deluge valves with highly reliable automatic wet-pipe sprinkler system alarm valves in the High Voltage Accelerator Laboratory (5500), the High-Level Radiochemical Laboratory Building (4501), and the Experimental Engineering Building (4505).

- Replace identified aged and maintenance-intensive automatic dry-pipe sprinkler systems with reliable and effective automatic wet-pipe sprinkler systems in the General Stores, Shipping, and Receiving Complex.

- Upgrade 4500N Wing 5 alarm system and connect it to the 4500N alarm system.

- Upgrade antiquated fire alarm systems in the HFIR Building.

- Upgrade antiquated fire alarm panels in various ORNL buildings.

- Replace fire doors in 4500N between the wings and main corridors.

- Upgrade fire barriers in ORNL facilities. National Fire Codes and regional/DOE-adopted building codes contain requirements to limit the spread of fire to a certain square foot area. The Life Safety Code requires physical separation in protected means of egress. Both code requirements must be met by installed fire barriers, which are rated by Underwriters' Laboratories, Inc. (UL) to withstand a fire for a time period (e.g., one-hour rated, two-hour rated, etc.). These two old, very large administrative and research facilities do not currently have required fire barriers in place.

- Install early warning smoke detectors to provide area protection in the CESAR and give early indication of an incipient fire to fire response forces. High-value robotics research is conducted at the CESAR Laboratory in Building 6010. High-value, one-of-a-kind robotics equipment and work stations in this densely populated laboratory create the potential for a fire loss exceeding $1 million.

- Replace the manually operated gasoline engine driver and water pump in Pumphouse Number 7953, which were installed in the early 1960s. This pump supplies fire protection and potable water to the DOSAR Site, which includes the Radiation Calibration Laboratory (7735), laboratories handling radioactive material in Building 7710, and Building 7709, which is currently being utilized for storage of unique, one-of-a-kind replacement parts for the HFIR. Recent tests of the aged pump and pump driver resulted in a failure to operate. This project will replace the manually operated pumping system with an automatic starting pump, along with updating the aged maintenance-intensive equipment with modern equipment.

- Install a fire alarm system in Building 7604, which is used for storage of experimental and test equipment such as development hardware, computers, and instrumentation. A portion of the building is used periodically as a control room for experiments conducted in adjacent areas outside the building. No personnel are housed full time in this building, but some personnel enter the building on a regular basis as part of their responsibilities, particularly when there is experimental activity in the control room area. The building has no fire protection system other than portable fire extinguishers. This activity adds a fire protection alarm system to Building 7604. Fire and smoke detectors will be installed in Building 7604 and will be connected to an existing fire alarm system in adjacent Building 7601.

East Campus Electrical Systems Upgrade (ADS AA0D0058, FY 2001 Landlord GPP)

This ADS will provide the resources necessary to extend the existing 13.8-kV electrical feeder #254 into the new east end campus area and set transformer stations, as needed, to provide electrical service to the new facilities to be located there. For aesthetic purposes, the new electrical services will be run underground in a concrete ductbank and placed in an established utility easement that will be flexible enough to provide for future expansion within the area without requiring constant utility relocations.

7603 Highbay Upgrade (ADS A99D0098, FY 2001 Landlord GPP)

This project will provide a needed upgrade to the highbay of Building 7602 to return a portion of an unused facility under EM40 into a vital ORNL work and research space. The project will involve covering the pit area with the fabrication and installing pit cover blocks, removing and dispositioning contaminated equipment, decontaminating floors and walls, and painting of surfaces.

6026 Gravel Lot Extension/Paving (ADS AA1D0037, FY 2001 Landlord GPP)

This project will provide for paving the existing gravel lot and expanding the existing 6026 Gravel Parking Area south of the 6026 Trailers. This expansion is necessary to replace parking areas eliminated due to construction of new facilities in existing parking east of 4500 North. The expansion will provide space for approximately 200 additional spaces in this existing lot.

ORNL Wayfinding Signs (ADS AA2D0095, FY 2002 Institutional GPP)

This project will provide new signage and associated landscaping at various entrance locations along Bethel Valley Road and on-site within the bounds of the 7000 Area and the west end of the Laboratory.

6026 North Parking Lots (ADS AA1D0047, FY 2001 Landlord GPP)

This project will provide for the expansion of the 6026 north parking lot in order to provide additional parking areas to support the ORNL Facilities Revitalization Project.

5th Street/Southside Avenue Parking Lot (ADS AA1D0048, FY 2002 Institutional GPP)

This project will provide for additional parking areas north and south of Southside Avenue, just to the west of 5th Street, to support the ORNL Facilities Revitalization Project.

5th Street Entrance (ADS AA1D0049, FY 2002 Institutional GPP)

This project will provide employees and visitors with improved access to the ORNL East Campus Area and to new parking located north of 4500N. The current access will be eliminated due to construction of new buildings in support of the ORNL Facilities Revitalization Project.

Central Avenue Extension (ADS AA2D0111, FY 2002 Institutional GPP)

This project provides for the extension of Central Avenue into the newly developed East Campus area. Landscaping features, including walkways, outdoor gathering areas, etc., will be provided along the extension of Central Avenue.

East Campus Entry and Parking Area (ADS AA2D0112, FY 2003 Institutional GPP)

This project will provide a new entry drive into the East Campus area, a parking court for visitors, and an interpretive terrace connecting the new state funded Joint Institute for Computer Science/Oak Ridge Center for Advanced Studies with the DOE funded Research Support Center.

Quadrangle Common Area (ADS AA2D0059, FY 2003 Institutional GPP)

This project provides for the development of the central area of the East Campus area with pedestrian ways connecting the surround facilities, and landscaped plazas adjacent to the facilities to enhance the utility of the exterior space between the facilities

Advanced Materials Characterization Laboratory (ADS AA0D0063, FY 2001 Landlord GPP)

The Advanced Materials Characterization Laboratory, a new 15,000-square-foot structure that will provide the high-quality environment required to optimize performance of sophisticated characterization equipment essential for the next generation of advanced materials R&D, will provide for the centralization of advanced materials structural characterization equipment. Electron microscopes, atom probe microscopes, and nanoindenter mechanical properties equipment are now housed in buildings that barely meet the manufacturers' requirements for optimum operation of this equipment. It is clear that the current buildings will not allow ORNL to maintain state-of-the-art instrumentation for the next generation of this equipment.

Rebuild Steam Station and Supply Piping, 7920 (ADS A01D0019, FY 2002 Institutional GPP)

All components of the existing steam supply, distribution, and containment systems in 7920 are aging and rapidly approaching the end of their operational lives. "Pinhole" leaks have developed in threaded lengths of fittings, valves, joints, and junctions (tees, unions, y's, etc.).

There are several steam stations throughout the facility that will require fittings, pressure reducers, and blowout protection.

Service Entrance - 100 psig steam comes into 7920 at the northeast corner of the mechanical equipment room (This room houses a GE chiller, etc.)

A 100 psig header splits off to two separate headers, one at 100 psig and one at 15 psig.

The 15 psig lines are routed throughout the facility, to feed preheaters and reheaters on all of the HVAC systems.

The 100 psig steam lines provide steam for evaporators and steam jets throughout the hot cells and pipe tunnels.

An interesting safety issue involves the use of copper lines to conduct the steam to various places in the facility.

Scope of Work also includes for the 15 psig headers - two steam stations and about 300 feet of steam line 2 to 4 inches in diameter. For the 100 psig header there would also be two reducing stations and about 100 feet of steam line.

7600 Highbay Building (ADS AA0D0072, FY 2003 Landlord GPP)

The Fusion Energy Division (FED) is an ORNL facility located at the Y-12 National Security Complex on Bear Creek Road. For the past several years there have been several attempts to relocate the FED facilities to the ORNL site because of the increasing costs of maintaining the old World War II structures in which the FED is presently located. Other reasons for leaving the Y-12 site are the access problems for foreign nationals, with which FED collaborates, legacies of contamination in the FED building itself, and the increasing (and uncertain) mission burden at the Y-12 Plant. The most recent efforts for the Laboratory revitalization have placed the FED in the 7600 Area. The primary reason that the 7600 Area was selected for the FED is because of the availability of electrical power. FED requires 161-kV power distribution with 13.8-kV feeders for their basic infrastructure.

Currently, the relocation of FED personnel to the 7600 Area, in accordance with the ORNL Revitalization Program, indicates there is a shortfall in available laboratory space. In order to achieve the relocation of FED to the ORNL campus, a new highbay laboratory will be required in the 7600 Area to carry out current and future programs and projects. This project will provide a highbay facility with a bridge crane of approximately 8000 square feet.

Upgrade Sewage Collection System (ADS AA1D0016, FY 2002 Institutional GPP)

This project will make improvements to the ORNL Sanitary Sewage Collection System that are necessary to accommodate the facility modernization plans. Facility modernization and additions will result in a shift in population centers at the Laboratory that will require upgrading sewage collection piping and sewage pumping stations. Additional facilities in the area to the east of 4500N and to the west of Building 1000 will place new loads on collection piping and sewage pumping stations currently in place. Line size will need to be increased to meet State requirements and pump station capacity will be increased to accommodate the new inflows.

HFIR Permanent Pool Storage Tanks Project (ADS AA1D0007, FY 2003 Programmatic GPP)

The project scope includes the design, construction, and installation of new aboveground tanks on support foundations to replace the underground pool water storage tank which has been abandoned. Three tanks (two 30,000-gallon and one 20,000-gallon) will be used for a total capacity of 80,000 gallons. The piping arrangement will allow the tanks to be filled and drained together to function as a single tank or as individual tanks, as may be required.

The new tanks will be double-walled stainless steel. The piping will include monitoring and secondary containment features. Appropriate electrical controls will be provided. Any leakage will be routed to the process waste drain system.

HFIR Maintenance Building (ADS AA0D0053, FY 2004 Programmatic GPP)

The current HFIR maintenance shop is contained in Building 7910, which is also an office building. The shop is about 3500 square feet. This building was built in 1963. The maintenance facilities are not adequate to maintain and support reactor operations in the manner required by today's standards. The reactor is expected to operate another 30 years, and the operating components must be maintained, replaced, and upgraded. The current facility is not adequate to do this work. Improvements are needed to resolve concerns with adequate materials control, records storage, materials storage, and housekeeping. These concerns deal with adequate controls of equipment and documentation necessary to ensure safe operations and shutdown. A new 10,000-square-foot maintenance facility will be constructed west of the HFIR Building.

FED Cooling Tower System (ADS AA0D0082, FY 2002 Programmatic GPP)

The Fusion Energy Division (FED) is an ORNL facility located at the Y-12 National Security Complex on Bear Creek Road. For the past several years, there have been several attempts to relocate the FED facilities to the ORNL site because of the increasing costs of maintaining the old World War II structures in which the FED is presently located. Other reasons for leaving the Y-12 site are the access problems for foreign nationals with which FED collaborates, legacies of contamination in the FED building itself, and increasing (and uncertain) mission burden at the Y-12 Plant. More importantly, the new UT-Battelle management team has stressed the need to have all ORNL facilities located within the bounds of the ORNL campus. The most recent efforts for the Laboratory revitalization have placed the FED in the 7600 Area. The primary reason that the 7600 Area was selected for the FED is the availability of electrical power. FED requires 161-kV power distribution with 13.8-kV feeders for the basic infrastructure.

The FED maintains a sizeable infrastructure required for performing fusion and related projects/programs. Included in the infrastructure are high-voltage power supplies, rf transmitters, cooling systems, and numerous laboratories.

As part of the proposed move to the ORNL campus, FED will be required to dismantle an existing cooling system or purchase a new cooling system. FED has the opportunity to acquire a complete 6-MW cooling system from the Massachusetts Institute of Technology (MIT), paid for by DOE. This system is presently located in Palo Alto, California, at a CPI (formerly Varian) site and is approximately 10 years old. This would be a two-phase funding. The first phase of the project will be the dismantlement and shipment of the MIT cooling system from California to Tennessee. The second phase will require the installation of the system. All data is provisional, estimate only.

HFIR Secondary Coolant System Life Extension (ADS A01D0046, FY 2004 Programmatic GPP)

HFIR's current secondary system, with the exception of the cooling tower, is more than 35 years old. Much of the 36-inch and 42-inch carbon steel piping is underground, and degradation has been observed. In addition, the emergency/backup secondary system pump, PU-14, needs replacement because it is nearing its end-of-life.

Recent construction of a new cooling tower indicated a need to replace the tower basin drain valves because the current ones are leaking and are near end-of-life. In addition, the tower blowdown system is in need of reconfiguration for better control of release of blowdown to the creek. The chemical addition and control system also needs replacement.

Material Handling Facility Addition (ADS A01D0049, FY 2006 Programmatic GPP)

An addition to the 7900 facility will allow for radioactive material handling, waste characterization, and material and equipment staging. Very limited laydown areas are currently available for radioactive surveys, hazardous material staging, material and equipment transfer, and waste satellite storage.

Current areas utilized in the HFIR are the beam and experiment rooms, which contain scientific personnel performing experiments, and the water wings, which contain in-service process equipment. Radiological surveying can only be performed in very limited areas due to relatively high radiation backgrounds resulting from reactor operation. A building physically attached to HFIR (Building 7900) would provide proper engineering controls for performing these tasks, increase personnel safety, and reduce potential environmental impact.

FED-Foundation For Cooling Tower System (ADS AA1D0059, FY 2003 Programmatic GPP)

The Fusion Energy Division (FED) is an ORNL facility located at the Y-12 National Security Complex on Bear Creek Road. For the past several years there have been several attempts to relocate the FED facilities to the ORNL site because of the increasing cost of maintaining old World War II structures in which the FED is presently located. Other reasons for leaving the Y-12 site are the access problems for foreign nationals with which the FED collaborates, legacies of contamination in the FED building itself, and increasing (and uncertain) mission burden at the Y-12 Plant. More importantly, the new UT-Battelle management team has stressed the need to have all ORNL facilities located within the bounds of the ORNL campus. The most recent efforts for the Laboratory revitalization have placed the FED in the 7600 Area. The primary reason that the 7600 Area was selected for the FED is the availability of electrical power. FED requires 161-kV power distribution with 13.8-kV feeders for the basic infrastructure.

The FED maintains a sizeable infrastructure required for performing fusion and related projects/programs. Included in the infrastructure are high-voltage power supplies, rf transmitters, cooling systems, and numerous laboratories.

As part of the proposed move to the ORNL campus, FED would be required to dismantle an existing cooling system. FED has the opportunity to acquire a complete 5-MW cooling system from the Massachusetts Institute of Technology (MIT), paid for by DOE. This system is presently located in Palo Alto, California, at a CPI (formerly Varian) site and is approximately 10 years old. Efforts to acquire this system through alternate funding sources are in progress. This ADS proposal is to acquire GPP funding for the concrete work required for an outside foundation, which must precede the arrival of the system. This cooling system (including power supplies) will be used for multi-FED programs requiring high-pressure, high-volume cooling water. All data is provisional, estimate only.

7000 Area Parking Lot Expansion (ADS AA1D0050, FY 2002 Institutional GPP)

This project will provide for additional parking areas adjacent to the existing 7000 Area parking lot to support the ORNL Facilities Revitalization Project. The 7000 Area lot must be expanded to accommodate vehicles currently parking in the 7012 lot adjacent to Bethel Valley Road. The 7012 lot will be eliminated by a proposed landscaped berm in this area to screen the 7000 Area facilities from traffic on Bethel Valley Road.

Facility Preparations for PU-238 Product (AA1D0015, FY 2003 Programmatic GPP)

This project provides certain infrastructure modifications for Building 7930 to allow for future installation of chemical processing equipment. The project is a direct result of a recently issued Record of Decision to reestablish domestic Pu-238 production using Building 7930 for target fabrication and chemical processing. The project will provide for additional hot cell shielding to an existing wall, additions of stainless steel barriers to protect existing hot cell walls, and modification of an in-cell waste line to facilitate future maintenance, etc.

Bethel Valley Road Access Control Improvements (ADS AA2D0009, FY 2002 Programmatic GPP)

This project will provide new entrance portals on Bethel Valley Road east and west of the main ORNL site to enhance access control to the ORNL site. Previously, Bethel Valley Road was open to all traffic. In December 2001, traffic was limited to personnel with official business at ORNL. Temporary portals will be located on Bethel Valley Road until the new portals are completed. At each portal location, Bethel Valley Road will be widened to accommodate one outbound and three inbound traffic lanes and an island for a prefabricated portal building. A turnaround loop will also be constructed for vehicles denied access.

East Campus Telecommunications Upgrades (ADS AA1D0051, FY 2003 Landlord GPP)

This project provides for installation for the telecommunications cabling and equipment required to support the development of the East Campus area.

3515/3524 SIOU Parking Lot (ADS AA1D0056, FY 2004 Institutional GPP)

This project will provide for additional paved and lighted parking areas over the surface of remediated surface impoundments 3513/3524. The additional parking areas are in support of the ORNL Facilities Revitalization Project.

1503 Greenhouse Renovation (ADS A00D0043, FY 2003 Landlord GPP)

This GPP is intended as a preferred alternative to two other GPP requests, Seismic Upgrades, 1506 (ADS A99D0055) and Renovation 1506 Greenhouses (ADS S97D0005). In response to a seismic evaluation driven by Executive Order 12941, it was found that Building 1506 was in the "Definitely Needing Repair (DNR)" category. This was based on the conclusion that a possible failure scenario has been postulated because of a lack of roof diaphragm action. The lack of a topping slab to ensure diaphragm action in the roof is the primary contributor to this postulation.

There are currently four greenhouses that are attached to the 1506 structure. They are nearly unusable as functional greenhouses, which makes it difficult to respond to recent sponsor research needs across several DOE Offices.

Given the seismic risk and the current conditions of greenhouses, this GPP request is aimed at moving all activities from 1506 to 1503, where modern laboratory space would be created, the existing spaces would be renovated to create a head house, and new greenhouse structures would replace the existing ones (the existing greenhouses at 1503 are also no longer functional).

The following tasks/activities are covered by this GPP request:

- Renovate the 1503 conference room to accommodate two large laboratories currently in 1506. This will include construction of a new wall, electrical upgrades, installation of bench space, laboratory sinks, fume hoods, eyewash/shower units, etc.

- Modify other rooms in 1503 to accommodate activities currently housed in multiple 1506 instrument rooms.

- Convert the current maintenance shop in 1503 into a head house to support greenhouse operations.

- Demolish existing 1503 greenhouses and construct replacement units on existing foundations.

- Construct an addition to the south end of 1503 to house new environmental growth chambers and move select growth chambers from 1506 into modified spaces in 1505.

- Erect a large pre-engineered storage building in the lot south of 1503 to accommodate ESD sample and equipment storage needs.

- Move equipment essential to programmatic research needs from 1506 to the renovated 1503.

Upgrade HOG/GBOG System in Building 3047 (ADS A01D0037, FY 2003 Programmatic GPP)

The original mission of Building 3047 did not include the processing of alpha emitting radioisotopes, but rather was focused on processing, handling, and separations of relatively large quantities (curies) of beta- and gamma-emitting radionuclides within the confines of heavily shielded 3-foot-thick wall concrete hot cells. However, at some time (probably early 1970s), there began an alteration of laboratories and off-gas systems in the West End of 3047 Labs 110, 208, 209, 210, 211, 212) to process alpha emitters. Thus, a glove box off-gas system was installed in the area. It consisted of one or two major control valves, two vacuum relief devices, a wide array of pipe fittings, 100-200 feet of high integrity stainless steel piping (2-3 inches ID), inlet and exhaust HEPA filters and capacity for 8-10 glove boxes, theoretically. Also, the most important component was an alpha hot cell capable of being outfitted with shielding and glove box capabilities. The recent loss of pressure event has led to the request for some of the work described here. All components of the GBOG system, as described above, should be tested to determine priority of replacement, particularly HEPA filters, filter houses, the main control valves, and vacuum relief dampers. If the pressure drop has become too large in the system, sections of 2- and 3-inch off-gas duct should be replaced with 4-inch I.D. all-welded 304L stainless steel pipe.

For the back-up GBOG vent option, a section of pipe (as specified above) with appropriate valving and instrumentation, shall be installed between the existing main control valve and the 3028 filter house. This tie-in will be radioactively contaminated and must be done carefully, with planning and work sequences and ALARA considerations. The suction end will be tied into an existing sleeve in the wall of Cell A, thereby supplying the COG (cell off-gas) as the backup for the GBOG system. As the COG is only -1.0 to -2.0 ins w.g., it can only be temporary. No operations should be performed until full negative pressure is restored.

Road and Parking Lot Paving - ORNL (ADS C97D0104, FY 2002 Institutional GPP)

This project will provide for the paving of gravel parking lots which have been constructed in recent years. These lots include the HFIR Area lot, the 2000 and 2001 lot, and other smaller areas that meet capitalization criteria for new paving.

Building 7920 Expansion for Master/Slave Manipulator (ADS A98D0013 FY 2003 Programmatic GPP)

The work, equipment, and insulation activities that will be required for completion of this facility addition will include major structural additions with footings and foundations, concrete block walls, new energy-efficient fluorescent lighting, fire protection piping, concrete floors, internal structures for holding master-slave manipulators, double doors on the south side, and a south side dock to match the existing dock.

The manipulator storage addition to Building 7920 will be located on the west side of the building just north of the existing external crane and double doors on the first floor, which are currently used for receipt and acceptance of manipulators in Building 7920 when ordered by the operator, and the double doors at the second level which are used for receipt and acceptance of drums and materials for the chemical makeup room for hot cell work. An existing elevated dock provides access to the first- level double doors. The addition to Building 7920 will be a two-story facility 24 feet high, 19.5 feet in the north-south direction, and 24 feet east-west near the wall of the existing roll-up door. The construction will be two story with no access between the two stories. However, the upper room will be accessed from the landing and the stairwell. The new roof will be flat with standard built-up roofing. No cooling system will be required for the normal function of the facility. If a fire protection system must be installed to meet the requirements of the National Fire Protection Association (NFPA) codes, a heating system of some sort will also have to be provided. Diking of some sort must be provided for the lower floor only. The engineering details of this dike or sump will be worked out in the design. Support utilities should be minimized; that is, lighting will be provided as is necessary for ES&H requirements, and electrical receptacles as required by code.

The addition to Building 7920 will now be required to serve at least two functions. First, it will provide space for staging of the crucial master/slave (series F) manipulators without which the work of 7920 cannot be accomplished; second, it will provide a location for the replacement of a VOG scrubber that is necessary to maintain long-term operation of 7920. The original VOG scrubber, which serves the primary role of controlling/containing the highly active alpha activity processed in the hot cells, was installed in Cell 7 in 1964/65 and has reached the end of its usable life. Addition of the scrubber will require expansion of the floor spec (by 100 sq. ft) of the originally prepared add-on facility. New additions will include utilities (process water, steam, etc.), hot LLLW drains, plumbing/piping to connect the new scrubber to Cell 7 and then to the off-gas treatment train, and a heavily shielded (3- to 4-foot thick walls) hot cell cubicle to shield the scrubber. An HVAC system will also be required.

SWSA 2 Parking Lot (ADS AA1D0058, FY 2006 Institutional GPP)

This project will provide for additional paved and lighted parking spaces over the filled area above SWSA 2. This additional parking is in support of the ORNL Facility Revitalization Project.

Multiple Projects 3500E Flexible Laboratory Shell (ADS A01D0058, A01D0059, A01D0060, A01D0061, A01D0062, FY 2005, FY 2006, FY 2007, FY 2008, FY 2009 Landlord GPP)

An upgrade to the east side of the Building 3500 complex is proposed to allow the implementation of flexible, special-purpose laboratories needed for support of future and ongoing research projects. As ORNL moves into newer nanotechnology, biological and life sciences, advanced neutron sciences, and nano/micro-instrumentation research, additional special purpose laboratory space will be needed to support new initiatives. To allow rapid design, construction, and modification of special-purpose laboratory space, it is proposed that the east side of Building 3500 be upgraded to provide a flexible shell with flexible utilities to allow rapid implementation of special-purpose laboratories within this space.

Existing wall partitions and utilities will be removed and replaced with a flexible matrix of utility feeder systems to allow special-purpose laboratory space to be rapidly erected, modified, or dismantled as future project requirements change. Legacy hazardous building materials in the existing 3500E Area will be removed to mitigate future problems with constructing and modifying special- purpose laboratories. Special utilities required include electricity, communications and network wiring, potable water, distilled water, compressed air, compressed nitrogen, vacuum, and precision environmental control of temperature and humidity. Overall environmental control of the shell is required, as well as systems required to condition individual special-purpose labs. This will mean that an overall building environmental management system will be required and up to four additional environmental control subsystems for individual labs will also be required. Lab exhaust systems will be needed, as well as laboratory makeup air systems. Waste chemical holding systems will also be required.

Metrology Service and Measurement Lab (ADS AA2D0053, FY 2002 Institutional GPP)

An upgrade is proposed to modify Building 5510A to provide a laboratory facility for the Quality Service Division, Metrology Services and Measurement Standards group (QSD/MS7MS). This will be accomplished by renovating two labs in the building to provide better humidity control.

Replace Cooling Tower 4511 (ADS A98D0016, FY2006 Landlord GPP)

The 4511 cooling tower wooden structure is deteriorating at a rapid rate under dry conditions and becomes increasingly hazardous to maintain. This project will replace the cooling tower superstructure.

Building 1059 Modification (ADS AA2D0004, FY 2004 Programmatic GPP)

Building 1059 will be connected to the Laboratory for Comparative and Functional Genomics (LCFG), which is scheduled to be constructed by July 2003. Modifications to 1059 are required to accommodate the research to be conducted in LCFG as research staff and equipment are transferred to the new facility from Building 9210 at Y-12. Microinjection laboratories, cryopreservation facilities, and radiotracer operations are needed to support the research in the LCFG but cannot be located in that facility because of requirements to make this a clean animal facility with limited access. Because these laboratories utilize the animals in LCFG, they must be located adjacent to that facility.

6000 Area Cooling Tower Replacement (ADS A01D0004, FY 2004 Institutional GPP)

A cooling tower presently exists to provide water to the Building 6000 Area for chilled water/HVAC and heat exchange purposes. The cooling tower was constructed around 1960 and is deteriorating after approximately 40 years of service. It has already exceeded normal cooling tower lifetime.

This project will replace the 6000 Area cooling tower in its entirety by extending plant chilled water lines (which presently run to the area south of Building 6010) to Building 6000. The cooling tower will be demolished and some modification to the existing Building 6000 utilities will be required. Two chiller units will be removed and heat exchangers and related components upgraded to accommodate the lower-temperature water.

Implementation of Fire Hazards Analysis (ADS A01D0047, FY 2003 Programmatic GPP)

During revision of the HFIR SAR and review by DOE, a new Fire Hazards Analysis was requested for HFIR. It will include a new section for Safe Shutdown Analysis for the Facility. Although this analysis is not yet completed, it is anticipated that considerable plant modifications may be required to implement the recommendations/requirements from this analysis. These modifications will be required to be implemented by April 10, 2003.

Power Supply Building - 7600 Area (ADS AA1D0010, FY 2004 Programmatic GPP)

The Fusion Energy Division (FED) is an ORNL facility located at the Y-12 Plant on Bear Creek Road. For the past several years there have been several attempts to relocate the FED facilities to the ORNL site as a result of increasing cost to maintain old World War II structures in which the FED is presently located. In keeping with this initiative, the UT-Battelle management team has committed to having all ORNL facilities located within the bounds of the ORNL campus. In accordance with the ORNL Revitalization Plan, FED is to be relocated to the 7600 area. This area was selected because of the electrical power requirements required by FED for current and future programs.

In the spirit of the ORNL Revitalization Plan, FED proposes to move infrastructure which will not interfere with program milestones or sponsor requirements. High Power/high voltage capabilities are a key to the existence of the FED. The power supplies required for the fusion programs can be placed outside. The power supplies require a concrete on-grade slab approximately 42 feet by 120 feet with a self-contained, pre-engineered metal enclosure. The enclosure will not require A/C or heating capabilities; fan cooling will suffice. Thus, the objective of this ADS is the construction of a self-contained metal enclosure with an on-grade slab for power supplies. These power supplies are generic, with the capability to drive high-current magnets for plasma science and technology programs. All data is provisional, estimate only.

HVAC Upgrades (ADS S97D0051, FY 2005 Institutional GPP)

This project provides the installation of new HVAC systems and replacements of deteriorated air conditioning components which provide environmental control for Laboratory facilities. A prioritized listing of activities included in this project is maintained by FMD. All equipment on this list has exceeded its life expectancy. Replacing these deteriorated components will improve air conditioning reliability and reduce operating and maintenance cost.

Infrastructure Improvements, HFIR (ADS AA0D0051, FY 2006 Programmatic GPP)

This project will design and relocate the overhead electrical power lines (13.8 Kv, 480- and 240-V), fiber optics, broadband cable, and telephone utilities to the south of the existing waste tanks; and install new pole-mounted power transformers (167 Kva) and new underground duct banks for the area. The relocation will provide upgraded power supplies for the southern quadrant of HFIR and neutron sciences research activities in this rapidly expanding area. The project will also provide a new access road to be located south of the existing waste tanks. All of these infrastructure improvements will reduce interferences (e.g., vehicular-pedestrian interactions) and open the research area into a more campus-like facility.

Transmitter Relocation - 7600 Area (ADS AA1D0009, FY 2004, Programmatic GPP)

The Fusion Energy Division (FED) is an ORNL facility located at the Y-12 Plant on Bear Creek Road. For the past several years there have been several attempts to relocate the FED facilities to the ORNL site as a result of increasing cost to maintain old World War II structures in which the FED is presently located. In keeping with this initiative, the UT-Battelle management team has committed itself to have all ORNL facilities located within the bounds of the ORNL campus. In accordance with the ORNL Revitalization Plan, FED is to be relocated from Y-12 to the 7600 Area at the ORNL main site. This area was selected because of the electrical power requirements required by FED for current and future programs.

In the spirit of the ORNL Revitalization Plan, FED proposes to move infrastructure which will not interfere with program milestones or sponsor requirements. One key component is the BBC Transmitter. The power supply required for the transmitter can be placed outside, as it is comprised of a self-contained enclosure. The power supply requires a concrete on-grade slab approximately 25 feet by 30 feet. The remainder of the BBC Transmitter will be placed inside a building at the 7600 site. Thus, the objective of this ADS is the construction of an on-grade slab for the power supply associated with the BBC transmitter. All data is provisional, estimate only.

Flow Monitoring Stations for Low-Flow Verification (ADS A99D0027, FY 2005 Institutional GPP)

This project provides for the installation of permanent flow monitoring equipment at upper First and Fifth creeks in the ORNL main plant area. The equipment will be designed such that ORNL can collect continuous flow data at a point above ORNL wastewater discharges. The ORNL NPDES Permit currently includes stringent effluent limits for several outfalls on First and Fifth creeks, and compliance is difficult. These limits are based on conservative regulatory assumptions about baseline flow rates in these two ORNL receiving streams and have been appealed by DOE. A long-term flow record is expected to allow ORNL to verify or disprove flow rate assumptions on which NPDES Permit requirements are based. This will position DOE to propose and negotiate more realistic and achievable NPDES Permit requirements for discharges to these streams.

HFIR Highbay Storage Building (ADS AA0D0078, FY 2005 Programmatic GPP)

HFIR warehouse storage for safety-related parts and equipment and nonsafety-related equipment is currently being stored in nine different locations, four of which are remote from HFIR. These remote locations are as follows: 3095, 7019, 7039, and 7709. Materials are also being stored in 7914, 7915, 7953B, and two tents located adjacent to 7917. Of these locations, 7709, 7915, and 7953B are conditioned space. HFIR safety-related equipment and parts must by law be stored in conditioned space. Buildings 7914 and 7915 were construction sheds that were used by the contractor when HFIR was built in 1963. They were temporary then. The two tents are an attempt to meet the need with no funding. Significant operational funds are expended every year for moving material and parts between storage places to try to make room for something else that must be stored or for moving things to the reactor site so that they can be used.

A single building with conditioned space on-site would allow HFIR to meet requirements and improve efficiency. Costs for riggers should be reduced. Currently, there are 11,640 square feet of unconditioned warehouse space and 6,420 square feet of conditioned space in use. A minimum of 18,000 square feet is required for continued operation of HFIR for another 25 years.

Ventilation Systems, Ductwork, and Fume Hood Upgrade (ADS C97D0054, FY 2005 Landlord GPP)

Work will include activities to upgrade ventilation systems, filtration systems, interconnecting ducting, and equipment for fume hood and exhaust systems located in facilities at ORNL.

Deteriorated fume hoods and associated exhaust ductwork will be selectively repaired or replaced from hood to filter housing. Repairs will replace all corroded ductwork (with stainless steel or equivalent) and provide leakproof construction with gasketed, flanged joints required for installation/removal. Duct size will be standardized as 12-inch-diameter for hood service. Existing exhaust ductwork from fume hoods will be considered a contaminated material in all cases and will require strict conformance to local work procedures during all repairs and/or replacements.

Fume hoods not previously replaced by interim improvements will be replaced with new fume hoods that conform with the new system concept. The intricate requirements for building airflow balance will be carefully considered in deciding the type of fume hoods and exhaust system arrangement to be employed. Variable-volume fume hoods (airflow regulated by sash position) provide a more appropriate application for these buildings than do auxiliary air hoods (as related to DOE 6430.1A, 1161-4 and 1161-5). Variable-volume fume hoods allow much less complication of controls and should require less total air volume to be heated and filtered (as supply and as exhaust) through system life.

Deteriorated HEPA filter housings will be replaced with new single-filter housings with prefilter space (thus allowing prefilter use to be optional). To achieve full airflow for an 8-foot Class II fume hood (1300 ft^3/min), two single-filter housings are required, using manifolding with interconnection to a single exhaust fan (or header connection). Specifically, these housings and fans will require stacking similar to that now practiced to conserve space. Unit modules will be standardized to use 24- by 24-inch prefilter elements and 24- by 24- by 11.5- inch HEPA filters. All new ductwork and filter housing will be made to conform with current regulations to allow its continued use in the future.

Replace Hood/Secondary Confinement Exhaust – 7920 (ADS A00D0032, FY 2005 Landlord GPP)

The scope of this project includes the following tasks:

1. Replace the flexible connections on the inlet of exhaust fans AJ-120, AJ-121, AJ-122, and AJ-123. Existing deteriorated materials should be fully removed, metal edges made smooth and non- protruding, and new material installed. New material should be double-layered, 30-ounce neoprene impregnated glass cloth (Ventglas) with joints overlapped and edges folded under the securing bands to prevent stretch and tearing under constant suction loading.

2. Replace the backdraft dampers in the suction ducting (at the plenum wall) of exhaust fans AJ-120, AJ-121, AJ-122, AJ-123 on the roof. The existing dampers have deteriorated to the point of being unreliable and are inaccessible for easy inspection and repair. Replacement units need to be better suited to the application and must fit into the existing (same) niche in the plenum wall, with concern for blade clearance immediately downstream due to the converging suction ducting. Viewing ports in the wall of the existing plenums will be provided to allow visual inspection using the existing internal lighting.

3. Replace/rebuild fans AJ-120, 121, 122, and 123 and install new vibration isotopes for these new replacement exhaust fans, specifying protective coating for isolators, coils, surfaces, etc., to provide resistance from long-term exposure to systems entrained moisture.

4. Replace control systems.

5. Verify structural integrity of roof support steel and replace it as necessary.

6. Replace corrected plenum.

6.1 Replace the deteriorated exhaust air filter plenums on the roof to eliminate the inleakage of rainwater and air. Seam leaks and corroded sections of sidewall must be repaired with particular concern for shedding rain (water) that can be sucked into internal compartments. Top areas can be roofed with extended coverage over fans and drives. Bottom curbs must be resealed after metal repairs and restoration of coatings. Particular care must be exercised in cutting and welding in the vicinity of mounted filters and when plenums are under suction. These plenums are essential single path components of these exhaust systems and, as such, they must be maintained in a fully serviceable condition at all times.

6.2 Install a system of monitoring that will detect the accumulation of water that may be collected in each compartment of the exhaust plenums on the roof. Existing curbing causes compartmentation that must be individually sensed so areas having water fault can be identified before accumulated water violates the contamination zone by overflow or backleakage at the perimeter joints. The lack of a drain system in the plenums requires an alternate method of water control to avert serious damage that would be caused by inleakage into the roof plenums.

6.3 Replace the deteriorated and failed backdraft dampers (BDD) in exhaust ducts with new flanged replacement BDDs having external accessories that will afford easier maintenance and better inspection. It is recommended the three BDDs in the main exhaust ducts on the roof be removed but not replaced because they are a duplication of backdraft devices inside the building, i.e., they represent a second device (in series) for the same exhaust streams. The six devices on exhaust streams inside the building will afford better maintenance conditions (than the roof area) and provide individual isolation from backdraft via the ducting for the six areas served.

6.4 Clean the main exhaust duct over the ceiling of Laboratory 209 of any and all debris (trash) that may have deposited that would impede drainage and/or airflow. It is essential that the valved drain in the heel of this main duct be kept clear and operable as the route to relieve any heavy water inleakage occurring in the exhaust plenum on the roof.

6.5 Replace exhaust ducting on the roof where failed backdraft dampers (BDDs) must be removed and replace balancing dampers in the new ducting to supplant those displaced by necessary duct removal. Because of the real limitation of welding new to existing coated ductwork, it is recommended that duct sections be replaced from existing flanged joint to existing flanged joint. This will enable new sections to be shop-fabricated to lessen downtime of the exhaust system and eliminate any welding to existing ducts. After welding existing coated ducts, it is impracticable to restore the internal coating system. Access to existing duct interior surfaces is essentially non-existent, so reworking existing ducts limits quality assurance control.

6.6 Modify pressure-sensing tubing for gages that sense differential pressure valves for filters in the plenums on the roof. The tubing must be arranged to separate any collected moisture without distorting gage readings and to resist clogging due to corrosion of exposed in-stream surfaces. This change is necessary to ensure the indicated values will truly reflect the status of the filter banks contained in the plenums.

6.7 After all renovations and repairs are completed, install new air filters in the exhaust filter plenums on the roof. In-place DOP testing of all HEPA filter installations will be provided to prove compliance with ORNL criteria for these systems. System airflow levels will require adjustment to normal volumes (19,860 cfm for Laboratory Exhaust and 15,905 cfrm for Cell Support Areas) after new filters are installed via the new manual control stations in Control Room 116. Also, adjustment of the new main duct exhaust dampers will be required to restore the needed distribution of exhaust airflow.

Dosimetry Laboratory (ADS A01D0020, FY 2006 Landlord GPP)

In support of the Facility Revitalization Project, the radiation dosimetry activities at the Laboratory will be consolidated into one facility (approximately 5000 square feet). The internal dosimetry located in 4500S, Wing 4, and the external dosimetry located in the 2652A Trailer will be housed in the new facility. The internal dosimetry will be impacted by the first renovation of 4500S. These operations will have to be relocated prior to initial construction activities. The external dosimetry is housed in trailers where deterioration of infrastructure is occurring at a rapid pace. Both operations are accredited by

DOELAP to perform operations. The structure will be located adjacent to the 2008 Whole Body Counting Facility, and they will have five laboratories, a counting room, and auxiliary offices and storage rooms.

Water System Upgrades, 1000 Area (ADS A98D0009, FY 2006 Institutional GPP)

This project will provide a needed infrastructure upgrade for the potable water system in the west end of the ORNL complex. This area is now supplied by a single feed of 6- and 8-inch water mains. This system will be inadequate for planned future development in this area and now provides only marginal fire water supply to the area. This project will install approximately 3000 feet of 16-inch main to the west end of the ORNL complex, along with the associated pressure-reducing valves, isolation valves, fittings, hydrants, and valve pits.

West Campus Infrastructure Improvements (ADS AA0D0068, FY 2006 Institutional GPP)

This activity provides for the construction of infrastructure roads, parking, and common areas associated with the new West Campus development portion of the ORNL Facilities Revitalization Project. This infrastructure improvement will support the West Campus reconstruction by providing new or improved parking lots north of Buildings 1000, 1060, and 1505 to replace the primary parking lots that will be the site of new buildings and common areas. The project also provides for construction of associated new roads and common areas (landscaped quadrangle) in the center of the West Campus. Approximately 0.2 miles of roads will be upgraded or replaced, 5.0 acres of parking upgraded/constructed, and 1.0 acre of landscaped common area provided.

M.1.5 Major GPE Projects – Phase I

Revised Access Controls (ADS AA0D0084, FY 2001 GPE)

This project will provide access control features that eliminate the need for ORNL perimeter fencing except at selected facilities. The present perimeter (fence) will be reconfigured to an access control system located closer to the resources being protected (building, room, etc.). Proximity cards and administrative means will be utilized for access control. This project will provide the necessary badge reader systems for Laboratory buildings.

Backup Diesel Generator for #6 Boiler (ADS AA0D0016, FY 2001 GPE)

This project involves the purchase and installation of a diesel generator at Building 2519 to provide backup power to the No. 6 Boiler. This project will be a turnkey job and provide 480V, 600 Amp service in the event normal power is lost.

SAP Server Upgrade Program (ADS A01D0018, FY 2002 GPE)

ORNL's SAP system supports the Laboratory's financial, human resource, and procurement functions, including such mission-essential areas as human resources, payroll, financial reporting (e.g., DOE, Tennessee, and Internal Revenue Service), and vendor payments.

The computing infrastructure supporting ORNL's SAP system was originally purchased beginning in 1997 and is reaching the end of its expected life span. A 4-year plan has been developed to (a) replace aging components, (b) curtail degrading response times at peak periods, and © upgrade where necessary to support growing system requirements.

(a) Regarding the age of the systems, a 3- to 5-year component life is typical for mission-essential servers in this class. Aging system components result in higher maintenance costs, higher support costs (to deal with compatibility issues between current software and aging hardware), more frequent service outages, and increased risk of unplanned outages. This upgrade program will result in an overall replacement life of 4 to 7 years for most components.

(b) Response times at peak processing have been deteriorating recently, with certain key reports taking about 2 minutes to generate (expected times are about 10 seconds). A planned upgrade to Version 4.6 of SAP in late 2001 is expected to increase system requirements by 25 to 35% based on estimates from SAP.

© Additional functionality continues to be deployed and/or is planned for deployment over this time frame. Running costs weekly instead of monthly, implementing several "employee self-service" functions within Human Resources, implementing SAP's time collection and absence management functions, and assessment of the SAP maintenance module are all being considered or actively worked.

An overall upgrade plan is the most cost-effective mechanism to address all of these needs in a coordinated manner over multiple years with minimal impact to the ongoing production environment.

High-Resolution Mass Spectrometer (ADS A98D0091, FY 2004, GPE)

This project will purchase a replacement isotope ratio mass spectrometer to maintain analytical capabilities required to fulfill the needs of critical programs, including REDC, HFIR, the Mark-42 program, the Cf program, the Pu-238 program, the MOX program, the stable isotopes program, the SNS, ORNL environmental compliance, Rad waste certification, ISPO, and NSPO.

The mass spectrometers currently used to support these programs were constructed in-house in the 1960s and are now virtually in their last days. Maintaining these instruments now takes the full-time services of an I&C technician, in addition to division manpower and the services of two part-time consultants. These two consultants are retirees who built the instruments nearly 40 years ago and are the only people who fully understand their operation. The personal commitment of these two retirees is heavily relied upon to maintain operations. In addition, with aged equipment, replacement parts are becoming increasingly difficult to obtain. The high level of labor required to operate and maintain these mass spectrometers is resulting in increasingly higher operational costs. Increased downtime makes the ability to respond to customers' needs increasingly unreliable. This situation is severely impacting (1) the capability to support current ORNL programs, which jeopardizes their existence, and (2) the ability of ORNL to compete for new programs. Without acquisition of new instrumentation, ORNL is in imminent danger of losing our capability to provide the required analytical support for these programs. Although some of this work (primarily low-level rad) could be done at a few other DOE sites (e.g., LANL), loss of the necessary analytical capabilities at ORNL would significantly increase the costs (and turn-around time) for the ORNL programs due to increased shipping and transportation requirements for these rad samples. In other cases, no other available option exists for these analyses, which would put many ORNL programs at risk. At present, ORNL is recognized as the lead laboratory in the DOE complex for these types of analytical measurements, reflecting our historical strength in this area; however, external perception of difficulties in ORNL isotope analysis capabilities makes us increasingly vulnerable to loss of programs to other national laboratories.

The proposal is to purchase a modern multicollector isotope ratio mass spectrometer for ORNL. This will allow ORNL to continue to provide the analytical capabilities required to support current programs and pursue new funding opportunities. This instrumentation will modernize our capabilities for isotope ratio analysis, reducing analytical costs and improving data quality for a variety of ORNL programs and projects, including:

1. Isotope production at REDC (process control and product certification)
2. Analytical support to EM30 and EM50 work by CTD, CASD, Waste Management, etc.
3. MOX fuel program
4. Pu-238 program
5. Radioactive waste characterization to meet compliance requirements, particularly in the area of criticality safety requirements
6. Generating legally defensible data for environmental samples
7. ORNL's Stable Isotope Program
8. Domestic and international safeguards programs. This system could help generate new funding from several sources, among which are safeguards and other programs with IAEA.

Convert Steam Plant Boilers to Natural Gas Firing (ADS C98D0142, FY 2005 GPE)

This task will entail the retrofit of the existing boiler structures to remove coal-related equipment and to install new burner arrangements to allow the boilers to each produce 50,000 pounds of steam per hour with gas and oil fuel.

M.2 PHASE II PROJECTS (FY 2007–11)

M.2.1 Line Items – Phase II

4500 North and South Modernization Upgrades (ADSs AA0D0098, AA0D00102, AA0D0103, AA0D0104, Multiyear Landlord LI)

The proposed projects are integral parts of the new Facilities Revitalization Project (FRP) for revitalization of ORNL's research capabilities and infrastructure in support of the DOE-SC initiative to modernize their national laboratories. Consistent with DOE's approved Institutional Plan for ORNL, new laboratories, supporting offices, and the necessary support facilities are being proposed for construction as part of an integrated new campus environment in the area north and east of the 4500 North and South Buildings complex. The 4500 North and South complex will be modernized to provide laboratory, office, and support functions. The overall goals of this facilities revitalization initiative are to reduce the burdensome costs of maintaining the current inventory of 50+-year-old facilities, provide a safer environment for current staff to work in, and to ensure ORNL's ability to conduct world-class science in the 21st century, including attracting and retaining world-class research scientists. The payback period is approximately 6 years. There are eight separate upgrade projects in these two facilities. 4500N (Wings 1,2, and 3) and 4500S (Wings 2 and 3) are in Phase II.

ORNL Center for Systems Biology (ADS A98D0087, FY 2007 Programmatic LI)

The ORNL Center for Systems Biology, a 50,000-square-foot facility with a modular complex of buildings, equipment, and supporting infrastructure to be located in the West Campus, will provide space for research programs for functional genomics, structural biology, proteomics, and systems biology. It will also provide staged facilities to house the Center for Systems Biology user facilities. A preliminary estimate of payback for this project is seven years.

Potable Water System Upgrade Phase II (ADSs C97D0062, FY 2007 Landlord LI)

The Potable Water System Upgrade, Phases I and II, will replace or refurbish aged water lines serving the primary research and support facilities in the central campus area of the Laboratory. The main lines running along Central Avenue and the north side of the Building 3508/3517 area will be replaced in the first phase of the project with the Laboratory facilities north of Central Avenue in the vicinity of First Street and the 3047 Isotopes Area. Because of the subsurface contamination concerns within the central campus, multiple technologies are being evaluated for this project, including standard below-grade pipe replacement, above-grade insulated piping, and in-situ lining of existing lines where appropriate and feasible. A preliminary estimate of return on investment is 10% with a payback period of seven years.

Laboratory Facility Ventilation System Upgrade, Phase II (ADS A98D0055, FY 2007 Landlord LI)

The Laboratory Facility Ventilation System Upgrades, Phases I and II, are projects that will modernize ventilation and exhaust systems in approximately ten ORNL facilities totaling over 200,000 square feet of space. Ventilation and exhaust systems in many ORNL facilities are in serious need of upgrade to continue service at any level. Some laboratory areas are not used for research because of a lack of proper ventilation. Systems feature 35-year-old equipment applied in a 35-year old design concept. In many systems the exhaust ducting and filter housings are seriously corroded and have only a marginal future life expectancy. New exhaust fans, ducts, hoods, and an EPA-compliant stack are needed for compliance with regulations. The majority of these duct/housing units are contamination zones that will require closely controlled work conditions. A preliminary estimate of a payback period for this project is seven to nine years.

M.2.2 Major GPP Projects – Phase II (FY 2007–11)

7900 Area Office Building I (ADS AA0D0043, FY 2011 Landlord GPP)

Research Reactors Division currently has 75 people housed in trailers. Several of these trailers were installed in 1987–89 and were used trailers when they were installed. Specifically, Trailers 7964A, 7964B, 7964D, 7964F, and 7964G have numerous recurring problems such as roof leaks, window leaks, HVAC unit malfunctions, mold, mildew, and rodent problems. Additionally, some of these units have deteriorated to the extent that they have serious odor problems associated with decaying facilities.
significantly since 1987, and the level of staffing will probably never return to the pre-1988 level. An office building is needed to revitalize the campus and improve working conditions for the Research Reactors staff and DOE HFIR site representatives.

Documents that are required by law to be maintained are currently being stored in 12 different locations. Some of these locations are trailers, and some consist of unairconditioned space despite requirements calling for the space to be air conditioned. Radiographs of the HFIR vessel and systems and QA records are examples of documents not stored in compliance. Many of the records are required to be stored for the lifetime of the facility, which is projected to be 2035. Requirements also
include maintaining all maintenance work packages as records. The proposed office building should
The trailers were all intended to be temporary structures. The operating environment has changed include
3000 square feet for document control.

6010/6025 Renovation (ADS AA0D0080, FY 2006 Landlord GPP)

This activity provides for the renovation of office and laboratory space in Buildings 6010 and 6025 to accommodate the needs of Physics Division staff moving into the vacated space. Both buildings will also require upgrading of computer access, including installation of twisted-pair connections to offices and laboratories. Both buildings will require modernization of conference rooms to enable utilization of modern projection techniques and the addition and/or renovation of laboratory space to ensure adequate electrical power, water, and bench space. Specific issues to be addressed in 6010 include conversion of the present Center for Engineering Systems Advanced Research (CESAR) Laboratory space into laboratory space (and possibly some office space) appropriate for Physics Division needs, conversion of some office space back to laboratory space on the first floor, and increased women's rest room space (likely to be required). Originally, 6010 had only one floor and no light switches were installed in offices; therefore, light switches should be added as appropriate. Painting will be required.

In 6025, the central area of the building originally contained large office/laboratory space, which since has been converted to offices. Renovation will include converting these offices back to appropriate laboratory/open space. There has been significant settling of the subsurface of 6025, with resulting cracks in the walls, particularly in the south end of the building. This issue will need to be addressed. There is a small sub-basement, which contained a small neutron generator (no longer there) that was covered over during conversion to office space. This area needs to be located and may need attention. Air conditioning has often been a problem and needs to be reviewed for adequacy, particularly in the central areas. Incidental maintenance will also be needed to ensure appropriate office space (unblocking of doors, patching of cracks, painting, etc.).

Restoration of the Natural Gas Distribution System (ADS S97D0020, FY 2010 Landlord GPP)

This project will restore the existing natural gas distribution grid located in the Bethel Valley area of the Laboratory. Restoration activities will include replacement of line segments, valves, and pressure regulators, where warranted, and will use trenchless technology techniques to rehabilitate pipe where these methods can be proven cost effective. All cathodic protection systems currently in use to prevent corrosion of the system will also be upgraded.

The natural gas piping system is a steel piping grid that provides gas to research facilities throughout the center portions of the Bethel Valley complex. It was constructed in 1948 and has been in continuous use since that time. While it has been largely trouble-free, design life has been exceeded, and it is expected to develop problems over the next few years. Given the serious nature of accidents caused by natural gas leaks, it is imperative that measures be taken to restore this system to "as-new" condition before degradation of piping and valves can cause a leak.

Upgrade Motor Control Centers/Switchgear – REDC (ADS A01D0036, FY 2009 Landlord GPP)

The scope of this project includes the following tasks:

1. Replace the motor control centers for Building 7930.

2. Replace the switchgear outside Building 7920 (substation east of main building).

3. Replace the motor control centers in both of the REDC generator shacks (7921, 7931 - safety inspections have shown the precarious condition of wiring inside 7931).

4. Even though the wire electrical conductors, enclosed within a concrete containment enclosure which travels underground between 7920 and 7930, were last replaced about 1992, the presence of the underground steam line in such close proximity to this concrete electrical wireway impels ORNL's electrical system experts to relocate the main electrical feed for 7930 from the underground wire way (concrete tray) to the existing 14KVA power lines in the area (circuit 294?). The exact route to be taken is not yet clear. The project would have to be aware of the rabbit transfer line (7920 and 7930) and other north/south underground piping in that area.

The ORNL Line Item most recently initiated to fix electrical systems in Bethel Valley facilities (4501, 4505, 4500N) focused heavily on service entrances and motor control centers.

Bethel Valley Road Traffic Calming Measures (ADS A00D0017, FY 2007 Landlord GPP)

This project will relocate 1.3 miles of Bethel Valley Road approximately 1000 feet to the north of its present location. It will be a lower-speed roadway containing three 12-foot lanes and two 14-foot shoulders. The proposed relocation will reroute "through" traffic around an area proposed for near-term development of new facilities, reducing the potential for public traffic to enter Laboratory roadways. The proposed relocation will eliminate the dangerous "S" turn located at the Laboratory's main entrance.

Building 4509 Maintenance Shop Addition (ADS C97D0089, FY 2007 Landlord GPP)

This project will construct an addition of approximately 2500 square feet to Building 4509, which houses the Air Conditioning Compressor maintenance activities for the Laboratory. The addition will allow space for maintenance personnel to work on major air conditioning units and support equipment. The addition will improve safe operations for maintenance personnel who work with gasses having the potential for significant hazards.

Electrical Service Upgrade - Building 7601 (ADS A00D0027, FY2007 Landlord GPP)

This project will upgrade the electrical system serving the offices in Building 7601, provide additional clean conditioned power to the office areas to support office equipment (computer) operation, and add electrical outlets and individual light switches to each office.

Upgrade Electrical Systems (Buildings in the 3000, 6000, and 7000 Areas) (ADSs C97D0069 and ADS C97D0070, FY 2007 Landlord GPPs)

This project will replace obsolete and inadequate switchgear and transformers at the main electrical service entrances of buildings in the 3000, 6000, and 7000 Areas. These electrical devices are the control points for the main electrical systems in these facilities. Much of this equipment has been in service for 50 years and must be replaced to ensure reliable electrical service to the customers and provide a safe environment for building occupants, system operations, and maintenance personnel.

Eyewash, Safety Shower Stations, and Supply Piping, 7920 (ADS C97D0081, FY 2008 Institutional GPP)

The scope of this activity includes the upgrade of water supply systems and encompasses the following: (1) installation of safety showers and eyewashes with potable water supply, (2) replacement of piping and associated components used to supply and remove process water, and (3) replacement of piping and associated components used for heating.

This project will consist of (1) the removal and replacement of any existing eyewash stations and safety showers in the laboratories and corridors of 4501 and 4505 (to meet OSHA standards, potable water headers will be installed to supply the water for the safety showers and eyewash stations) and (2) the upgrade of safety showers and eyewash stations in 4500N and 4500S to meet standards during the Line Item renovations proposed in the FY 2000 *Strategic Facilities Plan*.

Central Campus Research Building (ADS AA0D0077, FY 2007 Landlord GPP)

This activity provides for the construction of a research building of approximately 14,000 square feet. This facility will house a number of research programs currently located in Buildings 2024, 3115, 3080, and 2019. These very old and high-maintenance buildings provide substandard space for many high-profile research programs. The new facility will house multidivision programs supported by a number of agencies within the Office of Science (KC, EW, and EB) with direct ties to other national laboratories and industry.

Multiple Projects 3500E Flexible Laboratory Shell (ADS A01D0061, A01D0062, FY 2007, Landlord GPP)

An upgrade to the East side of the Building 3500 complex is proposed to allow the implementation of flexible, special-purpose laboratories as needed for support of future and ongoing research projects. As ORNL moves into newer nanotechnology, biological and life sciences, advanced neutron sciences and nano/micro-instrumentation research, additional special purpose laboratory space will be needed to support new initiatives. To allow rapid design, construction, and modification of special-purpose laboratory space, it is proposed that the east side of Building 3500 be upgraded to provide a flexible shell with flexible utilities to allow rapid implementation of special purpose laboratories within this space.

Existing wall partitions and utilities will be removed and replaced with a flexible matrix of utility feeder systems to allow special-purpose laboratory space to be rapidly erected, modified, or dismantled as future project requirements change. Legacy hazardous building materials in the existing 3500E Area will be removed to mitigate future problems with constructing and modifying special- purpose laboratories. Special utilities required include electricity, communications and network wiring, potable water, distilled water, compressed air, compressed nitrogen, vacuum, and precision environmental control of temperature and humidity. Overall environmental control of the shell is required, as well as systems required to condition individual special-purpose labs. This will mean that an overall building environmental management system will be required and up to four additional environmental control subsystems for individual labs will also be required. Lab exhaust systems will be needed, as well as laboratory makeup air systems. Waste chemical holding systems will also be required.

New Fire Headquarters Facility (ADS A01D0056, FY 2010 Landlord GPP)

This ADS is for the relocation and construction of a new Fire Headquarters Facility. The new facility will have approximately 13,000 square feet of floor space and will, at a minimum, house the following: (1) ORNL fire alarm central receiving station; (2) indoor parking for fire, EMS, and other emergency response apparatus; (3) administrative offices; (4) training classroom facility; (5) conference room; (6) shop space for equipment (i.e., SCBA, fire extinguishers, etc.) maintenance; (7) changeroom facilities; and (8) storage space for fire department/fire alarm/fire suppression equipment and supplies.

The current facility (Building 2500) was constructed in the 1960s and is co-occupied with Wackenhut Security. Available floor space and building configuration is inadequate to accommodate the increased roles and responsibilities of the fire department. Additionally, the existing facility is not optimally located to service major population shifts in ORNL's configuration and the Spallation Neutron Source site.

Computer Network Upgrades (ADS AA1D0001, FY 2012 Landlord GPP)

This project will cover refurbishment of the ORNL network to include:

1. Installation of new fiber optic cabling and equipment for the "backbone". This fiber replacement is required for dense wave division multiplexing (DWDM). This technology uses multiple colors of light. The dispersion characteristics of standard fiber optic cabling are incompatible with this technology over long/moderate distances. Implementing this technology would give a 10-100 increase in capacity. (Year 1)

2. Rewiring legacy buildings with current technology copper and fiber to the desktop and replacement of "edge" electronics in all buildings to take advantage of the faster backbone. (Years 2 and 3)

3. Installation of wide area broadband wireless networking. (Years 3 and 4)

Water System Upgrades, 7600 Area (ADS A98D0010, FY 2010 Landlord GPP)

This project will provide a needed infrastructure upgrade for the potable water system in the east end of the ORNL complex. Presently, there is only a single feed to the 7600 Area of ORNL where there is major potential for a fire loss. Relocation of the Fusion and Engineering Technology facilities from Y-12 to this area is also planned for the future. This project will install approximately 9000 feet of 16-inch main to the 7600 Area at the far east end of the ORNL complex, along with the installation of associated isolation valves, fittings, hydrants, and valve pits.

Radioactive Liquid Wastes Collection System (ADS A00D0025, FY 2008 Programmatic GPP)

Liquid Low Level Waste (Hot Drains)

Purpose: The system provides a means for collection, storage, and transferring of radioactively contaminated liquids.

Isolation: The LLLW system is a gravity drain system and contains no valves for isolation from the Isotopes Area LLLW header.

Major Loads: The LLLW system provides drains from:
- hot cells;
- glove boxes, hoods, and enclosed hoods within the laboratories;
- decon shower in Room 105; and
- drains in the cell blisters.

Proposed change to the LLLW System: Currently, there are plans to install a Liquid Waste collection tank (~300 gallons) in Cell C. The existing drains in each cell will be modified such that it will act as a sump and not allow liquid to flow through the underground LLLW header. The sump will collect any liquid waste which will be vacuum-dragged into the Cell C collection tank. When the tank needs to be emptied, the liquid will be jetted (air jet) to the outside of RDL via existing ½-inch stainless steel lines (the lines are located in the east-west pipe trench in the floor of Room 215). It is currently uncertain how the waste will be delivered to the ORNL LLLW System. Possibilities include installing a new underground doubly contained pipe which will connect to an existing header or transferring the liquid to a specially designed truck at the concrete pad outside the southwest corner of RDL.

Renovation of 4515 (HTML) (ADS AA0D0076, FY 2009 Institutional GPP)

This activity will support the relocation of several grinding machines, electric furnaces, and other potential sources of either vibrational or electrical/magnetic interference from HTML (Building 4515). This is necessary to make HTML suitable for the emplacement of M&C's research projects in support of accelerator and electron optic instruments. It also includes support for the installation of the instruments (including necessary modifications to electrical systems, water system, ventilation, etc.) removed from 4515 into space in Building 4500S. Renovation of the laboratory space in 4500S is the subject of a separate ADS.

Transportation and Packaging Management Facility (ADS S97D0058, FY 2011 Landlord GPP)

This project will provide a one-story building, 85 feet by 130 feet, with 3400 square feet of space. The building will provide three managers' offices, 16 employee offices, a shipping area 30 feet by 20 feet, a loading dock, and a hazardous/nonhazardous and radioactive packaging area. The facility will provide space for packaging, quality assurance checks, and shipment which will comply with regulatory requirements.

The current operation for the transportation and packaging of facility materials occurs in three different locations, and these facilities have levels of fixed contamination. The construction of the new facility will reduce potential exposure to personnel.

East Campus Service Building (ADS AA0D0064, FY 2010 Landlord GPP)

This project involves the construction at ORNL of a 20,000-square-foot multistory office building, the Central Services Building, to be built just north of 4500N. This project will allow consolidation of photography, graphic arts, and duplication services, which currently are located in the basement area of 4500S. These functions will be relocated to a new facility that will more effectively and efficiently serve ORNL's mission and also provide needed space in the 4500S basement to allow the Metals and Ceramics (M&C) Division to vacate 5500 and consolidate its activities in this space. This new building will provide approximately 50 offices for staff that will be displaced by the planned construction efforts of the 4500N Line Item. The Central Services Building will be constructed on the current site of Building 5000.

M.2.3 Major GPE Projects – Phase II (FY 2007–11)

New External Web Server (INFOSRV1) (ADS A00D0003, FY 2010 GPE)

This request is for a new external Web server that will become part of the new external Web server cluster. The external Web server is getting more and more hits, and the CPU is running at or close to 100% utilization a large percentage of the time. This is the critical piece of computing infrastructure for ORNL's external Web presence.

The current external Web server is a single computer system with attached disk and tape storage subsystems. The proposed architecture would consist of two essentially identical computer systems that are made to appear as if they were one system through the use of a smart switch. This switch would be the "traffic cop" for incoming connections from clients' Web browsers. The switch would balance the load between the two servers by continually measuring responsiveness. If either server were to fail for any reason, the switch would immediately stop handing connections to that server. Until that server could be restored, the service might appear somewhat slower to clients, but it would continue operating. A second switch would be configured to provide redundancy in case the first switch failed. The two computer systems would each be configured with RAID-based disk storage subsystems to provide redundancy for the most common type of failure, a disk failure. Data would be replicated automatically from one computer's storage system to the other at regular intervals to maintain the single-system appearance to all clients.

Two Web proxy servers would also be set up in a redundant configuration. These proxy servers would satisfy security concerns about users browsing malicious Web sites and control access to Web servers on the corporate network.

HVAC Upgrades (ADS C97D0083, FY 2010 GPE)

This project will replace deteriorated air conditioning components which provide environmental control for Laboratory facilities. Job scope includes removal and replacement of old equipment and subsequent tie-in support. Many HVAC units are used for loads and purposes other than their original designs, resulting in many developing operational problems, which create occupant health hazards. The equipment listed in the scope of this project has exceeded its life expectancy. Replacing these deteriorated components will improve air conditioning reliability and reduce operating and maintenance costs. The reliability of these HVAC systems is critical to proper operation of laboratory equipment (microscopes, lasers, etc.) and calibration of research apparatus.

Replace Steam Plant Economizers (ADS C98D0179 FY2009 GPE)

The economizers in the coal-fired boilers in the Steam Plant have deteriorated significantly and must be replaced. The economizers are a critical subsystem used in the production of steam in the Steam Plant. Hot flue gases pass through the economizers, transferring heat to the boiler feed water. Because of the sulfur content, these flue gases are corrosive and erode away the tubes over time. Many tubes have been repaired, and the frequency of failure is increasing. Tube wall thickness continues to decrease on the heat exchangers and without replacement, many tubes will need to be plugged. This will not only decrease the efficiency of the economizer but also of the boiler itself as cooler feed water will require more fuel to generate steam.

Data Network Layer 2 Upgrades (ADS A00D0040, FY 2009 GPE)

This capital request is for layer 2 networking devices to ensure that all edge devices provide the features necessary to implement cyber security techniques. New hardware procured as a result of this request will utilize switched technology and eliminate shared media devices at ORNL. Other features that may be deployed as a result of this request are global tagged Virtual Local Area Networks (VLANs) and automated blocking to ensure that unregistered users are not granted access to the network. Utilizing the latest layer 2 networking switches all the way to the edge of the network will allow management systems to be implemented that automatically provide certain registration information and block increased level of security network-wide. This request includes hardware to improve the condition of the network to the edge of the entire network, both "public" and "private." This request also provides for the upgrade of network wiring where necessary to allow for the use of the latest hardware.

The last time significant funds were dedicated to a network rebuild was in 1992 when the current Fiber Distributed Data Interface (FDDI) hardware was procured and installed to make up the backbone. In addition, in 1992 fiber optic cable was installed to allow for this FDDI backbone. Technology has leapfrogged and the FDDI is now obsolete. Also, there has never been a major project funded to build or replace the layer 2 devices, which are the devices closest to the users.

Recent efforts have resulted in the installation of layer 3 gigabit Ethernet in a new backbone, which is nearing completion. This new backbone has been procured for the most part utilizing funds from "public" network users and, in fairness, is currently limited to use by divisions that are willing to pay these rates. Due to funding constraints, deployment of new hardware is done in a fragmented, piecemeal way.

This capital request is for layer 2 networking devices to ensure that all edge devices provide the features necessary to implement cyber security techniques. New hardware procured as a result of this request would utilize switched technology and eliminate shared media devices at ORNL. Other features that may be deployed as a result of this project are global tagged Virtual Local Area Networks (VLANs) and automated blocking to ensure that unregistered users are not granted access to the network. Utilizing the latest layer 2 networking switches all the way to the edge of the network will allow management systems to be implemented that automatically provide certain registration information and block access to the network if the user refuses to provide the remaining required information. This will provide an increased level of security network-wide. This request includes hardware to improve the condition of the network to the edge of the entire network, both "public" and "private," and provisions for the upgrade of network wiring, where necessary, to allow for the use of the latest hardware.

Tube Furnaces and Process Gas Handling (ADS A99D0100, FY 2009 GPE)

This project will procure and install diffusion and passivation tube furnaces and a process gas handling station. As part of the microfabrication infrastructure for ORNL, tube furnaces for precision controlled heating of silicon wafers and other substrates under precision-controlled exposure to a variety of cover gases is required to produce a variety of passivations and substrate dopings. The substrate passivations form masks for subsequent chemical processing of micro- and nano-devices and structures. These passivations can also form mechanical features of devices and structures. Substrate doping is used to form varying semiconducting regions in devices to form active electronic devices or to form regions within the substrate bulk that differ in reaction to subsequent chemical processing. These tube furnaces in combination with high-purity gas metering and control systems form the primary means to form mechanical features on the surface and in the bulk of substrates.

APPENDIX N

Project Cost Tables

Table N.1

Landlord Line Item List

Date: August 5, 2002

($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
A99D0056	RESEARCH SUPPORT CENTER (LI)	1,500.0	5,000.0	9,600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0056	4500N, WING 4, LAB UPGRADES & RENOVATION	0.0	0.0	1,890.0	12,460.0	2,250.0	0.0	0.0	0.0	0.0	0.0
AA0D0057	4500S, WING 1, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	0.0	2,000.0	12,000.0	3,000.0	0.0	0.0	0.0
AA0D0095	4500N, WING 3, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	0.0	0.0	1,750.0	14,000.0	3,000.0	0.0	0.0
AA0D0096	4500N, WING 2, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,900.0	15,000.0	3,000.0
AA0D0098	4500S, WING 2, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	0.0	0.0	0.0	2,100.0	12,500.0	3,400.0	0.0
AA0D0102	4500N, WING 1, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,200.0
AA0D0103	4500S, WING 3, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,200.0	13,000.0
AA0D0104	4500S, WING 4, LAB UPGRADES & RENOVATION	0.0	0.0	0.0	2,450.0	11,450.0	4,300.0	0.0	0.0	0.0	0.0
A99D0018	FIRE PROTECTION SYSTEMS UPGRADE (LI)	3,120.0	2,216.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A99D0017	LABORATORY FACILITIES HVAC UPGRADE (LI)	3,000.0	3,600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0094	PRIMARY SUBSTATION UPGRADES, ORNL (LI)	0.0	0.0	740.0	5,975.0	525.0	0.0	0.0	0.0	0.0	0.0
AA0D0017	MANIPULATOR REPAIR FACILITY (LI)	0.0	0.0	0.0	1,500.0	8,500.0	2,000.0	0.0	0.0	0.0	0.0
A98D0007	LABORATORY FAC VENT SYS UPGR-PHASE 1 (LI	0.0	0.0	0.0	1,000.0	2,500.0	4,000.0	0.0	0.0	0.0	0.0
AA0D0055	LABORATORY FAC VENT SYS UPGR-PHASE 2 (LI	0.0	0.0	0.0	0.0	0.0	1,000.0	3,500.0	4,000.0	0.0	0.0
C97D0061	POTABLE WATER SYSTEM UPGRADE I (LI)	0.0	0.0	0.0	1,000.0	4,000.0	2,000.0	0.0	0.0	0.0	0.0
C97D0062	POTABLE WATER SYSTEM UPGRADE II (LI)	0.0	0.0	0.0	0.0	0.0	1,000.0	4,000.0	2,000.0	0.0	0.0
Total		**7,620.0**	**10,816.0**	**12,230.0**	**24,385.0**	**31,225.0**	**28,050.0**	**26,600.0**	**23,400.0**	**20,600.0**	**18,200.0**

Table N.2

Landlord GPP List

Date: August 5, 2002

($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AA2D0052	PROCESS WASTE DRAIN CONTAMINANT DISCHARG	0.0	500.0	1,500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0113	EAST AND WEST PORTALS	2,600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C97D0071	FIRE PROTECTION SYSTEMS UPGRADE-GPP (TEC	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0058	EAST CAMPUS ELECTRICAL SYSTEMS UPGRADE (	295.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0006	BUILDING 1061 MODIFICATION (TEC=$203K)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0072	7600 AREA HIGHBAY BUILDING-DESIGN ONLY(T	0.0	1,100.0	3,700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A00D0043	1503 GREENHOUSE RENOVATION UPGRADE	0.0	0.0	280.0	1,400.0	0.0	0.0	0.0	0.0	0.0	0.0
A99D0098	BUILDING 7602 HIGHBAY UPGRADE (TEC=$850K	325.0	0.0	325.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0037	6026 GRAVEL LOT EXTENSION/PAVING (TEC=$1	535.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0042	MISCELLANEOUS AREA PARKING LOTS (TEC=$19	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0047	6026 NORTH PARKING LOTS (TEC=$467K)	412.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0063	ADVANCED MATERIALS CHARACTERIZATN LAB (T	1,700.0	2,540.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0051	EAST CAMPUS TELECOMMUNICATIONS UPGRADE(T	100.0	1,700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A01D0058	3500E FLEXIBLE LABORATORY SHELL UPGRA (T	0.0	0.0	0.0	300.0	800.0	700.0	0.0	0.0	0.0	0.0
A01D0059	3500E FLEX-LAB1 (TEC=$600K)	0.0	0.0	0.0	0.0	100.0	500.0	0.0	0.0	0.0	0.0
A01D0060	3500E FLEX-LAB2 (TEC=$600K)	0.0	0.0	0.0	0.0	0.0	100.0	500.0	0.0	0.0	0.0
A01D0061	3500E FLEX-LAB3 (TEC=$600K)	0.0	0.0	0.0	0.0	0.0	0.0	100.0	500.0	0.0	0.0
A01D0062	3500E FLEX-LAB4 (TEC=$600K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	500.0	0.0
A99D0020	LAB EXPANSION-NANOSCIENCE METRLGY/INST(T	900.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C97D0054	VENTILATION SYSTEMS, DUCTWORK, & FUME HO	0.0	0.0	0.0	1,000.0	1,000.0	1,500.0	2,000.0	2,000.0	3,000.0	1,000.0
AA0D0077	CENTRAL CAMPUS RESEARCH BUILDING	0.0	0.0	0.0	2,500.0	2,000.0	0.0	0.0	0.0	0.0	0.0
A00D0032	REPLACE HOOD/SECONDARY CONFINEMENT EXH.	0.0	0.0	0.0	1,000.0	1,000.0	0.0	0.0	0.0	0.0	0.0
A98D0016	4511 COOLING TOWER REPLACEMENT (TEC=$140	0.0	0.0	0.0	0.0	200.0	1,200.0	0.0	0.0	0.0	0.0
A01D0020	DOSIMETRY LABORATORY	0.0	0.0	0.0	0.0	1,500.0	2,500.0	0.0	0.0	0.0	0.0
C97D0089	MAINTENANCE SHOP ADDITION 4509	0.0	0.0	0.0	0.0	0.0	200.0	1,000.0	0.0	0.0	0.0
A00D0017	BETHEL VALLEY ROAD TRAFFIC CALMING MEASU	0.0	0.0	0.0	0.0	0.0	500.0	900.0	0.0	0.0	0.0
C98D0127	UPGRADE/REPLACE HEPA EXHAUST SYS., 4501	0.0	0.0	0.0	0.0	0.0	0.0	1,750.0	0.0	0.0	0.0
A02D0010	INSTALL NEW VESSEL OFF-GAS SCRUBBER SYST	0.0	0.0	0.0	0.0	0.0	0.0	1,150.0	3,650.0	0.0	0.0
AA2D0018	REPLACE TSF/CROET WATER SERVICE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	1,000.0	0.0
AA0D0080	6010/6025 RENOVATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	900.0	0.0
A01D0036	UPGRADE MOTOR CONTROL CENTERS/SWITCHGEAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	500.0	600.0	0.0
A01D0056	NEW FIRE HEADQUARTERS FACILITY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,000.0	2,000.0
A98D0010	WATER SYSTEM UPGRADES, 7600 AREA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	1,000.0
S97D0020	RESTORE NATURAL GAS DISTRIBUTION SYSTEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	800.0	1,000.0
S97D0058	TRANSPORTATION AND PACKAGING FACILITY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	500.0	2,600.0	0.0
S97D0023	EXTEND WATER MAIN - 7000 AREA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,000.0	0.0	0.0
AA0D0064	EAST CAMPUS SERVICE BUILDING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,500.0	2,900.0
S97D0002	ADDITION TO BUILDING 6012	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	300.0
AA0D0043	7900 AREA OFFICE BUILDING I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.0
C97D0057	UPGRADE CONDENSATE REMOVAL, ORNL STEAM D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,100.0
A99D0154	GPP MANAGEMENT RESERVE	102.0	360.0	595.0	300.0	600.0	600.0	600.0	700.0	1,100.0	1,100.0
Total		**7,029.0**	**6,200.0**	**6,400.0**	**6,500.0**	**7,200.0**	**7,800.0**	**8,000.0**	**9,350.0**	**13,200.0**	**10,800.0**

Table N.3

Institutional GPP List

Date: August 5, 2002

($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AA2D0108	UPGRADE SEWAGE COLLECTION, EAST CAMPUS (	25.0	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0097	EAST CAMPUS UTILITY MODIFICATIONS (TEC=$	100.0	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0114	FIRE PROTECTION SYSTEMS UPGRADE-IGPP (TE	0.0	0.0	0.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0
A01D0019	REBUILD STEAM STA & SUPPLY PIPING, 7920(	75.0	675.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A02D0003	REBUILD STEAM STATIONS, 7930 (TEC=$750)	0.0	0.0	150.0	600.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0095	ORNL WAYFINDING SIGNS (TEC=$625K)	250.0	125.0	250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0048	5TH STREET/SOUTHSIDE AVE. PARKING LOT (T	295.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0049	5TH STREET ENTRANCE (TEC=$722K)	260.0	0.0	0.0	0.0	500.0	0.0	0.0	0.0	0.0	0.0
AA1D0050	7000 AREA PARKING LOT EXPANSION (TEC=$11	110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0055	SOUTHSIDE PARKING LOTS (TEC=$80K)	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0056	6000 AREA PARKING LOTS (TEC=$150K)	0.0	0.0	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0098	ROOFING REPLACEMENT, BUILDING 6007 (TEC=	130.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0096	EAST CAMPUS STORM DRAIN MODIFICATIONS (T	50.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0065	EAST CAMPUS INFRASTRUCTURE IMPROVEMTS (T	35.0	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0
AA1D0056	3513/3524 SIOU PARKING LOT (TEC=$850K)	0.0	0.0	850.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0058	SWSA 2 PARKING LOT (TEC=$350K)	0.0	0.0	0.0	0.0	350.0	0.0	0.0	0.0	0.0	0.0
AA2D0054	EAST CAMPUS NATURAL GAS LINE (TEC=$525K)	100.0	425.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0059	QUADRANGLE COMMON AREA (TEC=$3100K)	0.0	170.0	1,000.0	1,930.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0111	CENTRAL AVENUE EXTENSION (TEC=$1225K)	100.0	400.0	725.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0112	EAST CAMPUS ENTRY AND PARKING AREA (TEC=	0.0	150.0	1,500.0	350.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0107	FACILITY UPGRADES, BUILDING 4512 (TEC=$3	100.0	250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C97D0104	ROAD AND PARKING LOT PAVING - ORNL (TEC=	400.0	100.0	400.0	100.0	400.0	400.0	400.0	0.0	0.0	0.0
AA2D0053	5510A RENOVATION - METROLOGY SERV & MEAS	100.0	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0064	BUILDING 1060 STANDBY ELECTRICAL POWER S	0.0	125.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A02D0020	UPGRADE BLDG 5510 HVAC & UTILITIES ISOTO	0.0	0.0	215.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A01D0004	6000 AREA COOLING TOWER REPLACEMENT (TEC	0.0	0.0	0.0	200.0	800.0	0.0	0.0	0.0	0.0	0.0
A99D0027	FLOW MONITORING STATIONS FOR LOW-FLOW VE	0.0	0.0	0.0	155.0	0.0	0.0	0.0	0.0	0.0	0.0
A01D0010	INSTALL SYSTEM TO COLLECT LLLW,HOTCELLS&	0.0	0.0	0.0	0.0	500.0	500.0	0.0	0.0	0.0	0.0
A98D0009	WATER SYSTEM UPGRADES, 1000 AREA	0.0	0.0	0.0	0.0	500.0	0.0	0.0	0.0	0.0	0.0
C98D0145	REPLACE EAST END WATER SOFTENERS - B 251	0.0	0.0	0.0	0.0	0.0	800.0	0.0	0.0	0.0	0.0
AA2D0041	UPGRADE PA SYSTEM AT 7900 SITE	0.0	0.0	0.0	0.0	0.0	0.0	250.0	0.0	0.0	0.0
S97D0051	HVAC UPGRADES - GPP - SUPPLEMENTAL	0.0	0.0	0.0	500.0	500.0	900.0	500.0	600.0	600.0	600.0
A00D0027	ELECTRICAL SERVICE UPGRADE - BUILDING 76	0.0	0.0	0.0	0.0	0.0	115.0	0.0	0.0	0.0	0.0
C97D0069	UPGRADE ELECTRICAL SYSTEMS, 3019, 3025,	0.0	0.0	0.0	0.0	475.0	0.0	0.0	500.0	0.0	0.0
C97D0070	UPGRADE ELECTRICAL SYSTEMS, 6000 AND 700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.0	1,000.0	0.0
AA0D0068	WEST CAMPUS INFRASTRUCTURE IMPROVEMENTS	0.0	0.0	0.0	0.0	200.0	300.0	1,000.0	0.0	0.0	0.0
AA0D0076	RENOVATION OF 4515 (HTML)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	900.0	0.0	0.0
S97D0032	WEST END STEAM UPGRADE COMPLETION	0.0	0.0	0.0	0.0	0.0	0.0	250.0	0.0	0.0	0.0
A02D0008	INSTALL/UPGRADE SAFETY SHOWERS/EYEWASHES	0.0	0.0	0.0	0.0	0.0	0.0	150.0	450.0	0.0	0.0
A02D0011	INSTALL/UPGRADE SAFETY SHOWERS EYEWASHES	0.0	0.0	0.0	0.0	0.0	0.0	150.0	450.0	0.0	0.0
AA2D0106	BLDG 3017 TO 5500 X-RAY VAULT RELOCATION	0.0	0.0	0.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0013	IGPP MANAGEMENT RESERVE	40.0	300.0	300.0	565.0	500.0	500.0	500.0	500.0	500.0	500.0
Total		**2,250.0**	**3,870.0**	**5,540.0**	**5,200.0**	**4,825.0**	**3,515.0**	**3,200.0**	**3,800.0**	**2,100.0**	**1,100.0**

Table N.4

Landlord GPE List

Date: August 5, 2002

($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
A02D0019	REBUILD COMPONENTS ROBBINS-MYERS 10-T BR	0.0	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0047	REPLACE BUILDING 3525 AIR HANDLERS (2 EA	0.0	0.0	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0029	REPLACE HEPA FILTERS-CAT 2 7920/7930 (T	380.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0099	REPLACE TERTIARY FILTER - SEWAGE TREATME	0.0	125.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0084	ACCESS CONTROLS-OPEN CAMPUS IMPROVEMTS(T	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0092	ENGINEERING TECHNOLOGY FACILITY (ETF) CL	100.0	650.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0003	LDRD SCANNING PROBE ELECTROCHEMCL MICROS	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C98D0182	LDRD GENERAL PURPOSE EQUIPMENT RESERVE (	29.0	110.0	110.0	110.0	110.0	120.0	120.0	140.0	140.0	170.0
A01D0018	SAP SERVER UPGRADE PROGRAM (TEC=$1860K)	260.0	350.0	400.0	400.0	400.0	0.0	400.0	0.0	400.0	0.0
AA2D0006	4500N J233 CONF RM VIDEOCONFERENCING HAR	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0019	REPLACEMENT GENERATOR AT BUILDING 5505 (	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A98D0091	HIGH RESOLUTION MASS SPECTROMETER	0.0	0.0	825.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C98D0142	CONVERT STEAM PLANT BOILERS TO NATURAL G	0.0	0.0	0.0	600.0	0.0	600.0	0.0	600.0	0.0	600.0
S97D0056	BOILER #5 CONTROLS UPGRADE, STEAM PLANT(	0.0	0.0	0.0	125.0	0.0	0.0	0.0	0.0	0.0	0.0
A99D0129	33-MHZ TO 3-GHZ TIMING GENERATOR	0.0	0.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0050	SINGLE-PASS COOLING EQUIPMENT REPLACEMEN	0.0	0.0	0.0	490.0	500.0	600.0	700.0	700.0	700.0	700.0
A00D0035	BACKUP TAPE ROBOT DEVICE	0.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	0.0
A01D0014	ORNL COMPUTER NETWORK UPGRADES	0.0	0.0	0.0	0.0	150.0	0.0	0.0	0.0	0.0	0.0
A99D0097	SPINCOATER, DEVELOPER AND INSPECTION STA	0.0	0.0	0.0	0.0	455.0	0.0	0.0	0.0	0.0	0.0
A99D0099	PHOTOMASK ALIGNER AND EXPOSURE SYSTEM (T	0.0	0.0	0.0	0.0	0.0	450.0	275.0	0.0	0.0	0.0
A99D0100	TUBE FURNACES AND PROCESS GAS HANDLING S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	800.0	0.0	0.0
A02D0004	REPLACE DEGRADED COG HEPA FILTERS IN BLD	0.0	0.0	0.0	0.0	0.0	0.0	400.0	0.0	0.0	0.0
A01D0066	WILDLAND FIRE CONTROL 4X4 PICK-UP TRUCKS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.0	0.0	0.0
AA0D0036	CELL 1 WINDOW REPLACEMENT, BLDG 3025E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	225.0	0.0	0.0
A00D0040	DATA NETWORK LAYER 2 UPGRADES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	750.0	750.0	0.0
AA2D0014	SITE ACCESS CONTROL UPGRADE (INTERFACE W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
C98D0051	FLUKE 5720A TESTER (TEC=$62K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.0	0.0
AA2D0093	ELECTRONIC DISCHARGE MACHINE (EDM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	305.0	0.0
A00D0003	NEW EXTERNAL WEB SERVER (INFOSRV1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.0	0.0
A01D0011	SAP OPERATIONAL ANALYSIS SYSTEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	0.0
A98D0132	INSTALL BACKDRAFT DAMPERS, BUILDING 7920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	1,000.0
AA2D0078	4501 - EXHAUST FAN 56 PLENUM HOUSING REP	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0
A01D0031	REPLACE CRANES/HOISTING DEVICES IN CTD'S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	500.0
AA1D0022	GREEN IS CLEAN PROGRAM FOR REDUCTION OF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	250.0	250.0	0.0
A98D0110	UPGRADE EAST END FEEDWATER SYSTEM B-2519	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	510.0	0.0
AA1D0019	COMPUTER NUMERICAL CONTROL WATER CUTTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	525.0
C97D0125	CFC PHASEOUT - CLEAN AIR ACT COMPLIANCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	800.0	800.0	0.0
C98D0179	REPLACE STEAM PLANT ECONOMIZERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	650.0	650.0	0.0
A02D0015	REPLACEMENT GERMANIUM DETECTORS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	290.0	0.0
C97D0083	HVAC UPGRADES - GPE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	500.0	500.0
S97D0013	NEW 4000 SCFM AIR DRYER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	760.0	0.0
A98D0103	TRACK BRUSH CUTTER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	0.0

Table N.4 (cont'd)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
A98D0120	SOLID STATE STARTER FOR THE #3 AIR COMPR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.0	0.0
A99D0035	DOSIMETRY SYSTEM UPGRADE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0
AA1D0023	SEWAGE TREATMENT PLANT DENITRIFICATION S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	600.0
C98D0121	REPLACE FLEET VEHICLES (GPE)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	300.0	300.0	300.0
A01D0002	REPLACE 1991 AMBULANCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.0	0.0	0.0
A01D0013	UNIX SERVER FOR BUSINESS CONTINUITY PLAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.0
A01D0039	FLUKE MODEL 792A AC/DC TRANSFER STANDRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.0
A98D0101	BACK HOE, MODEL 310D JOHN DEERE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.0
P98D0249	REPLACE 1981 FIRE TRUCK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	510.0	0.0	0.0
A99D0131	MICROWAVE SPECTRUM ANALYZER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.0
AA0D0039	CELL 6 WINDOW UPGRADE, BLDG 3025E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0
C98D0005	DISTILLED WATER MAKERS, 4500N AND 4500S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.0
C98D0052	RETROFIT PACKAGES FOR LEBLOND LATHES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.0
C98D0101	MICROWAVE SIGNAL GENERATOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.0
A98D0116	TRANSFORMER FOR 2632 ELECTRICAL SUBSTATI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.0
A98D0117	TRANSFORMER FOR 3000 ELECTRICAL SUBSTATI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.0
A00D0037	REPLACEMENT FOR SWS1 COMPUTER SYSTEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
A00D0041	SUN A1000 STORAGE ARRAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0
A00D0042	NETAPP F720	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74.0
A01D0015	NETAPP F85 FILER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.0
A02D0001	REPLACE LERC VENTILATION SYSTEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0
A99D0104	GIGABIT ETHERNET PROTOCOL ANALYZER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
AA0D0002	LSS FIBER NETWORK FOR LERC DATA ACQUISIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128.0
AA2D0020	REPLACEMENT OF GC/MS SYSTEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136.0
AA2D0021	AA SPECTROMETER WITH GRAPHITE FURNACE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
A02D0014	1504 DECHLORINATED WATER SYSTEM UV UPGRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.0
A99D0135	REPLACE FIRE PROT. RECORDKEEPING SYSTEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
A02D0022	EXCHANGE SAN STORAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.0
AA2D0061	ORNL WIDE-AREA RADIO SYSTEM	0.0	900.0	1,020.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0109	GERBER EDGE 2 SIGN PRINTER	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0012	GPE MANAGEMENT RESERVE	21.0	39.0	115.0	100.0	125.0	230.0	55.0	115.0	150.0	204.0
Total		**1,413.0**	**2,549.0**	**2,820.0**	**1,900.0**	**1,900.0**	**2,000.0**	**2,000.0**	**6,140.0**	**7,231.0**	**7,179.0**

Table N.5

Programmatic Line Item List
Date: August 5, 2002
($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
S97D0043	LABORATORY - COMPARATIVE & FUNCTIONAL GE	11,405.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0002	CENTER FOR NANOPHASE MATERIALS SCIENCES	1,500.0	25,000.0	20,000.0	17,250.0	0.0	0.0	0.0	0.0	0.0	0.0
A99D0146	HFIR-ACCELERATOR/REACTOR IMPROVEMNT MODI	400.0	200.0	1,000.0	1,000.0	4,800.0	8,400.0	8,400.0	1,000.0	1,000.0	1,000.0
AA1D0041	ENERGY RELIABILITY AND EFFICIENCY LABORA	0.0	0.0	1,500.0	14,430.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0050	SANS GUIDE HALL, HFIR (AIP) (TEC=$4300K)	3,300.0	800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A98D0087	CENTER FOR SYSTEMS BIOLOGY (LI)	0.0	0.0	0.0	0.0	0.0	2,000.0	14,000.0	4,000.0	0.0	0.0
A99D0043	ACCELERATOR UPGRADE, HRIBF (AIP)	400.0	400.0	2,500.0	2,500.0	2,500.0	2,500.0	400.0	400.0	400.0	400.0
AA2D0115	PROTEOMICS AND PROTEIN COMPLEX ANALYSIS	0.0	0.0	0.0	5,000.0	20,000.0	70,000.0	30,000.0	25,000.0	0.0	0.0
S97D0046	SPALLATION NEUTRON SOURCE (LI)	276,300.0	210,571.0	124,600.0	79,800.0	41,100.0	0.0	0.0	0.0	0.0	0.0
Total		**293,305.0**	**236,971.0**	**149,600.0**	**119,980.0**	**68,400.0**	**82,900.0**	**52,800.0**	**30,400.0**	**1,400.0**	**1,400.0**

Table N.6

Programmatic GPP List

Date: August 5, 2002

($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AA2D0004	BUILDING 1059 MODIFICATION	0.0	0.0	200.0	1,000.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0039	REPLACE HFIR STEAM SYS PIPING, INTERNAL	0.0	110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0009	BETHEL VALLEY ROAD ACCESS CONTROL IMPROV	2,600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0007	HFIR PERMANENT POOL STORAGE TANKS PROJ(T	0.0	1,000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0053	HFIR MAINTENANCE BUILDING	0.0	0.0	300.0	2,600.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0009	TRANSMITTER RELOCATION - 7600 AREA	0.0	0.0	63.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0010	POWER SUPPLY BUILDING - 7600 AREA	0.0	173.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0082	FED COOLING TOWER SYSTEM	210.0	390.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0034	HFIR PRIMARY HEAT EXCHANGER REPLACEMENT	0.0	0.0	0.0	0.0	2,000.0	0.0	0.0	0.0	0.0	0.0
AA2D0035	HFIR POOL HEAT EXCHANGER REPLACEMENT	0.0	0.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0003	HFIR USER SUPPORT FACILITY	0.0	500.0	4,000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0015	FACILITY PREPARATIONS FOR PU-238 PRODUCT	0.0	3,000.0	750.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA1D0059	FED - FOUNDATION FOR COOLING TOWER SYSTE	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A01D0046	HFIR SECONDARY COOLANT SYSTEM LIFE EXTEN	0.0	0.0	1,500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0026	SBHE DUCTWORK IN-SERVICE INSPECTION AND	0.0	0.0	0.0	1,000.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0031	HFIR ELECTRICAL CABLING SYSTEM LIFE EXTE	0.0	0.0	0.0	450.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0032	NORMAL/EMERGENCY DIESEL GENERATORS AND S	0.0	0.0	0.0	1,300.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0078	HFIR HIGHBAY STORAGE	0.0	0.0	0.0	1,000.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0030	SBHE FAN SHED AND FILTER PIT HOUSING UPG	0.0	0.0	0.0	0.0	2,800.0	0.0	0.0	0.0	0.0	0.0
A01D0037	UPGRADE HOG/GBOG SYSTEM IN BUILDING 3047	0.0	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A02D0012	REPLACE/UPGRADE HOT CELL WINDOWS IN BLDG	0.0	0.0	100.0	500.0	100.0	500.0	100.0	500.0	0.0	0.0
AA2D0029	REPLACE 15 HVAC UNITS IN HFIR BUILDING	0.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA0D0051	INFRASTRUCTURE IMPROVEMENT, HFIR	0.0	0.0	0.0	0.0	625.0	0.0	0.0	0.0	0.0	0.0
AA2D0040	UPGRADE CAMS AND MONITRONS	0.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	0.0
A01D0049	MATERIAL HANDLING FACILITY ADDITION	0.0	0.0	0.0	0.0	1,800.0	0.0	0.0	0.0	0.0	0.0
A00D0025	RADIOACTIVE LIQUID WASTES COLLECTION SYS	0.0	0.0	0.0	0.0	0.0	0.0	1,250.0	0.0	0.0	0.0
A01D0047	IMPLEMENTATION OF FIRE HAZARDS ANALYSIS	0.0	1,000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A02D0021	RELOCATE ISOLATION FLANGE,CPS,LLLW DRAIN	0.0	50.0	250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A98D0013	BLDG. 7920 EXPANSION FOR MASTER/SLAVE MA	0.0	150.0	1,350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A98D0135	UPGRADE/REPLACE SHIELDED CAVES A AND B,	0.0	0.0	750.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S97D0004	EXT. POWER LINE TO INT. OF WALKER BRANCH	0.0	650.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S97D0057	BUILDING 3144 ADDITION - PROGRAMMATIC	0.0	1,500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		**2,810.0**	**9,523.0**	**9,563.0**	**8,170.0**	**7,325.0**	**500.0**	**1,350.0**	**500.0**	**0.0**	**0.0**

Table N.7

Programmatic GPE List
Date: August 5, 2002
($ x 1000)

ADS No.	Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AA1D0063	REPLACE HEPA FILTERS-CAT 2, BLDG 3047	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0065	3047 FILTER HOUSE REFURBISHMENT	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A00D0031	UPGRADE/REPLACE HOT CELL/OPER. AREA SUP.	0.0	0.0	750.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0025	SBHE CONFINEMENT CONTROL SYS SAF-REL UPG	135.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0046	STEAM SUPPLY PIPE RELOCATION	0.0	111.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0036	UPGRADE TO SECONDARY COOLANT RAD MONITOR	0.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0027	REPLACE 50-TON CRANE MOTORS	0.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0028	REPLACE REACTOR POOL COOLANT PUMPS	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0038	REPLACE EXPOSED INTERIOR DRAIN PIPING	0.0	140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0023	REPLACEMENT OF CHILLED WATER PUMPS	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AA2D0033	HFIR TRANSFORMER NO. 1	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		**271.0**	**596.0**	**750.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

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