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Resource Management Plan

for the

Oak Ridge Reservation

Volume 22: Resource Information and Site Analysis for Planning on the Oak Ridge Reservation

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RESOURCE MANAGEMENT PLAN FOR THE
U.S. DEPARTMENT OF ENERGY
OAK RIDGE RESERVATION

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ACRONYMS

ATDL	Atmospheric Turbulence and Diffusion Laboratory
CARL	Comparative Animal Research Laboratory
COMSEC	communications security
CRBRP	Clinch River Breeder Reactor Project
CTF	Central Training Facility
DOE	Department of Energy
DOT	Department of Transportation
ETNGC	East Tennessee Natural Gas Company
FM	Forest Management
FOB	Federal Office Building
GSA	General Services Administration
HPRR	Health Physics Research Reactor
ISM	industrial, scientific, and medical
MERT	Manpower, Research, Education, and Training
MISM	miscellaneous industrial, scientific, and medical
NERP	National Environmental Research Park
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OORTS	Official Oak Ridge Telecommunications System
ORAU	Oak Ridge Associated Universities
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation
OSTI	Office of Scientific and Technical Information
R&D	research and development
RMO	Resource Management Organization
SAIC	Science Applications International Corporation
SCB	South Central Bell
SDP	Site Development (and Facilities Utilization) Plan
SWSA	solid waste storage area
TIC	Technical Information Center
TSF	Tower Shielding Facility
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
UHF	ultra-high frequency
WMA	Wildlife Management Area
Y-12	Oak Ridge Y-12 Plant

existing facilities. However, stand-alone research functions or other facilities are possible on these sites.

These studied and measured findings lead to the conclusion that extreme care must be taken in the evaluation of future use or disposition of available land. Furthermore, it is time to consider and evaluate the feasibility for renewal. The potential for recycling lands formerly used by programs and functions that have been completed or terminated is very real, considering the age, condition, and obsolescence of these facilities.

Planning for use of the ORR is an iterative process based on existing conditions, known constraints, relative opportunities, and projected programmatic needs to identify the most effective use of the land resource. The land use administrative and review process gives the plan a maximum amount of flexibility, and the land use policies offer uniform and stable criteria. These plans must be updated annually and amended as required.

Some of these plans are similar to a municipal land use plan and zoning ordinance in that they list permitted uses and impose some degree of restrictions. The ORR has numerous land uses that have varying degrees of compatibility with each other and varying degrees of incompatibility that impact other programs or resources. The land use classifications used in this document are generic and similar uses are grouped together, thus limiting the number of classifications to eight (see Sect. 4.7). These eight classifications are all-inclusive, covering all conceivable functions and uses. This document describes and lists each specific compatible use within each classification. Each classification, in effect, permits multiple uses. "Incompatible" uses (those of different classifications) may be permitted if a review indicates that adverse impacts are satisfactorily mitigated. In addition to the basic land use classifications, some areas are designated as restricted and protected areas; such designations may have definite or indefinite durations.

The ORR Site Development and Facilities Utilization Plan (currently being proposed) will address and resolve planning issues and problems. In contrast, this document, as a source of resource information, attempts only to identify the issues that are most obvious. The list here is not complete; neither is it organized in any order of priority or value of importance. No attempt has been made to resolve these issues. The list serves merely to suggest the types of questions that need to be addressed to ensure meaningful planning on the ORR.

Figures 3.52 and 3.53 show the support role of the ORR Resource Management Organization (RMO) in providing technical input, reviews, recommendations, and implementation of ORR plans (such as an SDP) in support of planning on the ORR. Additional monetary support will be required so the ORR RMO can provide this assistance to DOE.

1. INTRODUCTION

Land is a vital resource. The land, combined with the other resources on it, and the ways they are utilized constitute "land use." Land use is an integral part of the site planning and facilities utilization process. Land use planning, a mechanism for controlling and shaping site development, is used to help ensure wise and efficient use of the land resource. Through "zoning," a land use plan can be implemented to allow growth or no growth, as may be appropriate, and to ensure that the type of development is compatible and effective. It will also designate suitable multiple-use areas where compatible uses can share the same land. This document consolidates and integrates information taken from other Resource Management documents.

1.1 BACKGROUND

Facilities (including real property, land, buildings, utilities, and programs) are expensive to acquire, develop, and maintain, and they have long lives; thus they require great expenditures over their economic lifetimes. Careful planning is required to ensure cost-effective development and efficient use of these resources. An understanding of long-term and future programmatic needs is essential for preserving the required resources; therefore, careful analysis and study are necessary before excessing and disposing of property. The cost of planning is small when compared with the cost of lost opportunities, poor preparation to meet development needs, and inefficient use of facilities and resources. For these reasons, the Department of Energy (DOE) has established a policy that requires facilities planning at all of its sites (DOE Order 4300.1B).

1.2 OBJECTIVE AND SCOPE

The objective of this resource document is to provide information that can be used by DOE to develop a mechanism for achieving effective use of the land resource within the physical, legal, and administrative constraints and with regard to programmatic needs as they exist today and as they are perceived to be in the future.

The scope of this document is to provide a comprehensive data resource that can be used in preparing a meaningful plan for future use of the land and facilities resources.

1.3 OAK RIDGE RESERVATION RESOURCE MANAGEMENT POLICY

For land use planning and zoning to be beneficial and effective, an approved land use philosophy and policy must be clearly effected at all levels of management. All planning on the Oak Ridge Reservation (ORR) is being done within the framework of the following "Policy Statement on Management of the Resources of the Department of Energy's Oak Ridge Reservation" (from ORNL-6026/V1):

The Oak Ridge Reservation constitutes an important physical, fiscal, and natural resource for the nation, the Department of Energy, and the operating contractor. To assist continued effective and efficient operation of the site facilities and to plan for long-term use, development, and maintenance of the reservation resources, a Resource Management Plan has been adopted and a permanent resource management organization has been established, acknowledging resource management as a necessary system for major site programmatic and operational planning and decision making.

2. SITE GENERAL INFORMATION

This section shows the geographic location of the ORR, gives a brief history of its development, and discusses its current status and relationship to the region.

2.1 LOCATION

Most of the ORR is located within the corporate limits of the City of Oak Ridge in eastern Tennessee. The site is predominantly to the west and south of the population center of the city. Oak Ridge lies in a valley between the Cumberland and Southern Appalachian mountain ranges and is bordered on one side by the Clinch River. The Cumberlands are about 16 km (10 miles) northwest; 113 km (70 miles) to the southeast are the Great Smoky Mountains (Figs. 2.1 and 2.2).

Oak Ridge and the ORR are within the region known as the Great Valley of the Tennessee River. The ORR consists of approximately 15,000 ha (37,000 acres) of federally owned lands in this valley. The three primary plant complexes found on the site [Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge National Laboratory (ORNL), and the Oak Ridge Y-12 Plant (Y-12)] have a combined fenced area of 810 ha (2,000 acres) with an additional 1,579 ha (3,900 acres) designated as a buffer for health and safety reasons. Another large part of the Reservation [5,500 ha (13,590 acres)] is designated as a National Environmental Research Park (NERP).

The City of Oak Ridge, which has a population of about 28,000, was built within the original Reservation to house the builders and operators of the K-25 (ORGDP), X-10 (ORNL), and Y-12 facilities for the Manhattan Project. Knoxville (population 185,000) is located approximately 48 km (30 miles) southeast of Oak Ridge. Although most employees live within 40 km (25 miles), employment opportunities are so attractive that many employees commute 80 to 120 km (50 to 75 miles) daily from their homes in surrounding counties.

2.2 THE EARLY YEARS

The current ORR has evolved from land originally acquired for construction of three major facilities that were part of the Army's Manhattan Project. These three facilities were originally built for one purpose: large-scale production of fissionable material to build the world's first nuclear weapon. Although these plants were built as "temporary" facilities, they have continued to be used and have grown into major research and development (R&D) and production facilities (Figs. 2.3 and 2.4).

This growth began in 1947 when the Atomic Energy Commission (a predecessor of DOE) was established to take charge of the nuclear program and to administer a new program of developing nuclear energy for beneficial peacetime

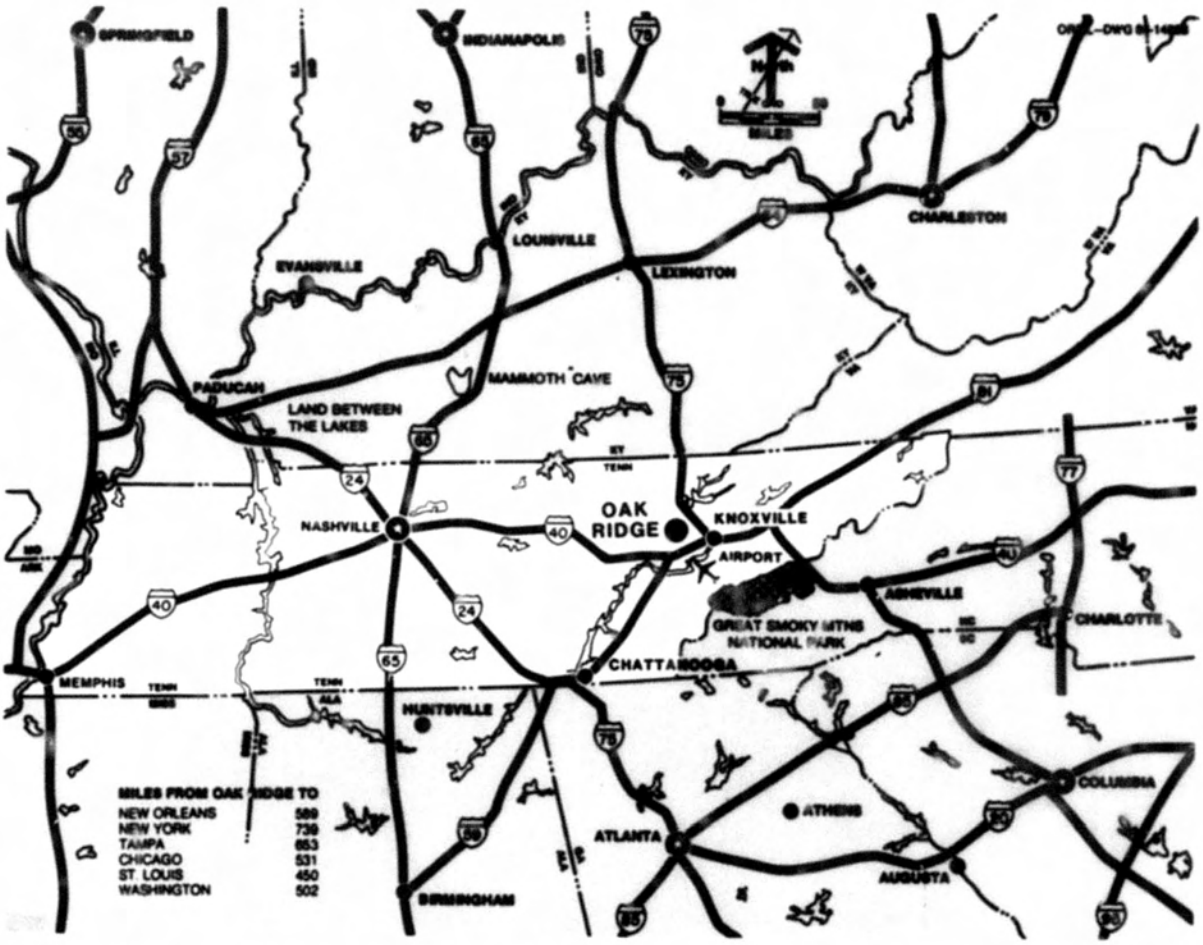


Fig. 2.1. Vicinity. The Oak Ridge Reservation is located in East Tennessee between the Cumberland Mountains and the Great Smoky Mountains National Park, about midway between the Kentucky and Georgia borders.

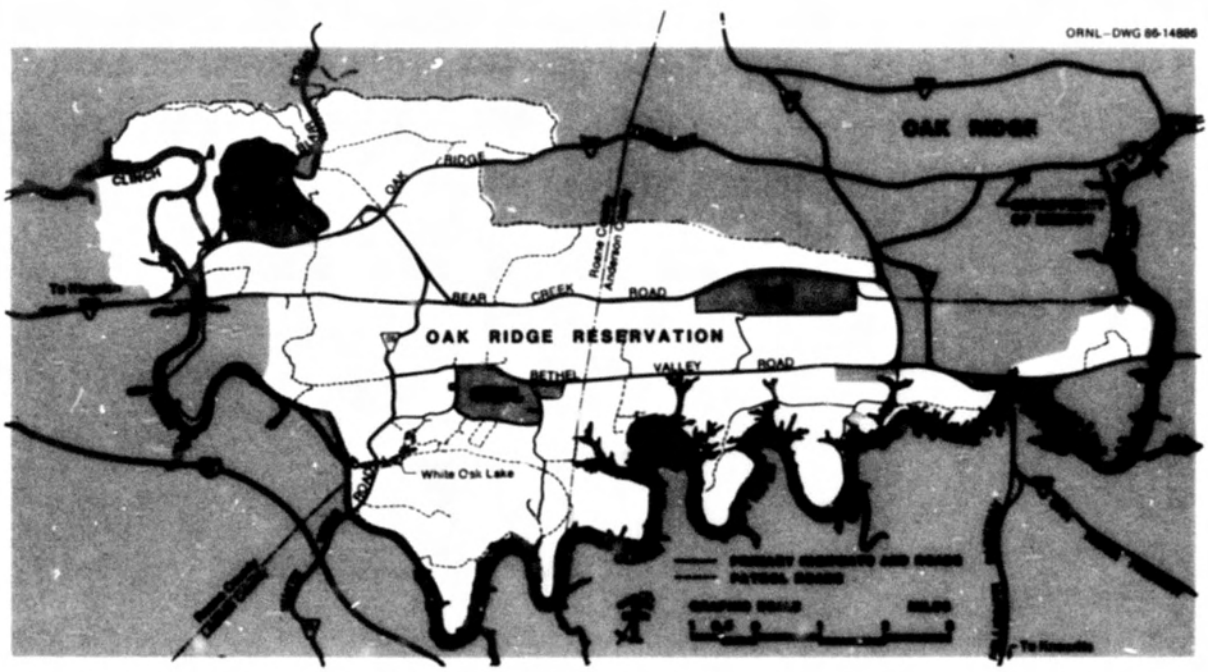


Fig. 2.2. Location. The Oak Ridge Reservation encompasses three major Department of Energy facilities (Oak Ridge Gaseous Diffusion Plant, Oak Ridge National Laboratory, and the Y-12 Plant).

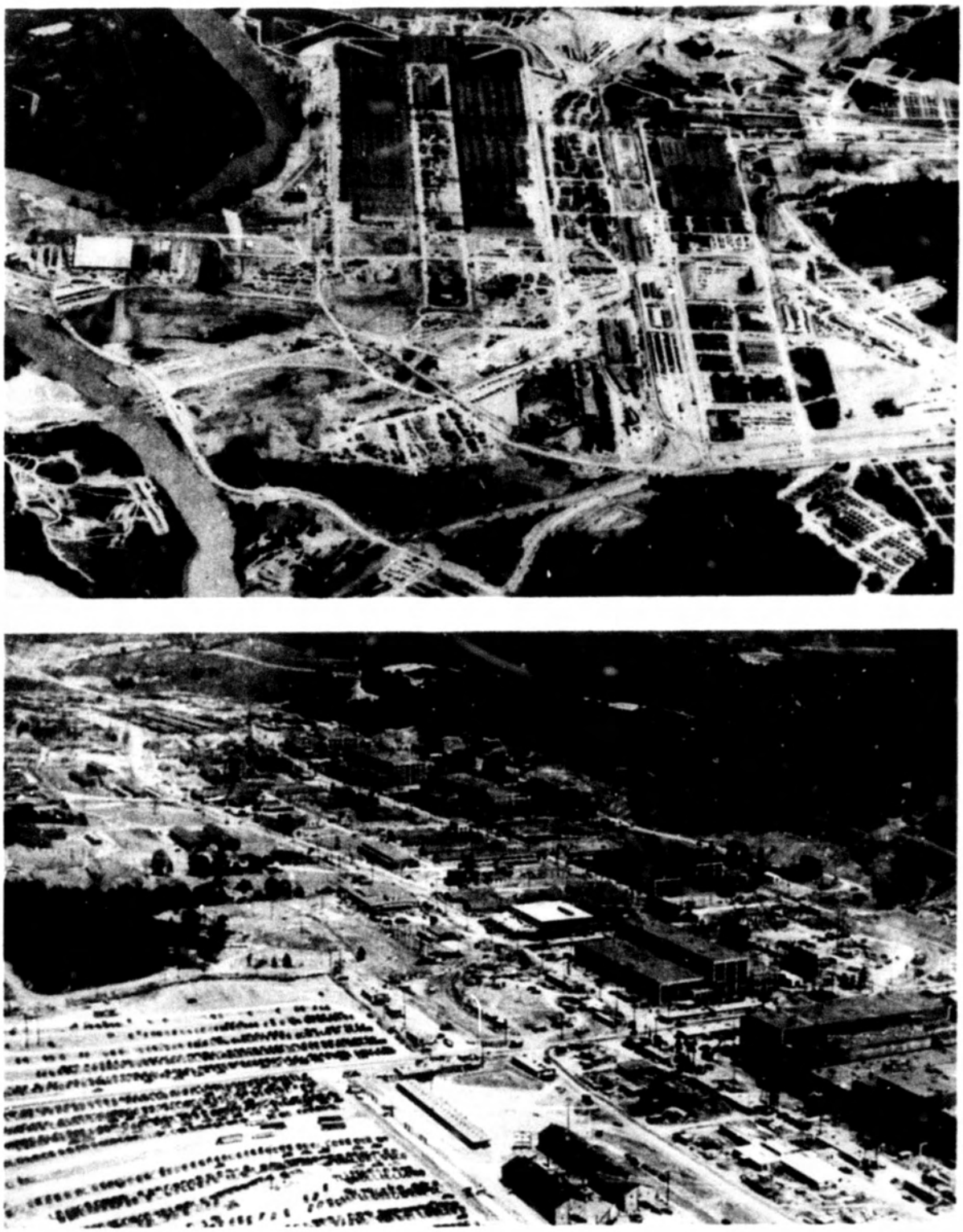


Fig. 2.3. Oak Ridge Gaseous Diffusion Plant and Y-12 in the early years. These photos were taken in the early 1940s and show construction of the K-25 building (top) and Y-12 (bottom).

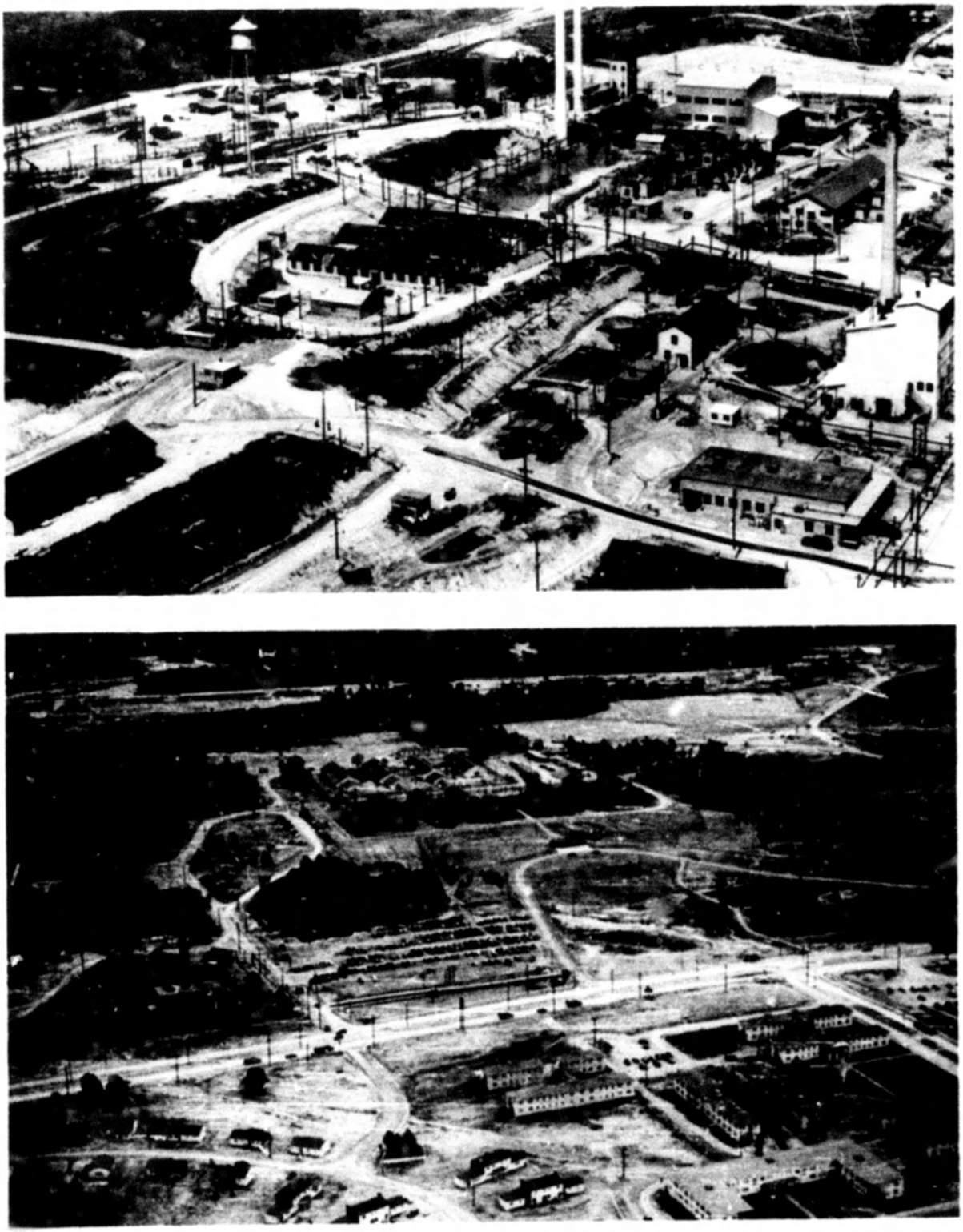


Fig. 2.4. Oak Ridge National Laboratory (top) and the Federal Office Building (bottom) in the early years.

applications. Since that time, ORGDP has continued its mission by producing fuel for nuclear reactors by the gaseous diffusion method; ORNL has grown into a major R&D facility; and Y-12 has continued to grow in function and mission as a production facility for weapons parts and in a support function for other DOE facilities. Today, these three facilities represent an investment of more than $2.8 billion (Fig. 2.5).

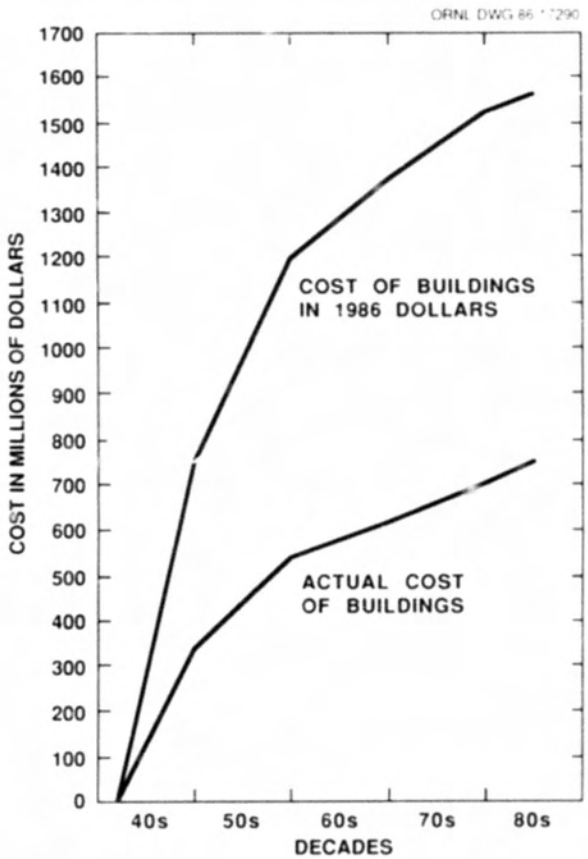


Fig. 2.5. Graph depicting the historical growth of the three primary facilities (ORGDP, ORNL and Y-12) combined in terms of total monies spent since 1943 as capitalized.

2.3 TODAY

DOE was established in 1977 to carry out in a coherent and effective manner elements of the nation's energy policy; it consolidated the many fragmented energy programs and offices within the federal government. Included in DOE's mission are programs for energy R&D and for national defense. DOE also brought together a vast number of physical facilities under one department, making it the second largest holder of property and facilities in the civilian sector of the federal government.

Many of these programs and facilities are found on the ORR, which includes the three major plants (Table 2.1) [ORGDP for enriching uranium (Fig. 2.6), ORNL for energy R&D (Fig. 2.7), and Y-12 for weapons component production (Fig. 2.8)] and a number of programs and facilities associated with these plants and their programs. Efficient operation and cost-effective management of these facilities are important parts of DOE's mission.

Because of the tremendous need for support and influenced by the resources surrounding such major production and R&D facilities, other programs and facilities have located in the region or have been attracted to the ORR. DOE's Oak Ridge Operations (ORO) office (Fig. 2.9) administers the many programs on the ORR. Support of DOE program information is provided by the Office of Scientific and Technical Information (OSTI) [formerly the Technical Information Center (TIC)]. Oak Ridge Associated Universities (ORAU) recently contracted to operate the Scarboro Facility [formerly the Comparative Animal Research Laboratory (CARL)] on the ORR to continue educational and research work for DOE and private industry. Also located in

Table 2.1. Missions and resources of the three major facilities on the Oak Ridge Reservation, FY 1986

Facility	Mission	Employment	Operating and capital cost (millions of $)	Principal plant area[a] (acres)	Buildings		Cost of plant and equipment (millions of $)	
					No.	Floor space (1,000 ft²)	Gross	Depreciated
Oak Ridge Gaseous Diffusion Plant	Uranium enrichment	2,499	100	1,700	249	12,198	1,456	(−1,283)
Y-12 (including Oak Ridge National Laboratory)	Nuclear weapons component fabrication	7,302	647	811	319[b]	6,477[b]	950	(−521)
Oak Ridge National Laboratory	Energy research	5,109	402	1,100	242	2,739	452	(−210)
Central functions		2,961						
Total		14,910[c]	1,149	3,611	810	21,414	2,858	(−2,014)

[a]Includes some land outside the fenced area. The total combined fenced area of the three major facilities is 810 ha (2,000 ha). To convert acres to hectares, divide by 2.47.

[b]Includes 43 buildings at 1.51 million ft² of floor space for ORNL.

[c]End of fiscal year.

Sources: Real Property Inventory System, Martin Marietta Energy Systems Capital Accounting, and DOE-ORO Planning and Budgets Office.

Fig. 2.6. Oak Ridge Gaseous Diffusion Plant today.

Oak Ridge is the American Museum of Science and Energy. "Townsite" is a central administration center for purchasing and employment for the prime contractor, Martin Martin Marietta Energy Systems, Inc. Some facilities at Y-12 are used for Rust Engineering and Transportation Safeguards in support of Y-12.

Table 2.2 shows the cost and the replacement value for buildings and other structures on the ORR. These amounts do not include the cost of equipment.

2.4 REGIONAL OVERVIEW

DOE seeks to be a "good neighbor" within the region and the state. In accordance with this policy, its highest priority is the operation of safe facilities that create no short- or long-term hazards to the surrounding populations and that mimimize any constraints to future uses of the land resource. The DOE ORR, inclusive of its facilities, seeks to assimilate its presence comfortably into the daily flow of the local communities' activities. Through use of an ORR Land Use Plan and an ORR Site Development and Facilities Utilization Plan (SDP), planning and growth of DOE's Oak Ridge facilities are to be coordinated with local governing bodies by ORO or its authorized representatives.

ORNL PHOTO 5733-83

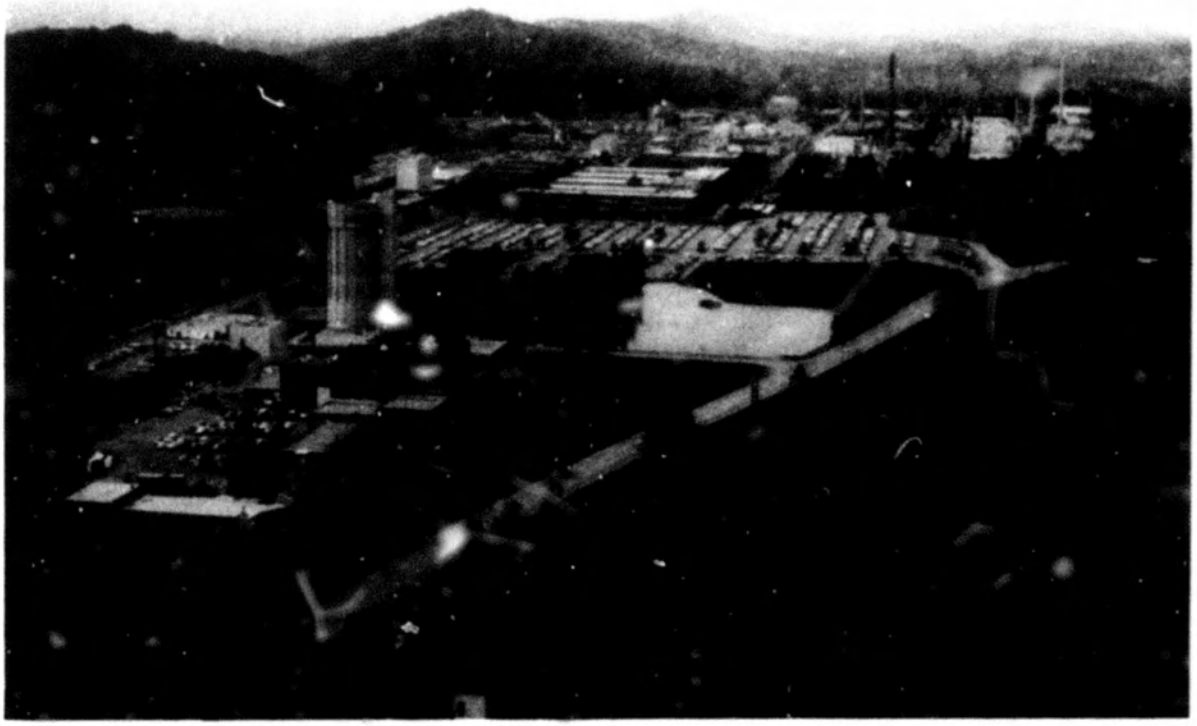


Fig. 2.7. Oak Ridge National Laboratory today (looking west).

2.4.1 Population

Primary contractor employees on the ORR number approximately 15,390; an additional 2,540 employees in other DOE facilities bring the total for the Oak Ridge area to around 17,930. These employees reside in more than 60 towns and cities within 120 km (75 miles) of Oak Ridge (Fig. 2.10), which has the greatest number of DOE-contracted employees living in any one city. During the Manhattan Project in the 1940s, when the major facilities on the ORR were being constructed, Oak Ridge had a population of over 75,000. Its current population, approximately 28,000, has not changed significantly over the last decade. With improvements in the rural highway system and the interstate system, however, an increasingly smaller proportion of the employees are choosing to live in Oak Ridge.

Knoxville, located 32 km (20 miles) east of the ORR, has a population of nearly 185,000, making it the third largest city in Tennessee. Knox County has nearly 320,000 residents, and the four-county (Knox, Anderson, Blount, and Union) Knoxville Standard Metropolitan Statistical Area has a population of nearly 477,000. As Knoxville continues to grow westward, a greater number of employees are choosing to live in West Knoxville.

Other than the cities of Oak Ridge, Maryville, and Knoxville, the primary facilities on the ORR (ORGDP, ORNL, and Y-12) are the major daytime population centers in the metropolitan Knoxville area. Each plant functions as a small

Fig. 2.8. Y-12 Plant today (looking west).

incorporated town. Each has its own fire and security forces, limited medical treatment facilities, sanitary and storm sewer systems, water supply system, road maintenance, central steam plant, etc.

The tremendous impact that these facilities have on the region through employment is evidenced by their payroll, which exceeds $550 million annually (Fig. 2.11). In addition, DOE has recognized its responsibility to the region by making payments in lieu of taxes to state and local governments (Table 2.3).

2.4.2 Transportation

2.4.2.1 Highway Transportation

The Knoxville-Oak Ridge area is served by three interstate highways: I-40 (east-west), I-75 (north-south), and I-81 (northeast-southwest). A bypass (I-640) around downtown Knoxville was completed in 1982 and has improved traffic flow through the area. The ORR is within a few miles of I-40 and I-75. The modern and scenic Pellissippi Parkway connects the ORR to these same highways to the east and serves as the major link between West Knoxville and Oak Ridge. The rural highway system around the Reservation is considered adequate to handle the average number of commuter trips the work force generates daily. Some congestion, however, does occur on and near the ORR from 7 to 8 a.m. and from 4 to 5 p.m. Recent highway construction, including a four-lane bridge over the Clinch River at Solway (Fig. 2.12), a grade-separate inter-

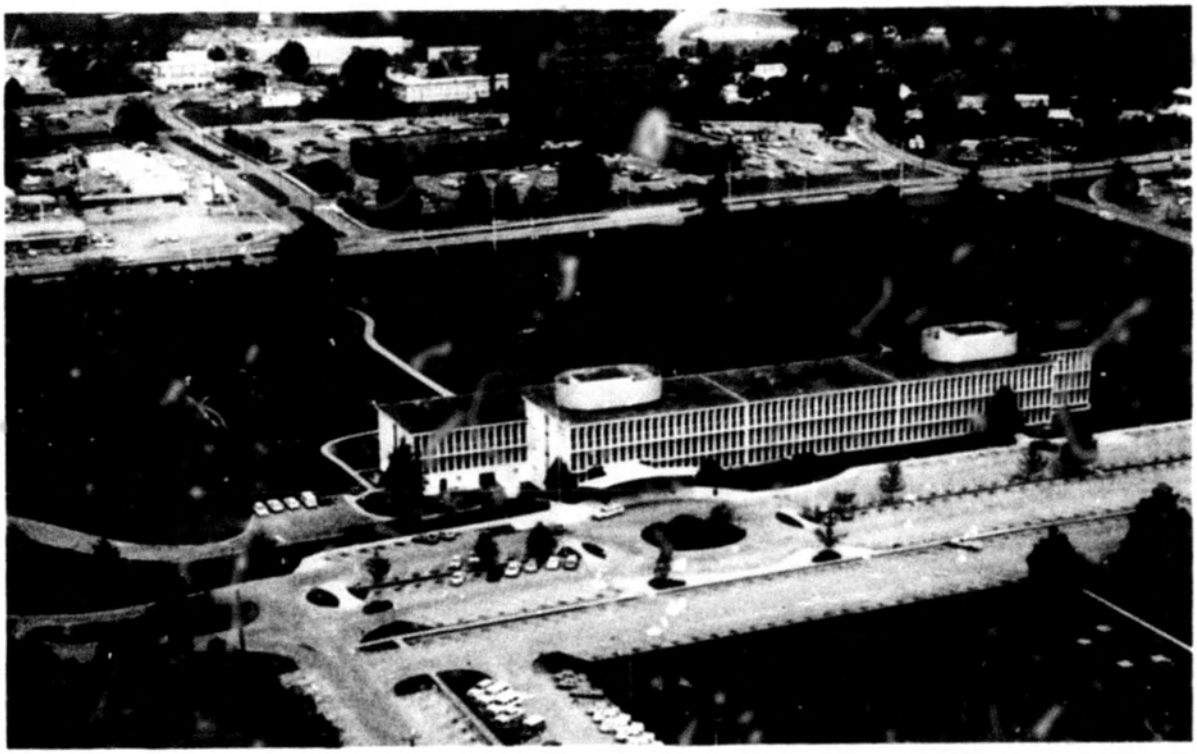


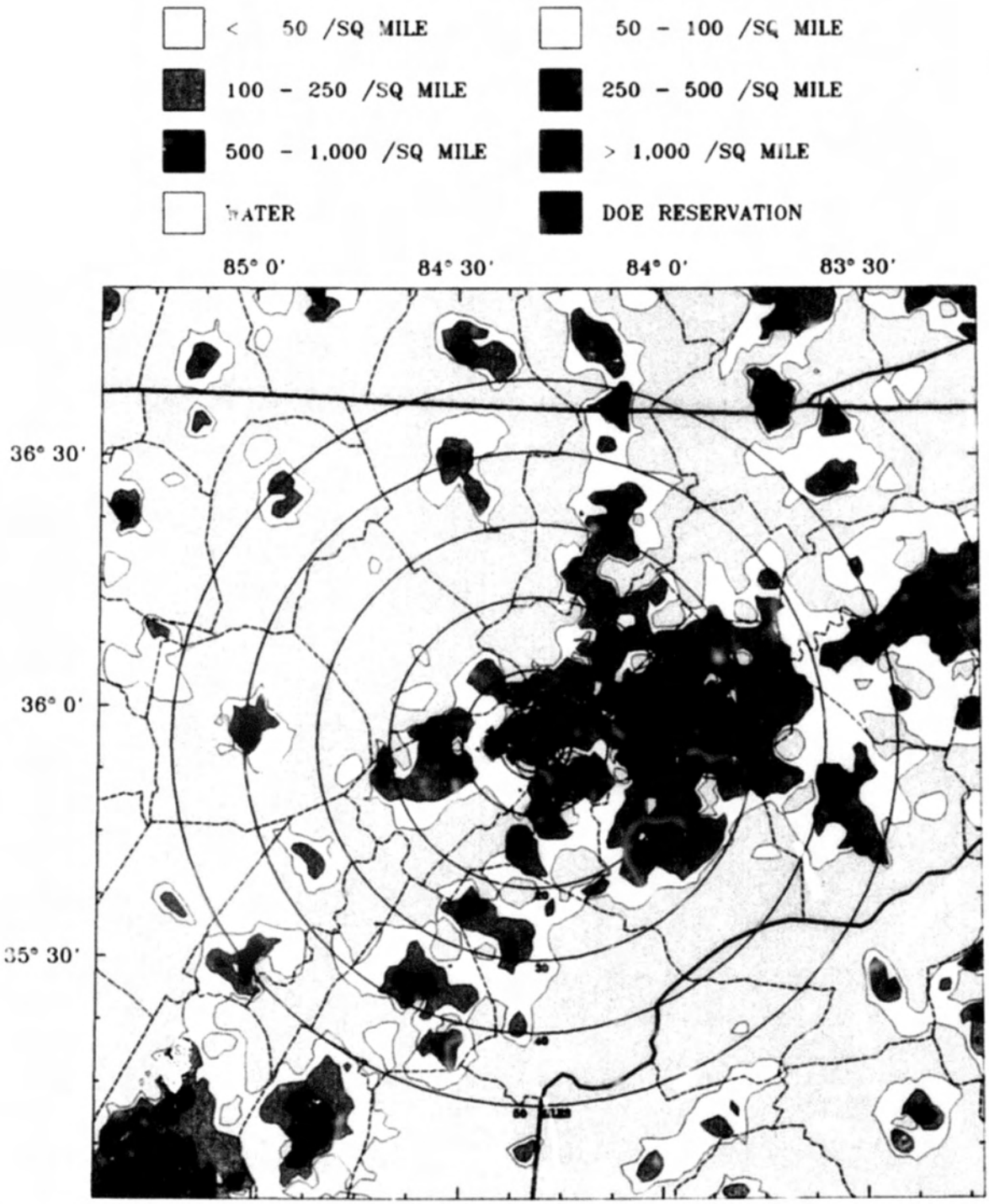
Fig. 2.9. Federal Office Building today (looking north).

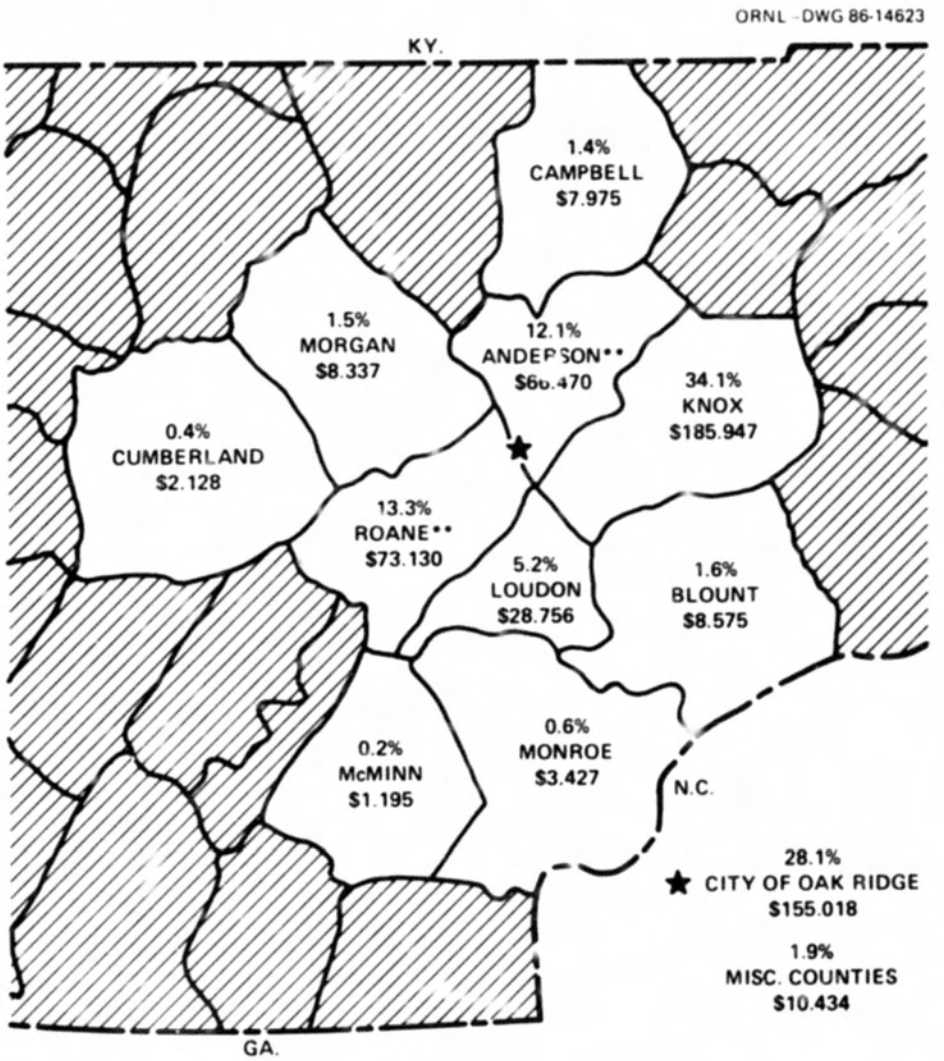
Table 2.2. Cost of buildings and other structures on the Oak Ridge Reservation[a]

Facility	Cost ($)		
	Buildings	Other structures	Total
Oak Ridge Operations	3,593,610	473,631	4,067,241
Oak Ridge National Laboratory	175,212,128	72,148,406	247,360,534
Oak Ridge Gaseous Diffusion Plant	266,898,097	180,373,692	447,271,789
Oak Ridge Y-12 Plant	302,296,064	120,252,253	422,548,317
Oak Ridge Associated Universities	10,396,961	446,334	10,843,295
Museum	3,790,975	194,657	3,985,632
Construction/ maintenance	4,744,879	9,912,644	14,657,523
Total	766,932,714	383,801,617	1,150,734,331
Replacement value	5,685,347,674	17,904,728,951	23,590,076,625

[a]Does not include the cost of equipment.
Source: Real Property Inventory System.

OAK RIDGE NATIONAL LABORATORY
POPULATION DENSITY
FINAL 1980 CENSUS





*Includes DOE in Oak Ridge and the following Oak Ridge area DOE contractors: Bechtel, Boeing, Burns & Roe, Calculon, Goodyear, Lockwood Greene, Maxima, ORAU, Rust, SAIC, SDC/DMJM, Martin Marietta, S&C.

**Excludes City of Oak Ridge.

Fig. 2.11. Payroll distribution for Department of Energy Oak Ridge Operations contractors in millions of dollars. (*Source*: DOE-ORO Planning and Budgets Office).

change at the intersection of State Highways 95 and 58 (Fig. 2.13), and the four-lane improvements to State Highway 95 between Maryville and I-40, has greatly improved traffic flow. Traffic studies to date that address peak-hour congestion problems have focused on physical solutions such as improved signage and signals, improved intersections, and grade separation of interchanges. Another feasi-

Table 2.3. Department of Energy payments to the State of Tennessee, the City of Oak Ridge, and Anderson and Roane counties because of DOE operations in Oak Ridge ($)

DOE payments	Fiscal year		
	1984	1985	1986
State of Tennessee sales and use tax	11,298,500	11,212,775	11,255,638
Roane County local option sales and use tax	1,234,089	1,344,386	1,289,238
Financial assistance under the Atomic Energy Commission Act			
City of Oak Ridge	2,163,368	3,508,573	22,254,187
Anderson County	982,301	1,499,589	9,511,595
Roane County	996,766	1,476,827	9,367,218
Total	16,675,024	19,042,150	53,677,876
"Self-sufficiency" payments under DOE five-year plans			
City of Oak Ridge	706,246	151,920	1,034,551
Anderson County	11,981	213,491	266,813
Roane County	108,065	158,752	34,273

Source: DOE-ORO Planning and Budgets Office.

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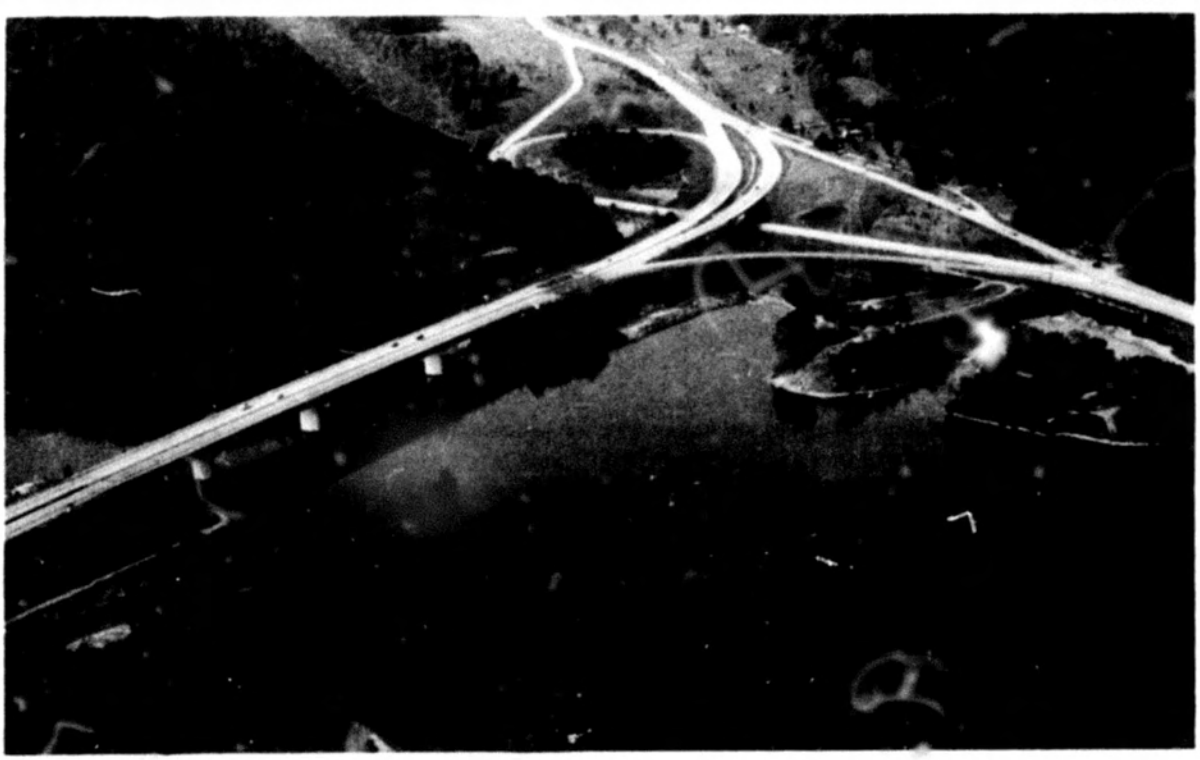

Fig. 2.12. Solway bridge (looking west toward the Oak Ridge Reservation).

ORNL PHOTO 5777-83

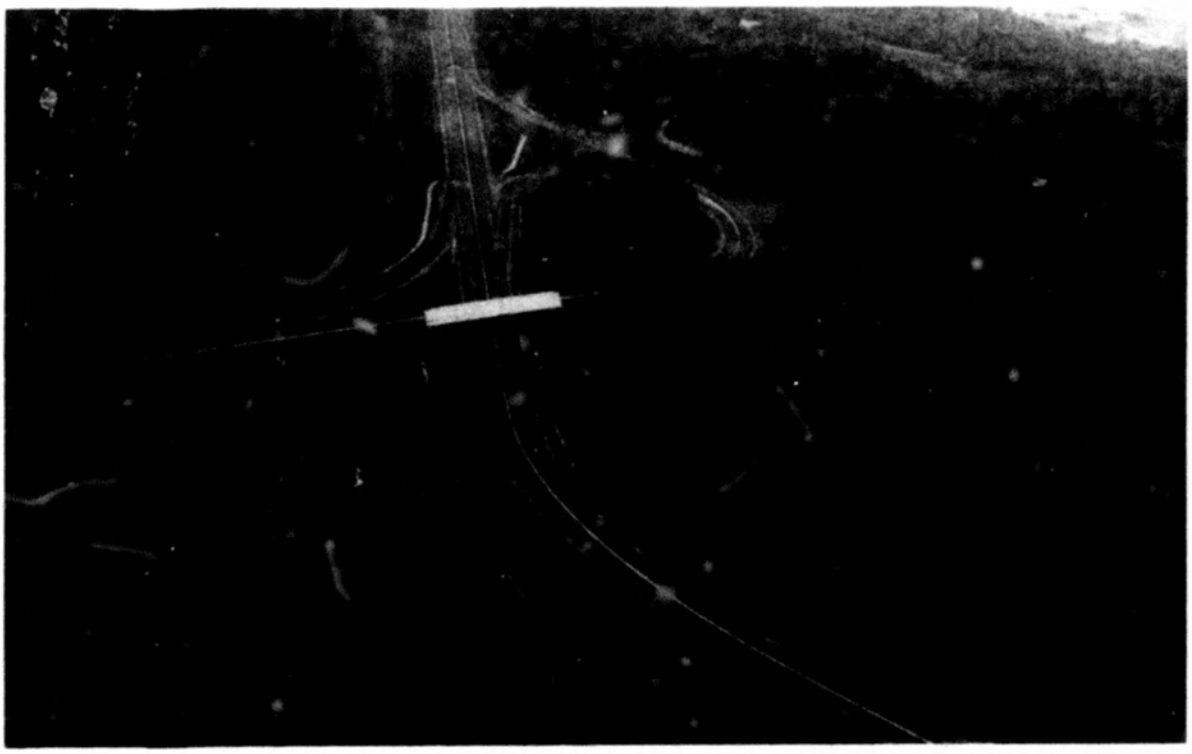

Fig. 2.13. Interchange of Highways 95 and 58 east of Oak Ridge Gaseous Diffusion Plant (looking west toward ORGDP).

ble solution to traffic congestion might involve staggering the work schedules at each plant. This is probably the most difficult solution to implement, however, from the standpoint of complexity and acceptability by the work force.

2.4.2.2 Water Transportation

The Knoxville-Oak Ridge area is connected by navigable waterways maintained by the Tennessee Valley Authority (TVA). They extend to the Forks of the River Industrial Park near Knoxville on the main channel of the Tennessee River and to the Clinton Industrial Park (northeast of Oak Ridge) on the Clinch River. Through this system, barge traffic can connect with ports on the Ohio and Mississippi River systems. Completion of the Tennessee-Tombigbee waterway could increase barge traffic into the area; the largest impact of the canal would probably be increased automobile traffic if new industries were attracted to the area.

2.4.2.3 Rail, Bus, and Truck Transportation

Several rail lines operate through Knoxville, and the area is a major stop on bus and truck routes. The City of Oak Ridge is served by 4 motor freight (truck) lines (Knoxville has 63 motor freight lines, which also serve the Oak Ridge area), 2 major bus lines (Greyhound and Trailways), and 2 rail lines (CSX Transportation and Norfolk Southern Railway).

Both ORGDP and Y-12 are served by rail lines.

2.4.2.4 Air Transportation

The regional airport, McGhee Tyson, is located 16 km (10 miles) south of Knoxville and approximately 65 km (40 miles) from the ORR. It is served by 12 commercial airlines with more than 65 scheduled flights daily. Private aircraft may use McGhee Tyson, a municipal airport on an island near downtown Knoxville, and two private airports south of Knoxville. A private, grass-runway airfield is located near Oliver Springs northwest of Oak Ridge. *Each year, the three major DOE facilities generate more than $6 million in commercial airline business, 1400 air freight shipments, and 1900 isotope shipments.*

The City of Oak Ridge recently considered building an airport to serve Oak Ridge and surrounding communities. (Oak Ridge is currently the largest metropolitan area in Tennessee without an airport.) The proposed airport would have been a general-aviation facility with a 1524-m (5000-ft) runway, a terminal, hangars, access roads, etc. Cost/benefit studies have been completed and have concluded that such a facility would cost $5.9 million and take up to 6 years to build. The current status involves a new engineering study funded by federal, state, and city participation to prepare a site feasibility plan and construction documents. This study will re-examine all potential sites, which may or may not affect the ORR.

In September 1986, Oak Ridge City Council passed a resolution that eliminated one proposed site and halted any further efforts related to the airport.

3. EXISTING CONDITIONS

Decision makers must understand the various factors that impact the effective utilization of resources to be able to make wise and meaningful decisions about how to utilize the land in the most effective manner—protecting what needs to be protected, preserving what needs to be preserved, and developing only those areas that lend themselves to development. In addition, decision makers must be aware of the impacts the various resources have on the land and on the other resources. This section addresses various factors and conditions and attempts to measure and quantify them. These factors include, but are not limited to, the missions as they have evolved and exist today along with the various programs and functions that implement these missions; the organization as it is structured to implement these missions; natural factors (topography, hydrology, flora, fauna, geology and soils, climate, and aspect); facilities (buildings, structures, and utilities); transportation systems; security and protection systems; the population and its distribution; circulation; resources [which may also be other factors and which include some 24 as perceived by the ORR Resource Management Organization (RMO)]; and land use.

3.1 MISSIONS

The missions of DOE-ORO are mainly carried out by the many contractors and other agencies under contract to that office, including some outside the Oak Ridge area. In addition to ORO's basic missions (as they apply to the ORR), the missions of the ORGDP, ORNL, Y-12, ORAU, OSTI, and Rust Engineering will be discussed.

ORO was established under the Manhattan Project during World War II, and it was later reoriented toward developing beneficial applications of atomic energy and expanded into non-nuclear energy areas. ORO, one of DOE's most diversified field offices, is responsible for a broad range of production, research, education, and training activities associated with energy development, demonstration, and applications. ORO is responsible for a major part of design and construction of new and improved production and research functions and facilities for the ORO complex; it also provides administrative assistance to OSTI. Major assignments include (1) the uranium enrichment service; (2) support to the national defense effort through manufacture of weapons components and refinement and reduction of uranium to metal form for use in plutonium production reactors; (3) R&D in energy generation concepts and energy conservation; (4) wide-ranging R&D efforts in education and environment with related training and public information programs; (5) national lead assignments for fuel reprocessing, nuclear standards, waste technology, fossil energy materials, load management, high-voltage technology, and nuclear materials and

structures technology; (6) responsibility for construction and administration of coal liquefaction demonstration plants; and (7) work for others.

The primary mission of ORGDP has been to provide an industrial toll enrichment service by which uranium is enriched for use in power reactors throughout the world. Because of current market conditions and because other DOE facilities under the administration of ORO can provide this service at a lower cost, the enrichment facilities at ORGDP have been placed in standby pending future market and production conditions. The current status of ORGDP is to maintain its major enrichment facilities in a standby condition, pursue and maintain production- and research-oriented programs, and provide facilities and support to other programs administered by ORNL, Y-12, and the operating contractor's central functions of computer services and engineering. ORGDP is being used increasingly for "work for others." A major study is under way to assess ORGDP's unique manufacturing capabilities and available resources in an attempt to market services to other government-related programs.

ORNL's primary mission is to carry out applied research and engineering development in fusion, fission, and other energy technologies and scientific research in basic physical and life sciences to underpin work in the energy technologies. A secondary mission of the Laboratory is the use of its resources to address other nationally important issues, such as hazardous and chemical wastes and nonnuclear defense technologies, when such work is closely related to the primary mission. In addition, ORNL designs and provides research facilities for the benefit of the scientific and technical community and supplies radioactive and stable isotopes that are not available from the private sector.

The primary missions of Y-12 are (1) production of nuclear weapons components; (2) fabrication support to DOE's weapons design laboratories; (3) processing of source and special nuclear materials; (4) support for ORNL facilities located at the Y-12 site; and (5) support for other government agencies.

The primary missions of ORAU are to provide educational and research programs in the areas of health, environment, and energy for DOE, other federal agencies, and private industry. ORAU and its capabilities are discussed in more detail in Sect. 3.4.1.3.

The OSTI has three major program responsibilities. First, its program direction responsibility includes the development of specific DOE-wide policies, procedures, and guidelines relating to scientific and technical information either developed by or purchased using DOE funds. Second, it has an oversight and appraisal responsibility to ensure that information resource management policies are effectively carried out. The third major program responsibility is to ensure that the OSTI, DOE's centralized scientific and technical information facility, is maintained on behalf of all programs to provide management accountability for DOE-funded information deliverables, to make accessible the results of worldwide investment in energy R&D to support research program productivity, and to ensure that DOE receives the maximum return on its research investment.

The primary missions of Rust Engineering, as an on-site contractor, are to provide construction and maintenance capabilities in support of the operating contractor.

3.2 ORGANIZATION

The organizational structure for the ORR is unique in that it is regional in nature with no conventional line structure. The organizational elements are tied together through contracts with ORO rather than through any single administrative function. It is similar in nature to a matrix organization. Figure 3.1 depicts the ORR organization in a conventional manner to illustrate all of the elements of the organization and the direction of reporting. The "other contractors" in the Oak Ridge area are separate organizations scattered throughout the city that perform specific tasks for ORO (Table 3.1). These contractors are not addressed in detail in this document for various reasons (they do not occupy DOE facilities; they have short-term contracts, small organizations, or small budgets; etc.) but primarily because their physical impact on the Reservation is relatively minor.

3.3 NATURAL FACTORS

Environmental scientists, architects, and site planners have demonstrated in recent years that the natural elements of a site can be used as positive forces in site design and operation and can produce favorable results, both economically for the project and environmentally for the site.

To work with the natural elements productively, these factors must be assessed and understood. Within this region, the most obvious factor is the pronounced topography, which is characteristic of the geologic structure and resulting watersheds that influence the hydrologic patterns. When these natural elements are combined with climatic elements and other natural phenomena (e.g., tornadoes and floods), the resulting conditions can be formidable. The following sections catalog the existing natural conditions of the ORR.

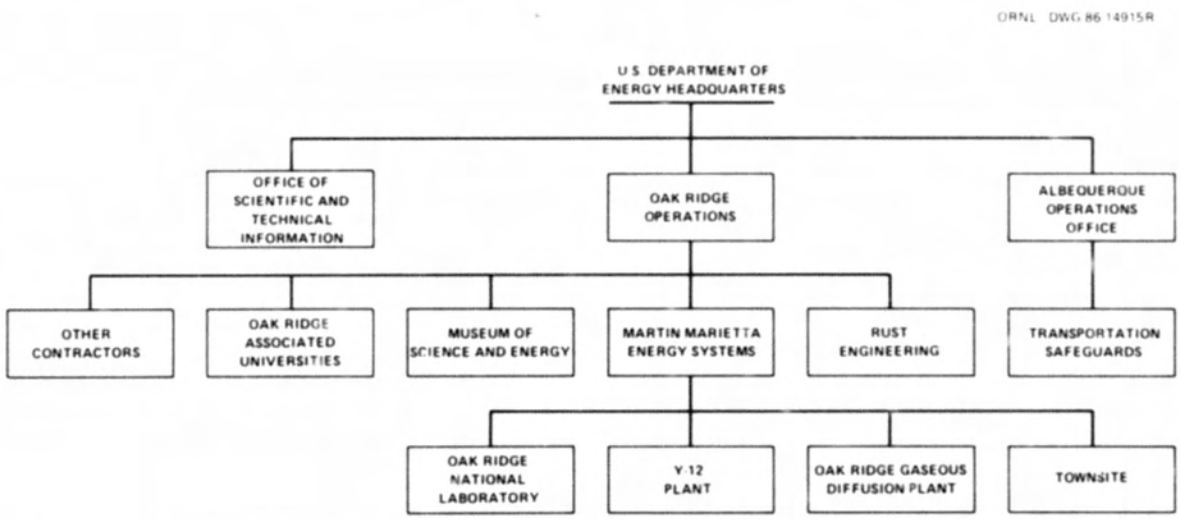

Fig. 3.1. Oak Ridge Reservation organizational relationships.

Table 3.1. Contracts for more than $1 million administered by Oak Ridge Operations for the Oak Ridge area

Contractor	Type of contract
CMC Construction Co.	Firm fixed price
Blaine-Hays Construction Co.	Firm fixed price
AMC Mechanical Contractors, Inc.	Firm fixed price
S&C Security, Inc.	Cost plus fixed fee
Industrial Contractors, Inc.	Firm fixed price
VEGA Corporation of Tennessee	Firm fixed price
Maxima Corporation	Cost plus fixed fee
Rouse Construction Company	Firm fixed price
U.S. Department of Commerce	Interagency agreement
Tibbetts Mechanical Contractor	Firm fixed price
East Tennessee Natural Gas Co.	Firm fixed price
Rust Engineering Co.	Cost plus award fee
Presearch/DMJM (Daniel, Mann, Johnson, and Mendenhall)	Cost plus award fee
Oak Ridge Associated Universities	Cost plus fixed fee
Tennessee Valley Authority	Firm fixed price
Martin Marietta Energy Systems, Inc.	Cost plus award fee
Union Carbide Corporation	Cost plus fixed fee

Source: DOE-ORO Planning and Budgets Office.

3.3.1 Topography

The ORR lies in a region characterized by elongated ridges and valleys that tend in a northeast-to-southwest direction (Fig. 3.2). Physiographically, this region is known as the Ridge and Valley Province, which extends southwesterly from New York and Canada to central Alabama. The ridges were formed by folding and faulting of compressed sedimentary materials. Over time, weathering and erosion removed the less-resistant strata, leaving ridges composed of sandstone or cherty materials. Erosion of the less-resistant materials formed the valleys.

The ORR is geographically bounded on the west by the Cumberland Plateau, on the distant east by the Great Smoky Mountains, and at its immediate eastern and southern boundaries by the Clinch River. Historically the ridges and valleys provided safety, isolation, and separation for the Manhattan Project. Each of the three major plant facilities is in a separate valley. Southernmost is ORNL in Bethel Valley between Haw Ridge and Chestnut Ridge (with ancillary facilities in Melton Valley to the south). To the north is Y-12 in Bear Creek Valley between Chestnut Ridge and Pine Ridge. Northernmost is ORGDP, located in the same valley (Big Valley) as the urban portion of the City of Oak Ridge.

The lowest elevations of the ORR are near the Clinch River at approximately 230 km (750 ft) above mean sea level; the highest are along Pine Ridge and are approximately 385 km (1260 ft) above


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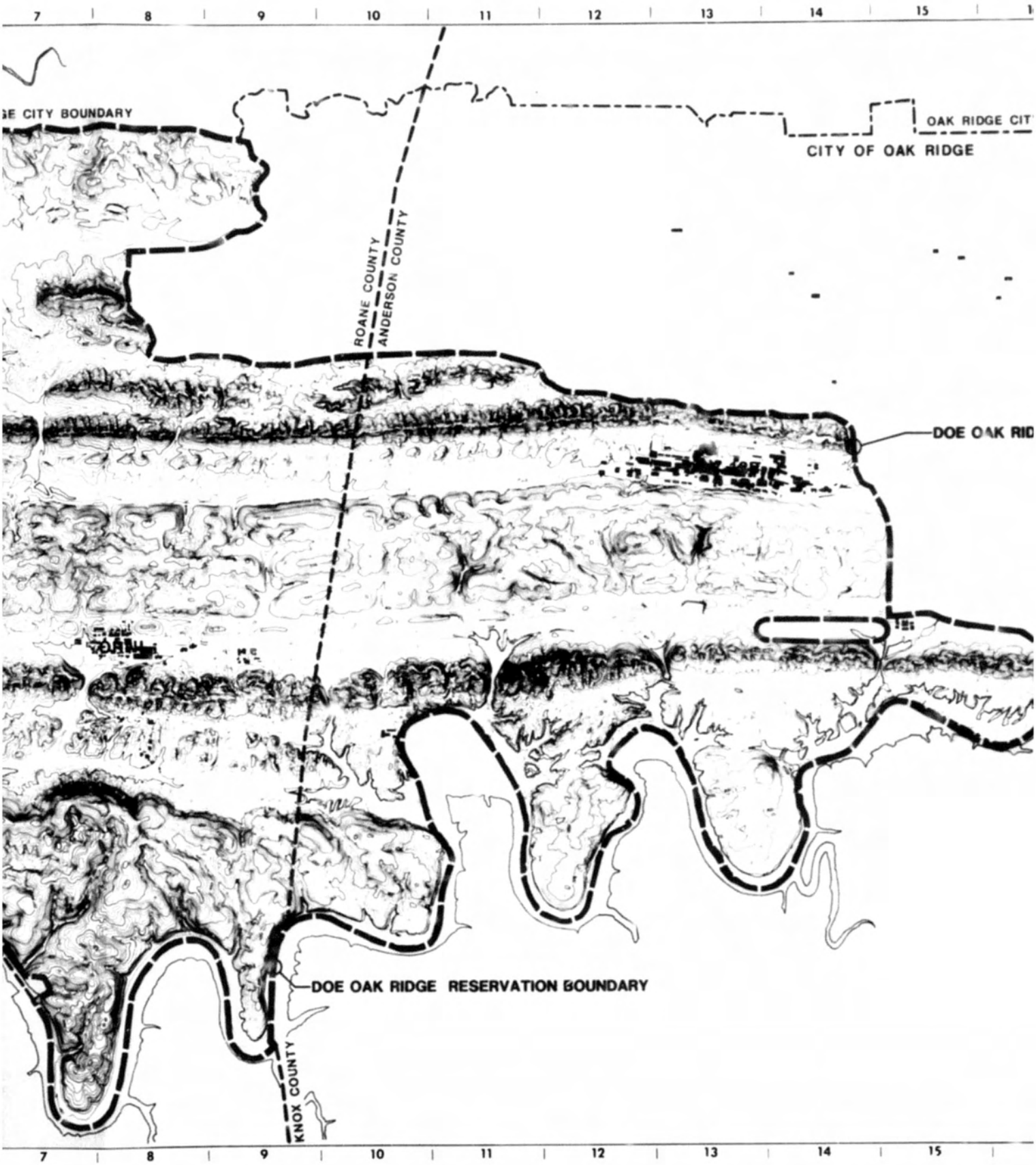
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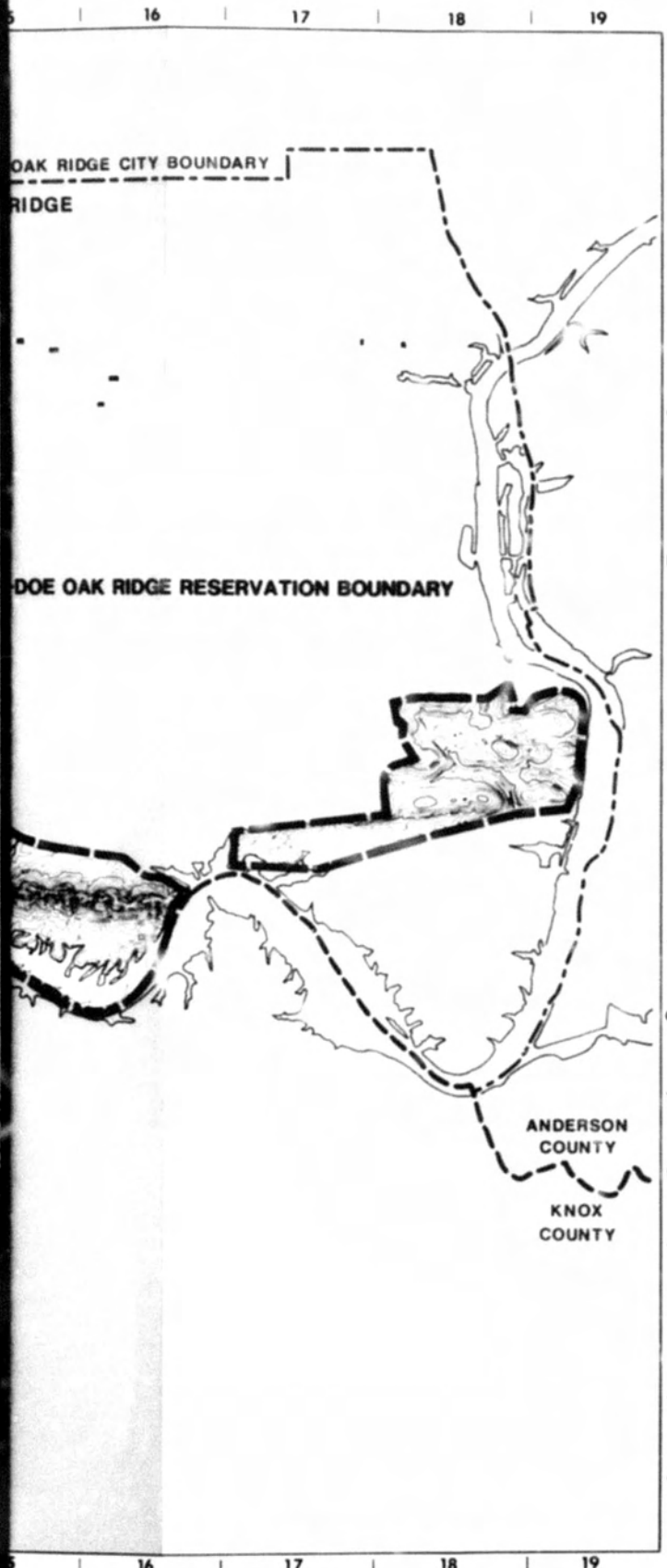


Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

HEAVY LINES REPRESENT 100 ft INTERVAL

LIGHT LINES REPRESENT 20 ft INTERVAL

Source of data: TVA-S-16A Map, June 1974

kilometers 0 1 2 3

0 1 2 miles

NORTH

TRUE GRID

Date **NOV. 1986** Rev. **1**

FIG. 3.2

TOPOGRAPHY

mean sea level. The ridges and river are natural physical barriers.

For more information about a topographical analysis, see Sect. 4.

3.3.2 Geology

Each geologic unit within the ORR (Fig. 3 3) presents a unique set of characteristics dictated by composition, structural configuration, and modifications brought about by chemical and mechanical weathering through geologic time. Understanding the geology of the site and the unique expression of the subsurface units that result in characteristic topography, soils, and groundwater geology will aid planners in matching requirements for future development (such as stability, depth of soils, and bedrock composition) with areas that represent the optimum available set of site characteristics. In this way, site development costs can be minimized by ensuring compatibility of site conditions and users' needs. Areas with unique and desirable combinations of conditions can be identified and reserved for future uses, while other areas must be restricted from certain uses because of the resulting negative impacts.

No systematic drilling program (or comprehensive and systematic cross-referenced record of past drilling sites or results) has been undertaken to determine and understand more thoroughly the geology of the Reservation. Drilling has accompanied specific needs and projects. Some geologic understanding has come from these disparate sources, however, and from core samples and observed geologic behavior in similar off-site formations.

The principal rock groups within the Reservation (Rome, Conasauga, Knox, and Chickamauga) represent the oldest formations and as such have experienced the most folding, thrusting, and faulting. All the ridges and valleys tend southwest to northeast; underlying rock units dip to the southeast.

The Rome Formation is a heterogeneous and variegated mixture of sandstone, siltstone, shale, dolomite, and limestone. The proportions vary greatly. The stratigraphy of the Rome is one of the major problems; its study is difficult because the Rome mainly occurs just above major thrust faults and hence is commonly folded and imbricated and shows no base and because fossils are comparatively scarce. The Rome is more than 213 m (699 ft) thick in many places.

[illegible] of the Rome Formation weather differently, but ordinarily sandstone and siltstone beds dominate the residuum and soil, which is only a shallow mantle full of rock chips. The carbonate rocks weather more deeply and locally form bodies of yellow, generally silty clay with a red-brown soil layer.

The Rome Formation grades conformably into the overlying Conasauga Group, which consists of six named formations of alternating shale and limestone. The ORR is located near the northwestern phase/central phase boundary. The Conasauga Shale, in the northwestern phase, consists of light green, olive green, and dull purple shale; the light green is the purest clay-shale, the purple the most silty. Layers and lenses of limestone are common but seem irregular in distribution. The Conasauga Shale weathers generally to a thin acid soil full of shale chips, but where limestone is present, the soil is prevailingly deeper and richer. These limestone strata are also indicated by the presence of low hills or knobs and often cedar trees. The shale normally

forms valleys. The thickness of the Conasauga is unknown because it is very crumpled, but it may be estimated at 610 m (2001 ft) or a little more.

In the Pine Ridge area, the upper limit of the Conasauga is drawn at the base of the first massive, dark, asphaltic dolomite bed belonging to the overlying Knox Group. The Knox Group extends from the top of the Maynardville Limestone to the marked disconformity between Lower and Middle Ordovician rocks. The Copper Ridge Dolomite represents stages of the Upper Cambrian Series, and higher formations are Lower Ordovician. The northwestern phase of the Knox Group is dominated by generally thick-bedded siliceous dolomite, the silica from which accumulates in the residual clay and soil as chert. The chert and other residual materials associated with each formation are commonly even more distinctive of the formation than the bedrock lithology.

Within the ORR, the Knox Group is composed primarily of massive, siliceous dolomite. The general lithology is from massive, dark gray, crystalline, very cherty dolomite at the base to generally less massively bedded, lighter gray, densely to finely crystalline, less cherty dolomite at the top. The Knox weathers to form a deep residual mantle held in place by the abundant chert on the surface. The group underlies broad ridges generally having fairly gentle slopes on the southeastern side and steeper slopes on the northwestern side. Knox dolomite is very soluble and caverns are common; some of them are large. Sinkholes are a persistent topographic feature of the group.

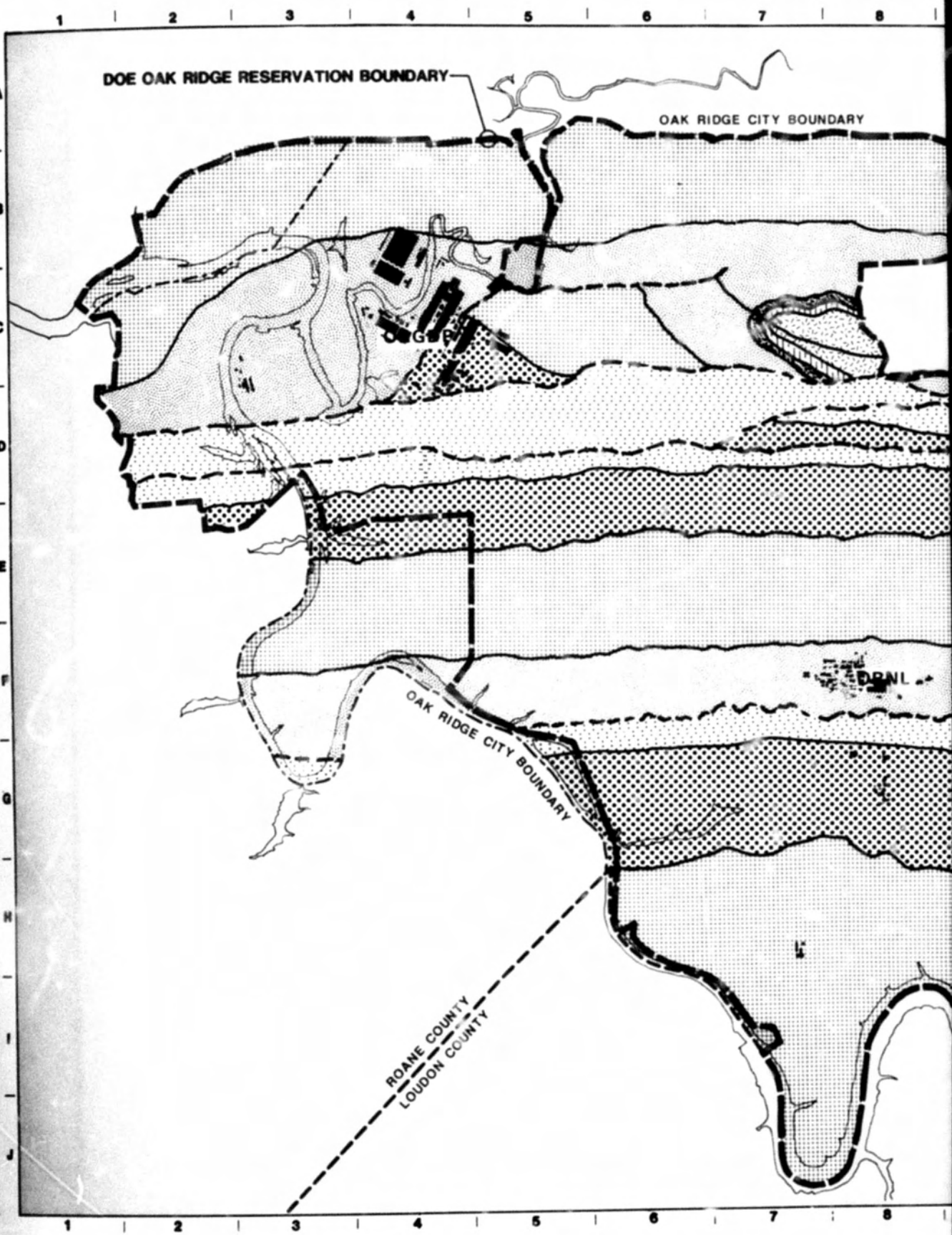
The Knox Group is the only formation other than Conasauga Shale that has an adequate residuum thickness and sufficient uniformity for land burial of waste material. The Knox overburden (fine-grained cherty clays) has the greatest thickness [normally 3 to 8 m (10 to 26 ft)] and extends to a depth of up to 30 m (100 ft) in places on the Reservation.

Groundwater is usually quite deep in the Knox soils. This ensures separation between wastes and groundwater. Siting waste disposal areas at higher elevations generally affords this benefit but is not without potential problems. Because of the dolomite formations, the Knox group is subject to high water solution and productivity and is the most hydrogeologically unpredictable formation in the Reservation. Therefore, any consideration of its use for waste burial should be carefully evaluated.

The Chickamauga Group includes strata between the top of the Knox Group and the base of the Sequatchie Formation. The group contains many varied lithologies arranged in complex relationships and carbonate facies complicated by an influx of terrigenous clastics from southeastern sources. Lithologically, the Chickamauga is extremely variable, although the entire sequence is calcareous.

The surfaces of valleys underlain by the formation are irregular, with the more silty and cherty layers underlying low ridges and hills. Sinkholes exist but are not as numerous or as large as those in the Knox Group.

The remaining geologic units on the ORR are present in the synclinal structure topographically expressed as East Fork Ridge, located along the northwestern boundary of the Reservation. The units in the syncline include (from oldest to youngest): Sequatchie Formation, Rockwood Formation, Chattanooga Shale, Maury Shale, and Fort Payne Formation. These units comprise approximately 424 m (1391 ft) of stratigraphic section and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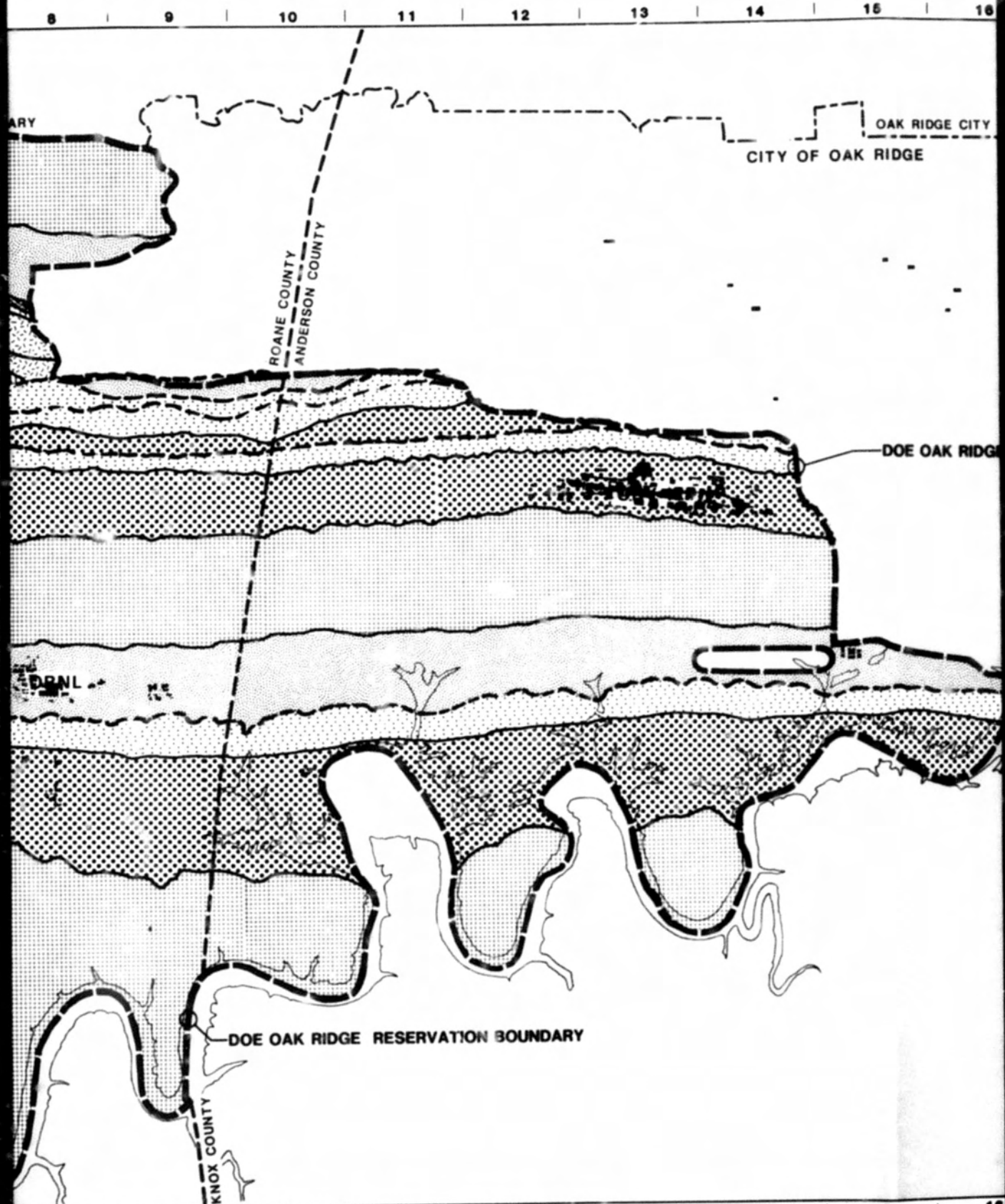
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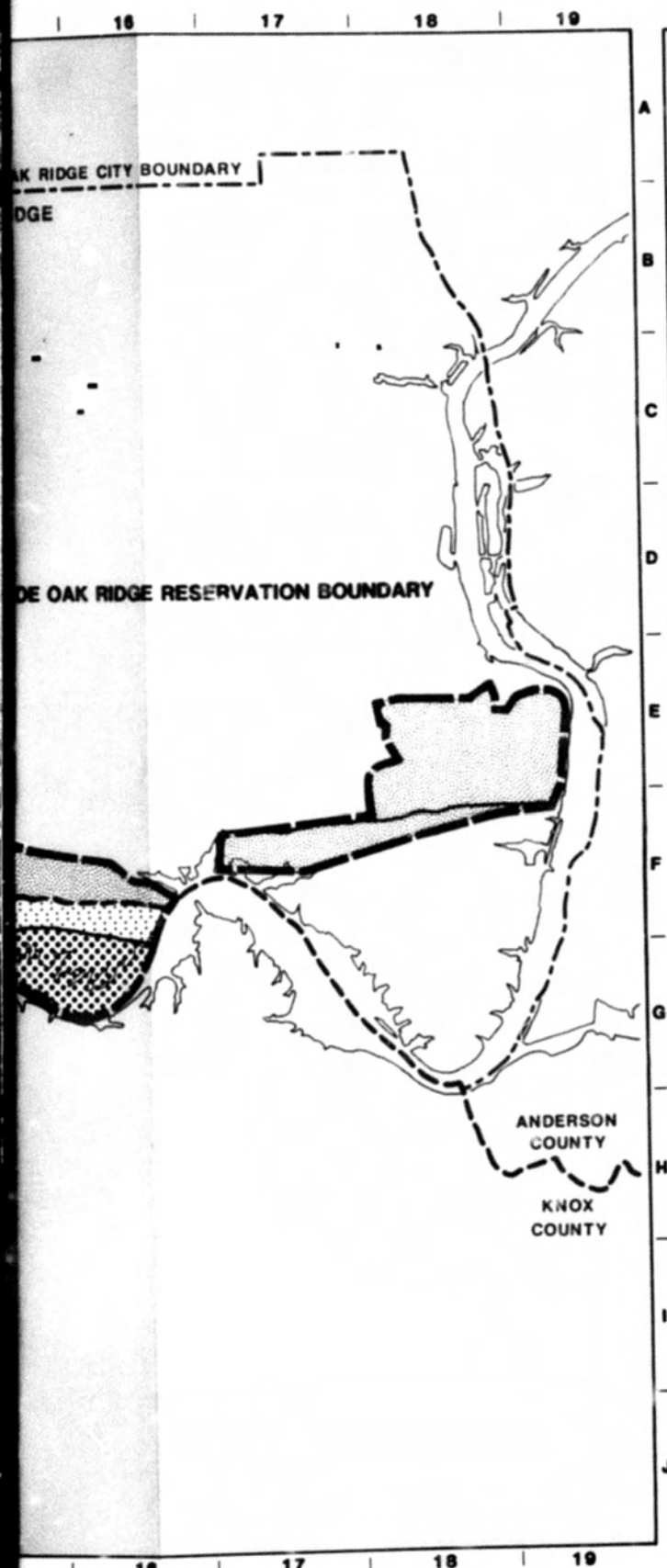

Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- KNOX GROUP
- REEDSVILLE SHALE
- ROCKWOOD FORMATION
- SEQUATCHIE FORMATION
- CHICKAMAUGA LIMESTONE
- CONASAUGA GROUP
- ROME FORMATION
- FORT PAYNE CHERT
- CHATTANOOGA SHALE
- FAULT ZONE

kilometers
0 1 2 3
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miles

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TRUE GRID

Date **NOV. 1986** Rev. 1

FIG. 3.3

GEOLOGY

underlie less than 2.5 km^2 (1544 acres or 4%) of DOE lands in the Oak Ridge area.

The underlying structure of the ORR is complex because of the extensive faulting and deformation in the region. Three regional thrust faults in the area of the Reservation, the Kingston, Whiteoak Mountain, and Copper Creek faults, strike to the northeast and dip to the southeast. The latest movement on the faults was Late Pennsylvania/Early Permian (280 to 290 million years ago). Although minor seismic activity has been recorded in the region, no surface rupturing associated with any of the faults within the ORR has been recorded. The possibility of fault movement is considered extremely unlikely; therefore, the presence of the faults constitutes only a moderate to minor constraint to future development.

3.3.3 Soils

Soil management and conservation are important factors in land use, and soil erosion is a key consideration. The land and its soils are a limited vital resource; their use to the greatest potential without degradation is a key consideration in conservation planning.

3.3.3.1 Issues, Concerns, and Opportunities

Soil erosion concerns on the ORR are related to land uses where vegetative cover is disturbed, leaving the ground bare and the soil disturbed. These land uses include waste burial ground management, vegetative maintenance of powerline right-of-ways, road construction, temporary haul roads and site preparation for forestry purposes, and building construction.

Soil management problems and concerns also involve the spreading and disposal of sewage and sludge for the City of Oak Ridge in both open land and forests. What are the long-term effects on soil productivity given the properties of the sludge and the loading rate? Soil erosion is also a factor in the disposal of sewage sludge, particularly in areas with no vegetative cover or inadequate cover or in areas where sediment containment provisions and practices are inadequate. These areas run the risks of contamination by radionuclides and of transport of contaminants into streams. Another concern related to sludge disposal is overloading the soil system's capability to contain nitrogen. Vegetative cover (mainly grasses) takes up the most soluble nitrate form of nitrogen, transforming it into amino acids. The subsequent death and decay of grass during the winter releases this organically bound nitrogen in a slow and controlled manner. Wet soil conditions in the winter and early spring are also conducive to denitrifying bacteria in the upper soil horizons to reduce nitrates to nitrogen gases.

Soil management and conservation concerns interface with all surface land uses on the Reservation. Natural in-place soil properties must be considered for some land uses such as forestry, wildlife, and especially the NERP areas that are to be maintained in their current "natural" state of plant succession. Both modified and natural properties of soil must be considered for most engineering uses, especially waste management designs, practices, and long-term maintenance.

3.3.3.2 Background

From a land use standpoint, it is important to have a common understanding of what soil is. Various disciplines have different definitions of soil and of what certain words mean with respect to portions

of the soil profile that extend from the surface downward to hard rock. The *Dictionary of Geological Terms* defines soil as "that earth material that has been so modified and acted upon by physical, chemical, and biological agents that it will support rooted plants." Soil scientists describe soil horizons. The A horizon has received the greatest input of organic matter. The B horizon or subsoil is highly altered chemically and usually has a higher clay content than the horizons above and below. The C horizon becomes less chemically altered with depth. It lacks soil structure, and relict geologic rock structure can still be observed. The Cr horizon precludes most biologic activity, especially plant roots, and it gradually merges with the unleached and unoxidized rock below. Soil horizons form at and below the soil surface to a depth of usually not more than 1 to 2 m (3.3 to 6.6 ft). Geologists tend to equate soil with regolith, which is defined as "the layer or mantle of loose incoherent rock material, of whatever origin, that nearly everywhere forms the surface of the land in the absence of true soil and rests on bedrock." The words "true soil" evidently refer to the A and B horizons. The engineer usually considers soil to be earth that can be moved and transported, as opposed to rock that must be drilled and blasted before it can be moved. Figure 3.4 graphically compares the three major definitions of soil and the rough correlation of the various horizons (layers) that compose a soil. The definition of soil used in this document includes the pedogenic horizons defined by soil scientists as well as the underlying sediments or residuum of chemically weathered rock (saprolite). Soil begins at the earth's surface and extends downward to hard unoxidized and unleached rock.

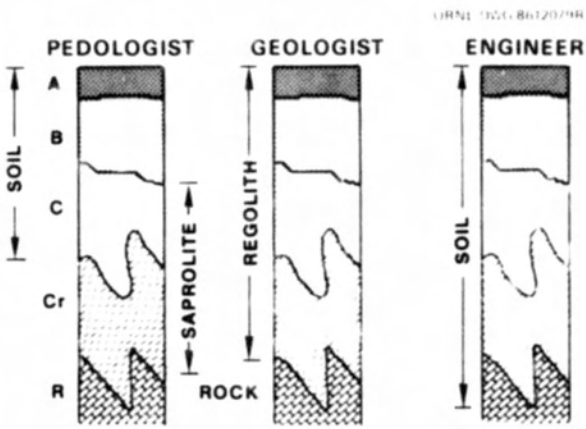
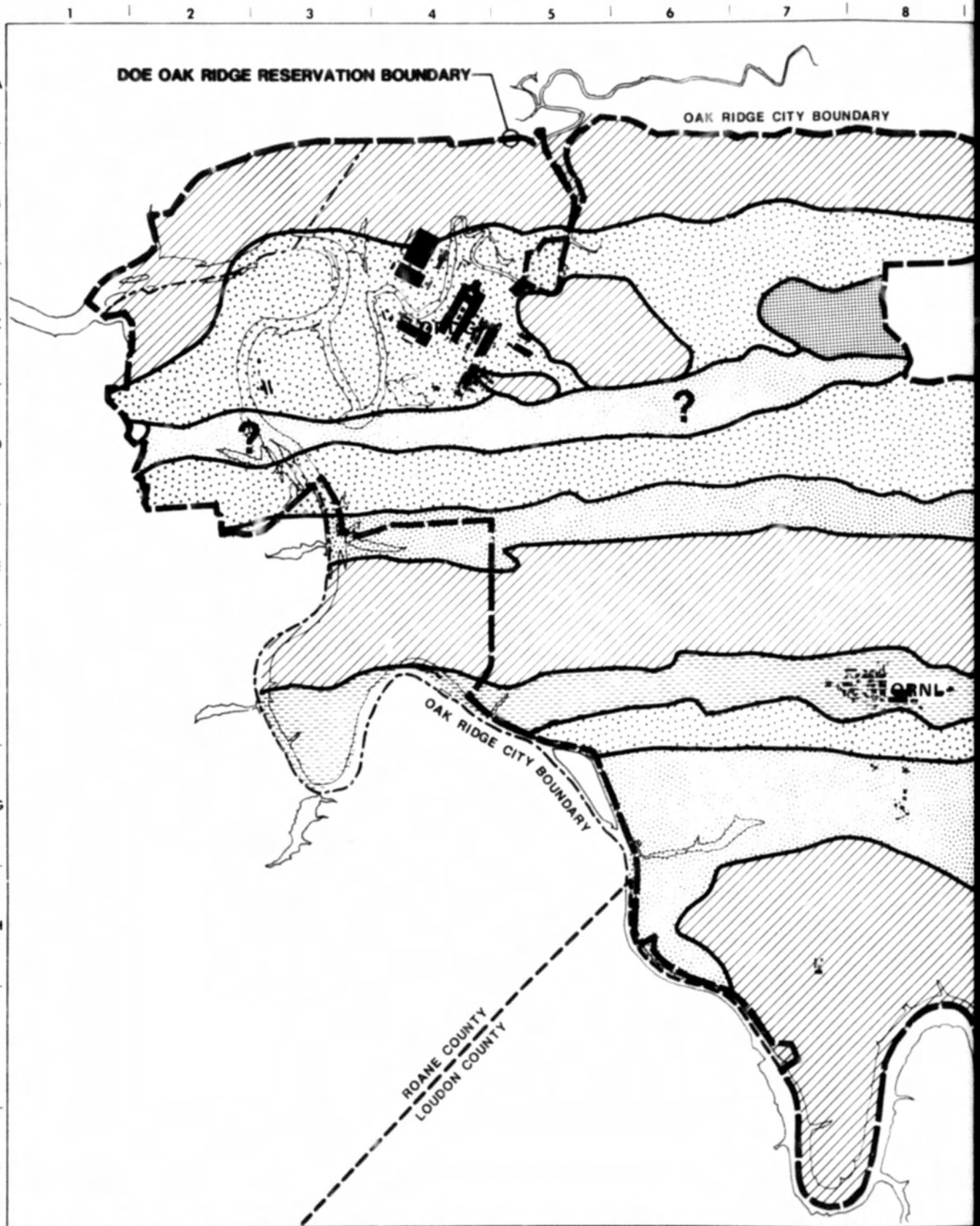


Fig. 3.4. Soil comparisons and correlations.

To plan for conservation, management, and various land uses, knowledge of soils and their properties and characteristics is needed. In the broad planning aspects of the ORR, soil series with mostly common properties can be grouped together. Most of the soil series shown on the current ORR soil survey are confined to certain geologic groups. Each geologic group contains several formations. Each formation chemically weathers to form the distinctive parent materials of each different kind of soil series. Soil parent materials (regolith) are grouped into two major categories: *residuum*, the chemical weathering of in-place rock, and transported soil materials. The latter is further subdivided as: *colluvium*, mostly preweathered soil materials, identified from the source geologic group, that have been transported downslope under the influence of gravity and water; and *alluvium*, soil materials transported and deposited by running water in floodplains and low stream terraces. These are even further separated into two classes on the basis of their geologic age.

Figure 3.5 shows the general distribution of the residuum soil groups, and Fig.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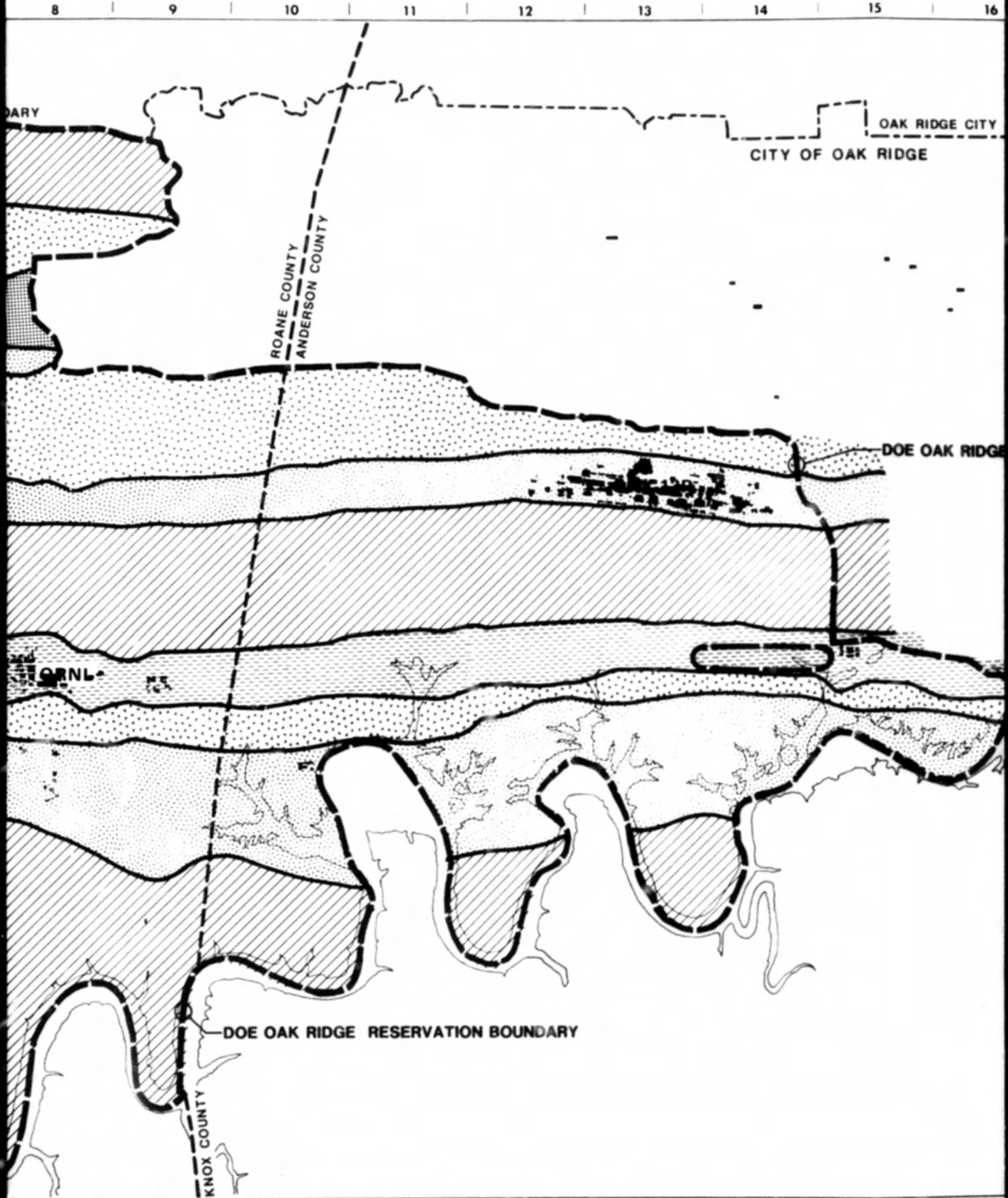
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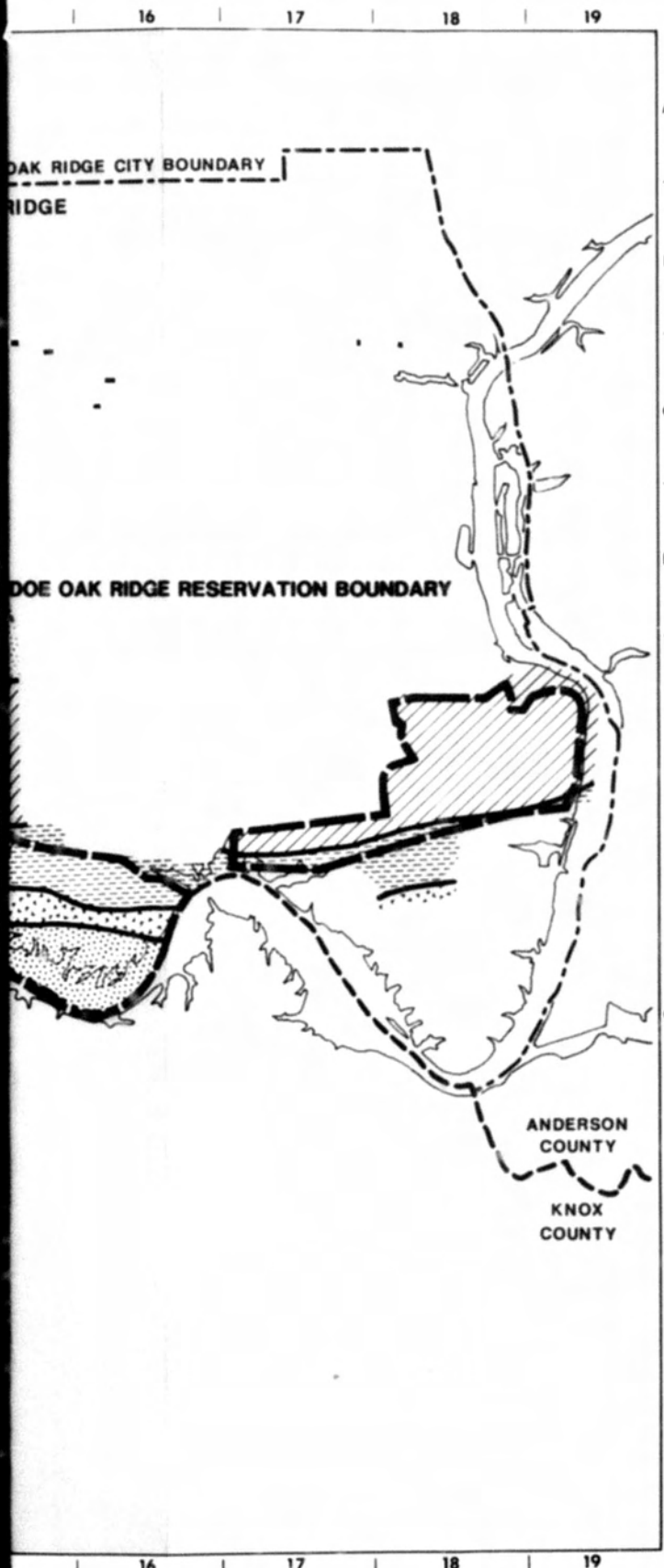


Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND

1. ROME
2. CONASAUGA
3. KNOX
4. CHICKAMAUGA
5. REEDSVILLE-ROCKWOOD

kilometers
0 1 2 3
0 1 2
miles

NORTH
TRUE GRID

Date **NOV. 1986** Rev. **1**

FIG. 3.5

SOIL GROUPS (RESIDUUM)

3.6 shows the alluvium and colluvium soil group distribution.

3.3.4 Hydrology

The hydrologic system within the ORR is of major importance to the functioning of natural ecosystem processes as well as to the mobility and fate of contaminants. Because of its importance, the hydrologic system warrants careful utilization and management. The hydrologic regime on the Reservation, both surface water and groundwater, is controlled regionally by the Clinch River. Table 3.2 lists the location and drainage areas of Clinch River tributaries. Table 3.3 lists flow characteristics of some major tributaries on the ORR.

The ORR and the City of Oak Ridge are net importers of water from the Clinch; hence, water quantity for supply purposes is not of major concern. Water quality is the major concern of hydrologic management on the Reservation, particularly in conjunction with waste management. Flooding can be important, but proper site planning practices can avoid economic losses as well as mitigate other drainage problems associated with development and its impacts on the hydrologic system. Controlled study areas, such as the Walker Branch watershed, are valuable hydrologic assets to our understanding of the long-term fate and effects of energy technology effluents on forested landscapes.

Hydrologic patterns are controlled by the topography, which in turn is formed by the geology. Differential weathering of geologic units in combination with structural deformation causes the Reservation to have a "banded" appearance of both geology and topography. Surface water drainage on the ORR follows the northeast-to-southwest trending valleys, with some flow across the ridges for short distances. Cross-topography flow sometimes follows faults or other structural weaknesses and in other cases may be due to entrenchment of old stream courses.

Precipitation, the driving mechanism of the hydrologic system, is plentiful on the Reservation. The historical mean annual rainfall is about 1.36 m (53.5 in.). Precipitation is not evenly distributed over time. Five-year cycles in wet seasons and droughts are evident. Precipitation also varies on an annual scale. The winter months are characterized by passing storm fronts and are the period of highest rainfall. Winter storms are generally of low intensity and long duration. Another peak in rainfall occurs in July when short, heavy rains associated with thunderstorms are common.

Loss of water to the atmosphere by evapotranspiration is about 0.76 m (30 in.) annually or about 55% of the total annual precipitation. Evapotranspiration is at a maximum from July to September during the vegetation growing season. Seasonal relationships between evapotranspiration and precipitation are reflected in seasonal patterns of runoff to streams. Runoff is greatest in the winter when evapotranspiration is low and precipitation is high. Precipitation not lost as evapotranspiration or quick runoff to streams percolates through the soil and eventually recharges the groundwater system.

Surface water hydrology on the ORR is characterized by a network of small streams that are tributary to the Clinch River. Water levels on the Clinch are regulated by TVA, and fluctuations on the river have an impact on the tributary streams and creeks draining the Reserva-

Table 3.2. Location and drainage areas of Clinch River tributaries

Stream	Mouth location	Drainage area	
		km^2	($mile^2$)
Powell River	CRK[a] 142.9	2430[b]	938
Big Creek	CRK 133.5	174[b]	67
Coal Creek	CRK 120.7	95[b]	37
Hinds Creek	CRK 105.9	165[b]	64
Bull Run Creek	CRK 75.1	270[b]	104
Beaver Creek	CRK 63.7	234[b]	90
Conner Creek	CRK 57.1	16.6[b]	6.4
Walker Branch	CRK 53.1	3.89[b]	1.5
Hickory Branch	CRK 45.7	17.9[b]	6.9
Melton Branch	WOCK[c] 2.49	3.83[b]	1.5
White Oak Creek	CRK 33.5	15.5–16.5[b,d,e]	6.0–6.4
Raccoon Creek	CRK 31.24	1.2[d,f]	0.4
Ish Creek	CRK 30.6	0.9[e,g]	0.3
Caney Creek	CRK 27.2	21.4[e]	8.3
Poplar Springs Creek	CRK 25.9	7.8[d]	3.0
Grassy Creek	CRK 23.2	5.0[d]	1.9
Bear Creek	EFPCK[h] 2.36	19.2[a]	7.4
East Fork Poplar Creek	PCK[i] 8.8	77[a]	30
Poplar Creek	CRK 19.3	352[d,e,f]	136
Emory River	CRK 7.1	2240[b]	865

[a]CRK = Clinch River kilometer.

[b]Source: F. C. Fitzpatrick, *Oak Ridge National Laboratory Site Data for Safety Analysis Reports*, ORNL-ENG/TM-19, Oak Ridge, Tenn., 1982.

[c]WOCK = White Oak Creek kilometer.

[d]Source: J. M. Loar, *Ecological Studies of the Biotic Communities in the Vicinity of the Oak Ridge Gaseous Diffusion Plant*, ORNL/TM-6714, Oak Ridge, Tenn., October 1981.

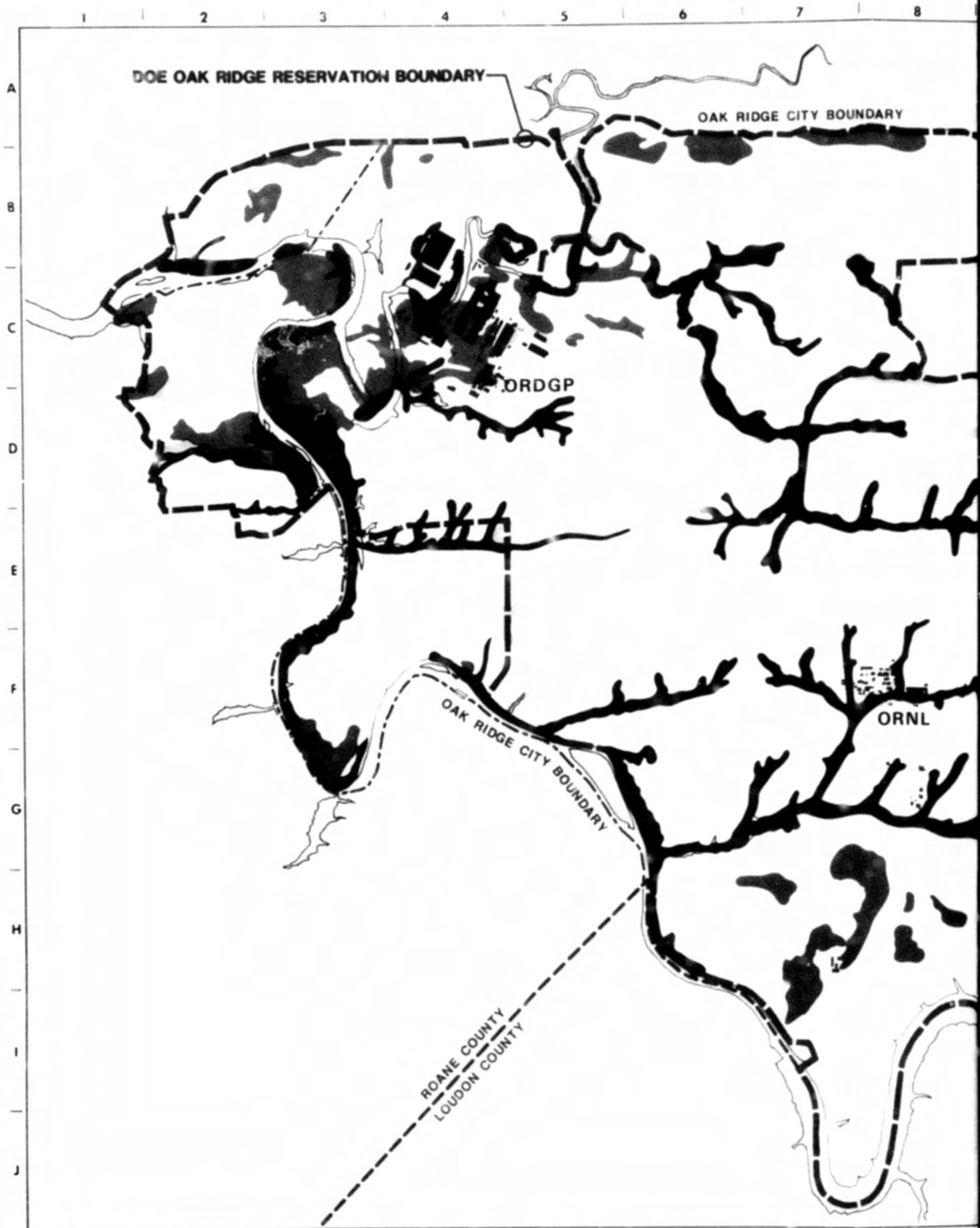
[e]Source: D. E. Edgar, *An Analysis of Infrequent Hydrologic Events with Regard to Existing Streamflow Monitoring Capabilities in White Oak Creek Watershed*, ORNL/TM-6542, Oak Ridge, Tenn., 1978.

[f]Source: Oak Ridge Operations-Land Use Committee, *Oak Ridge Reservation Land-Use Plan*, DOE/ORO-748, Oak Ridge, Tenn., 1975.

[g]Source: W. M. McMaster, "Hydrologic Data for the Oak Ridge Area, Tennessee," U.S. Geological Survey Water Supply Paper 1839-N, 1967.

[h]EFPCK = East Fork Poplar Creek kilometer.

[i]PCK = Poplar Creek kilometer.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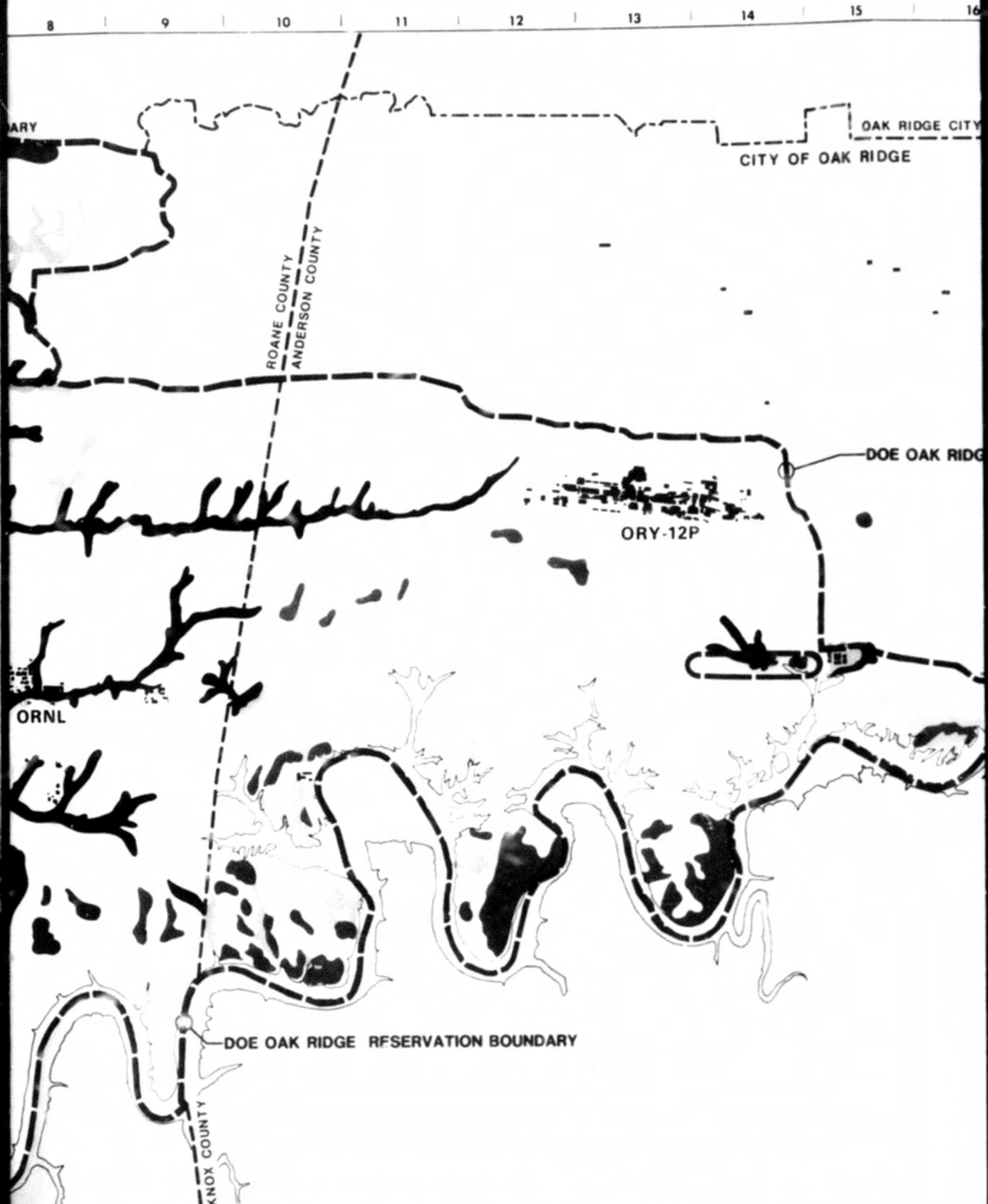
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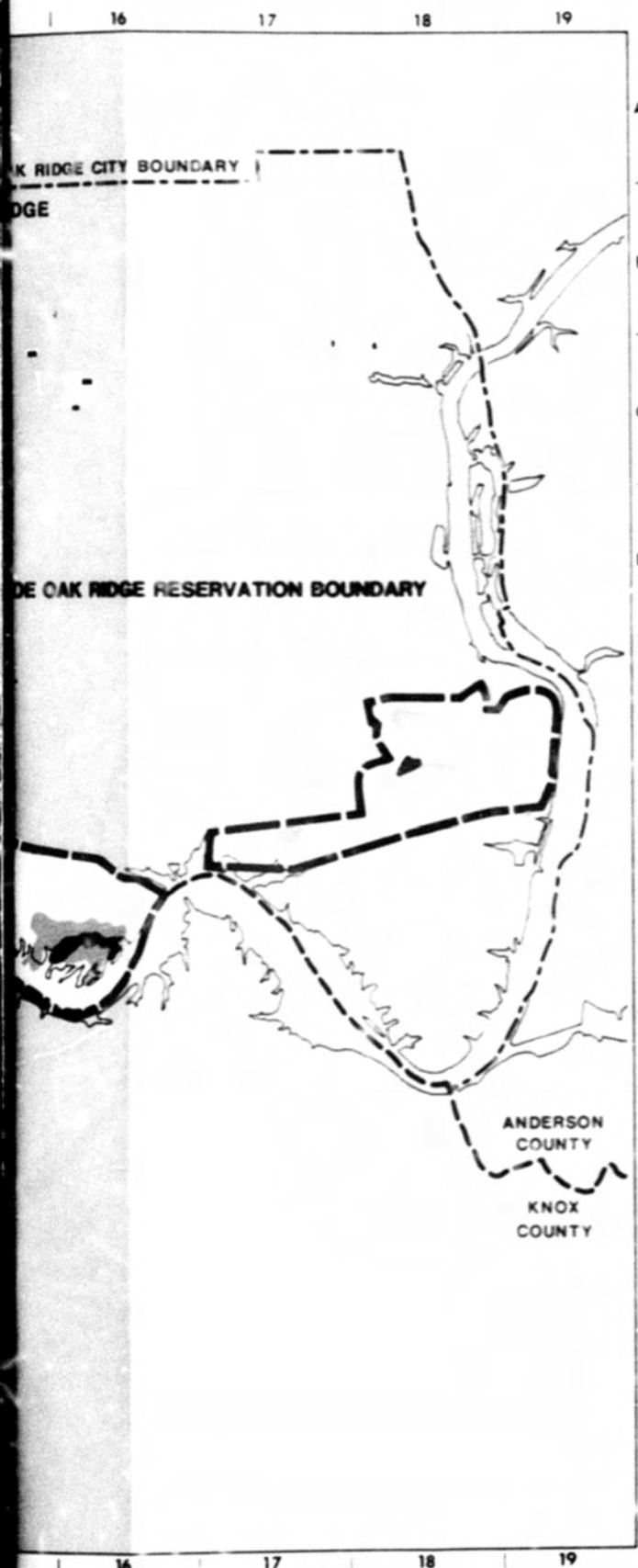

Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC

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Date **NOV. 1986** Rev. 1

FIG. 3.6

SOIL GROUPS (TRANSPORTED)

Table 3.3. Flow characteristics of some major tributaries on the Oak Ridge Reservation[a]

Stream	Gauge location	Discharge[b]					
		Maximum		Minimum		Average (m^3/s)	Period of record
		(m^3/s)	Date	(m^3/s)	Date		
Melton Branch	MBK[c] 0.15	6.85	03/11/62	0	09/02/62	0.07	1955–1963
White Oak Creek	WOCK[d] 2.65	18.2	08/30/50	0	09/16/61	0.27	1950–1953 1955–1963
White Oak Creek	WOCK[d] 0.96	18.9	12/29/54	0	(During power releases from Melton Hill Dam)	0.38	1950–1953 1955–1963
East Fork Poplar Creek	EFPCK[e] 5.31	73.9	07/06/67	0.37	08/16/69	1.37	1960–1970
Bear Creek	BCK[f] 1.29	16.8	03/12/63	0.01	08/12-14/62		
Poplar Creek	Mouth	180	03/12/63	0.14	10/27/63	4.67	1961–1965

[a]Source: J. M. Loar, *Ecological Studies of the Biotic Communities in the Vicinity of the Oak Ridge Gaseous Diffusion Plant*, ORNL/TM-6714, Oak Ridge, Tenn., October 1981.

[b]To convert m^3/s to yd^3/s, multiply by 1.307.

[c]MBK = Melton Branch kilometer.

[d]WOCK = White Oak Creek kilometer.

[e]EFPCK = East Fork Poplar Creek kilometer.

[f]BCK = Bear Creek kilometer.

tion. As shown in Fig. 3.7, the three major facilities (ORGDP, ORNL, and Y-12) each affect a different subbasin of the Clinch River. Drainage from ORGDP enters Poplar Creek. ORNL has its greatest impact on White Oak Creek, and drainage from Y-12 enters both Bear Creek and East Fork Poplar Creek. Hydrologic data are generally most extensive for these streams because of their size and relationship to the major facilities.

Poplar Creek has the largest drainage basin [352 km^2 (136 square miles)] of any stream on the ORR. East Fork Poplar Creek drains an area of about 78 km^2 (30 square miles). Bear Creek drains an area of approximately 19.2 km^2 (7.4 square miles), and White Oak Creek drains an area of about 16.8 km^2 (6.5 square miles). [For more information see the "Watercourses" section of the *Oak Ridge Reservation Land-Use Plan*, DOE/ORO-748 (Rev. 1).] By monitoring the larger streams on the ORR, most of the water draining the site is sampled. A few small streams drain directly to the Clinch and are not continuously monitored or studied. These include Grassy Creek, Raccoon Creek, Bearden Creek, McCoy Branch, Kerr Hollow Branch, Scarboro Creek, and several unnamed Clinch River tributaries.

Flow in streams in the Oak Ridge area varies greatly depending on the geologic unit underlying the drainage basin. As noted earlier, rainfall, evapotranspiration, and therefore runoff vary throughout the

year, so stream flow is seasonally dependent. Equations have been developed that can be used to estimate peak instantaneous discharge for streams in the ORR at different recurrence intervals. The peak instantaneous discharge value is used to design structures in and around streams.

Intraformational groundwater flow is primarily controlled by the distribution and orientation of joints, fractures, folds, and faults in sandstone and shale units and by solution features in carbonate rocks. Flow is also strongly influenced by topography. Groundwater flow is predominantly a near-surface phenomenon. However, significant water movement may occur at great depth [305 m (1000 ft)] along the thrust faults, solution cavities, and other geologic structures on the Reservation.

The regional groundwater discharge area is the Clinch River, and little flow beneath it is likely. Within the ORR, streams and tributaries are local discharge areas, and groundwater divides are usually assumed to be approximately equivalent to surface water divides.

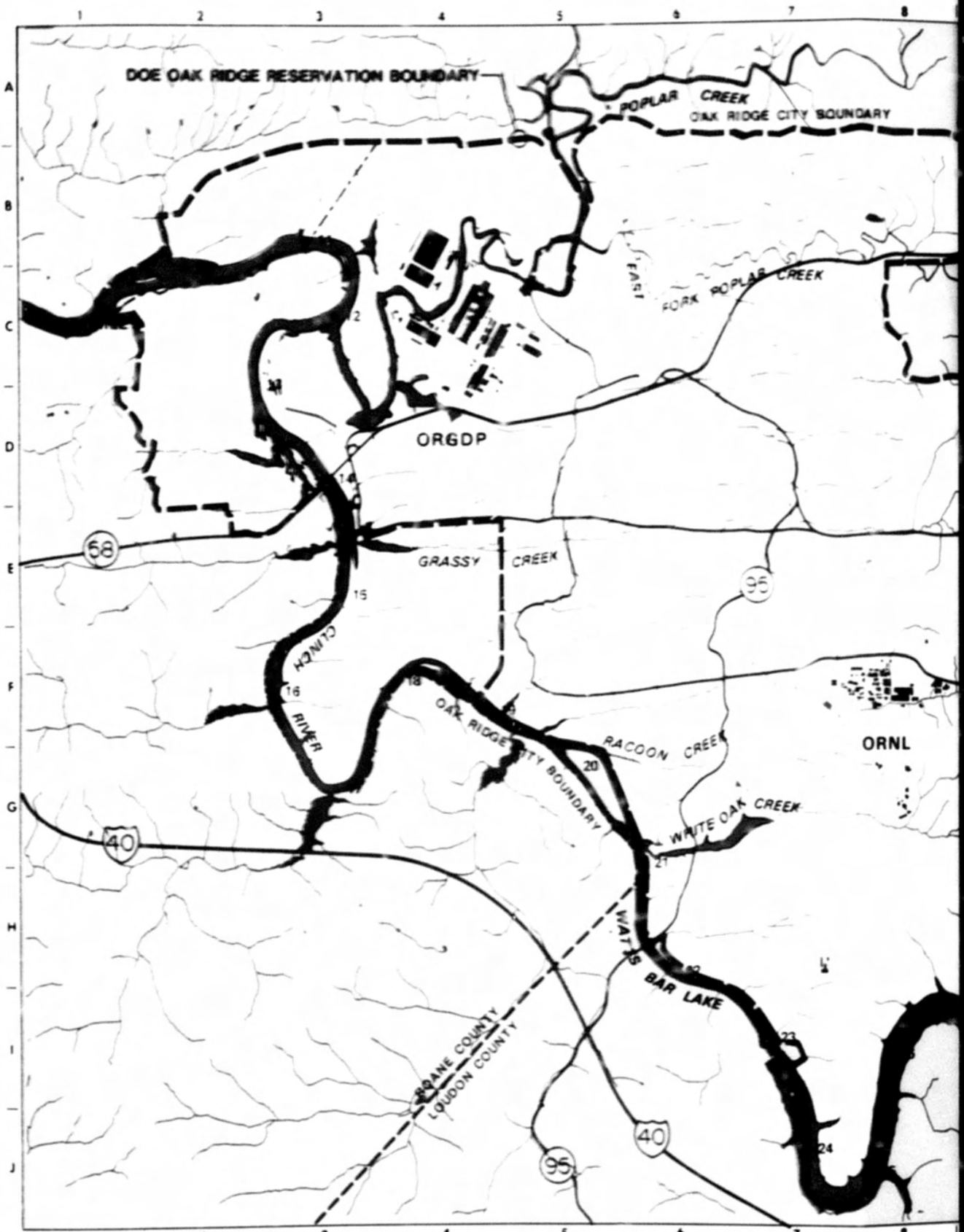
Water table maps may be indicative of the direction of groundwater movement, at least in the near-surface, weathered zone of rock units. Deeper in the groundwater flow system, in relatively unweathered rock, water movement is controlled by the orientation of secondary openings.

In Melton Valley, it has been observed that groundwater flow is primarily parallel to geologic strike, along either bedding planes or fractures. Folds in the Conasauga also tend to parallel strike and may be conduits for movement. The transport rate of dissolved constituents in the Conasauga is probably less than 1.8 m/d (6 ft/d) but will vary greatly depending on local conditions.

Waste burial has occurred primarily on the Conasauga because it is of low permeability, it has a thick enough residuum that trenches may be excavated, and the clays in the residuum are highly adsorptive to radionuclides. Much of the Conasauga cannot be used for disposal because of shallow water tables. Most other formations (except the Knox) have insufficient residuum thickness. Depth to groundwater is usually quite high in the Knox [up to 88 m (289 ft)] beneath Copper Ridge, but the Knox is generally unsuitable for waste disposal because solution cavities found in the Knox yield complex, unpredictable flow patterns.

Groundwater is generally in an unconfined (water table) condition on the ORR, but locally perched water exists, and confined conditions are likely. The groundwater storage is reflected by fluctuating water table elevations. The depth to water is generally greatest from October to December and shallowest from January to March. In Bethel Valley, depth to water varies between 0.3 and 11 m (1 and 36 ft), while in Melton Valley the range is generally 0.3 to 19.8 m (1 to 65 ft). The water table is usually a subdued reflection of topography; therefore, water is deepest below ridges. Usually flow divides also occur beneath hills and ridges and are the areas of greatest seasonal fluctuation in water levels.

Construction of burial grounds or other facilities modifies both surface hydrology (e.g., due to increased runoff) and groundwater hydrology. Soil disturbance generally increases permeability, and clear-cutting of vegetation reduces or eliminates evapotranspiration, causing groundwater levels to rise. Modifications to topography, such as covering surface drainages, may also cause problems. Old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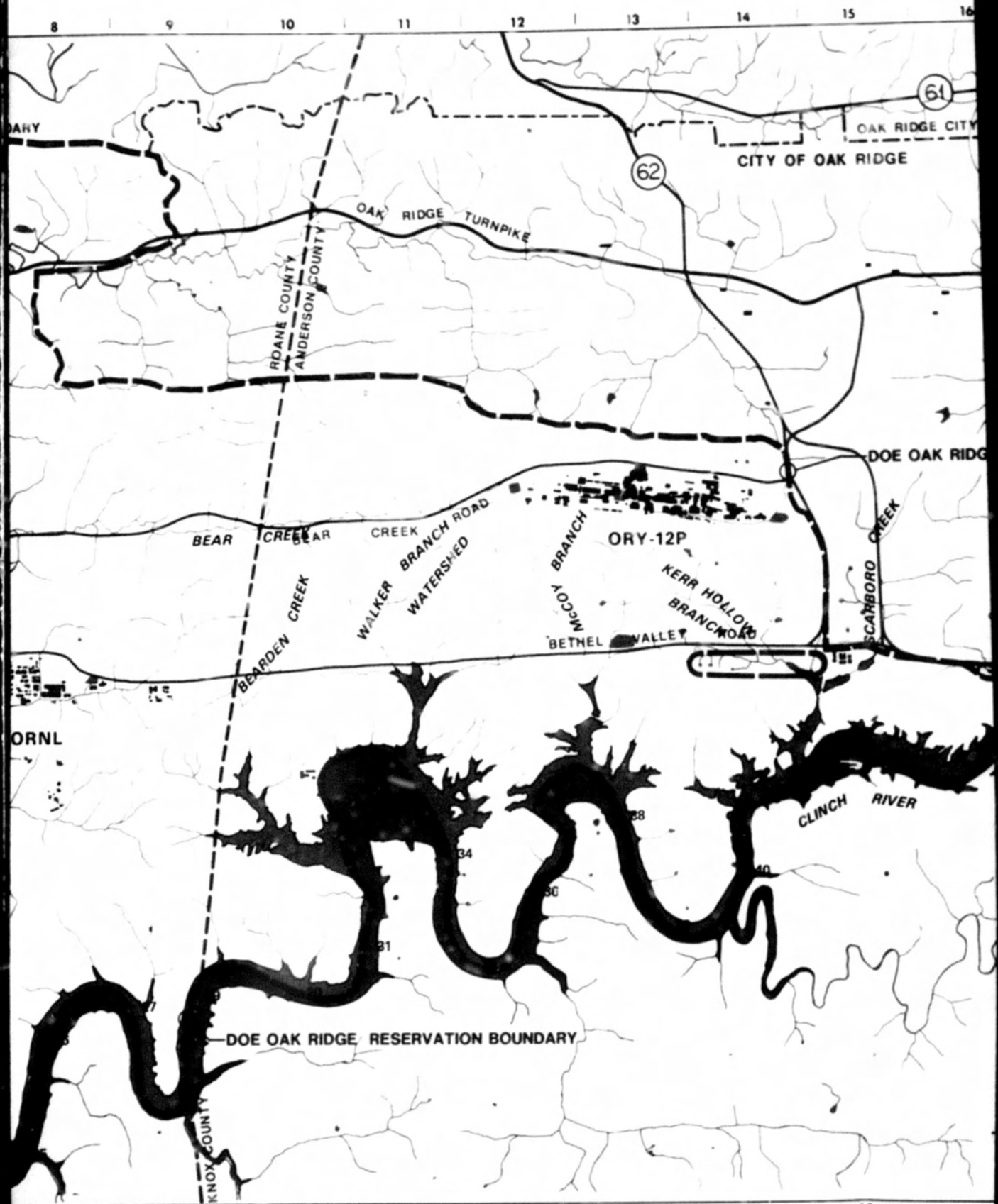
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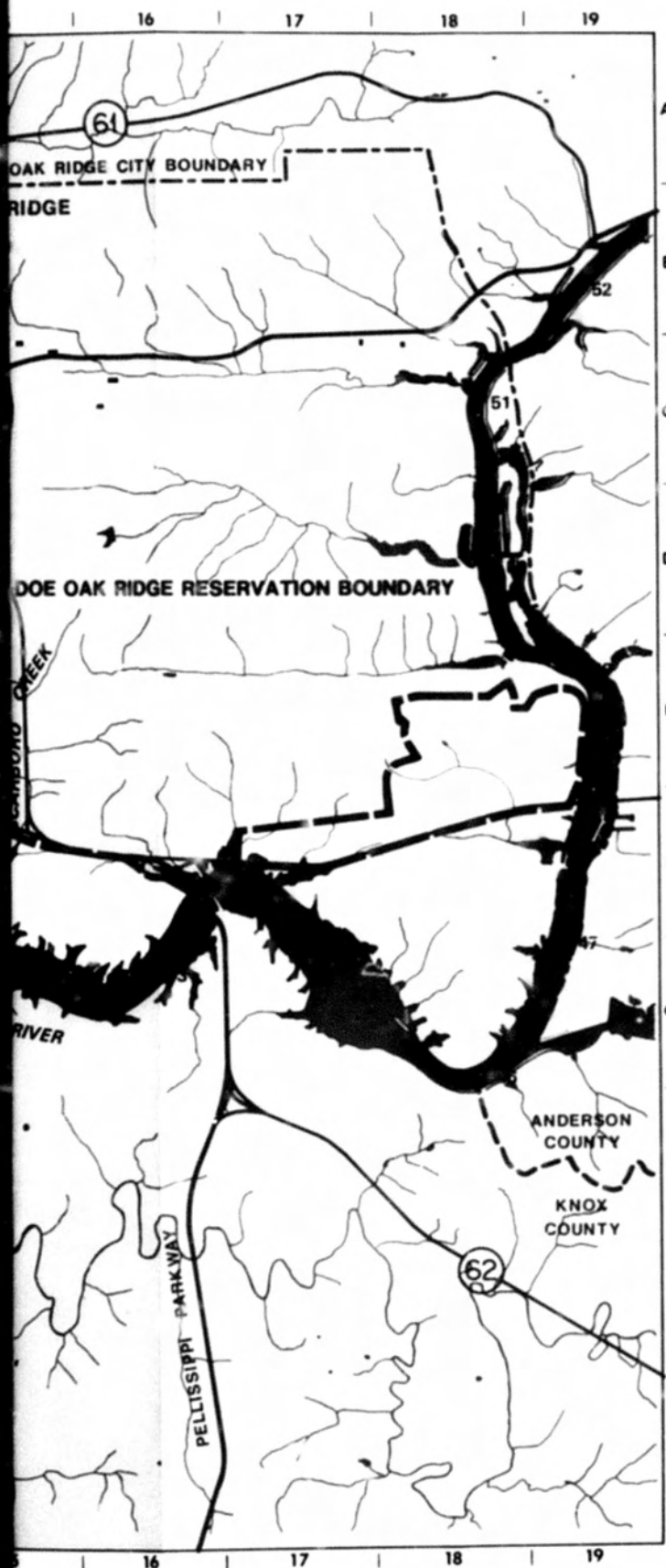


Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

IMPOUNDMENT

TRIBUTARY

\+ MILE MARKER

Source of data: TVA S-16A Map, April 1985

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.7

HYDROLOGY

surface drainages later function as "new" groundwater drainages or preferred flow paths. These and other manmade alterations must be minimized and/or mitigated to protect the natural ecological processes. Additional studies are necessary to map groundwater flow within the ORR and to know more about how it interfaces with the hydrologic systems off site.

Water quality in Reservation streams is affected by wastewater discharges and by groundwater transport of contaminants from land disposal of waste. Groundwater contamination is a significant problem on the ORR. It is promoted by using land underlain by shallow groundwater and because direct conduits to groundwater are common. Contamination is associated with waste disposal facilities, buried pipelines, and accidental spills.

Water quality is of vital concern from a health, safety, and environmental standpoint. Various land uses within the ORR contribute significantly to degradation of the natural water quality. These contributions have been and are continually being monitored, and corrective actions are being implemented to neutralize their impacts. However, existing functions must be reassessed and great care must be taken in locating any future functions that are known to have detrimental impacts on the environment.

3.3.5 Climate

Oak Ridge enjoys a mild climate with warm, humid summers and cool winters. No extreme conditions prevail in temperature, precipitation, or winds. Spring and fall are usually long, and the weather is normally pleasing—dry and sunny with mild temperatures. Severe storms such as tornadoes or high-velocity wind storms are rare. The mountains frequently divert hot, southeasterly winds that develop along the south Atlantic Coast.

Total annual precipitation (water equivalent) is 1.36 m (53.5 in.), including approximately 0.25 m (10 in.) of snowfall. Total precipitation peaks in January and February (Table 3.4). Winter months are characterized by passing storm fronts of low intensity and long duration. Rainfall peaks in early winter, early spring, and again in mid to late summer when heavy rains associated with thunderstorms are common. The year's minimum precipitation usually occurs in the fall. Typically in October, slow-moving high-pressure cells suppress rain and, while remaining nearly stationary for many days, provide outstandingly mild, clear, dry weather. Poor air dilution (and thus the primary air pollution episodes) occurs with the greatest frequency and severity during this period.

Oak Ridge's mild climate has an annual mean air temperature of nearly 14.4°C (58°F). Diurnal swings in temperature are relatively constant from month to month [about 11.1°C (20°F)]. Oak Ridge has an annual total of 3817 heating degree-days [determined from a base of 18.3°C (65°F)] and approximately 470 cooling degree-days using a baseline of 25.5°C (78°F) for discomfort. Because summer day and night temperatures are both high, indoor temperatures are controlled most effectively by increasing air movement and minimizing radiant heat gain. Use of effective shading through appropriate architectural and vegetative techniques, light-colored exterior surfaces and reflective materials, and well-insulated construction all help moderate heat and humidity in the summer.

The sun angle diagrams (Fig. 3.8) show the vertical and horizontal paths of the sun through the various seasons.

Table 3.4. Monthly climatic summary for the Oak Ridge area based on a 20-year period

Month	Temperature						Precipitation			
	Mean		Maximum		Minimum		Rain		Snow	
	[°C	(°F)]	[°C	(°F)]	[°C	(°F)]	[cm	(in.)]	[cm	(in.)]
January	3.3	(37.9)	9.3	(48.8)	−1.8	(28.8)	13.5	(5.3)	8.6	(3.4)
February	4.9	(40.9)	10.7	(51.2)	−0.8	(30.6)	13.5	(5.3)	6.6	(2.6)
March	8.6	(47.5)	14.8	(58.7)	2.4	(36.3)	14.2	(5.6)	3.3	(1.3)
April	15.0	(59.0)	21.7	(71.1)	8.3	(46.9)	11.2	(4.4)	0.03	(0.01)
May	19.3	(66.8)	26.2	(79.1)	12.5	(54.5)	9.1	(3.6)	0.0	(0.0)
June	23.3	(74.0)	29.6	(85.2)	17.1	(62.7)	10.2	(4.0)	0.0	(0.0)
July	24.9	(76.9)	30.7	(87.3)	19.1	(66.4)	14.2	(5.6)	0.0	(0.0)
August	21.2	(70.1)	30.4	(86.7)	18.4	(65.2)	9.7	(3.8)	0.0	(0.0)
September	24.4	(76.0)	27.5	(81.5)	14.8	(58.7)	8.4	(3.3)	0.0	(0.0)
October	15.2	(59.3)	21.8	(71.3)	8.4	(47.2)	6.8	(2.7)	1.5	(0.6)
November	8.3	(46.9)	14.3	(57.8)	2.2	(35.9)	10.7	(4.2)	1.3	(0.5)
December	4.3	(39.7)	9.3	(48.8)	−0.8	(30.6)	14.5	(5.7)	6.4	(2.5)
Annual	14.4	(57.9)					135.9	(53.5)	26.2	(10.3)

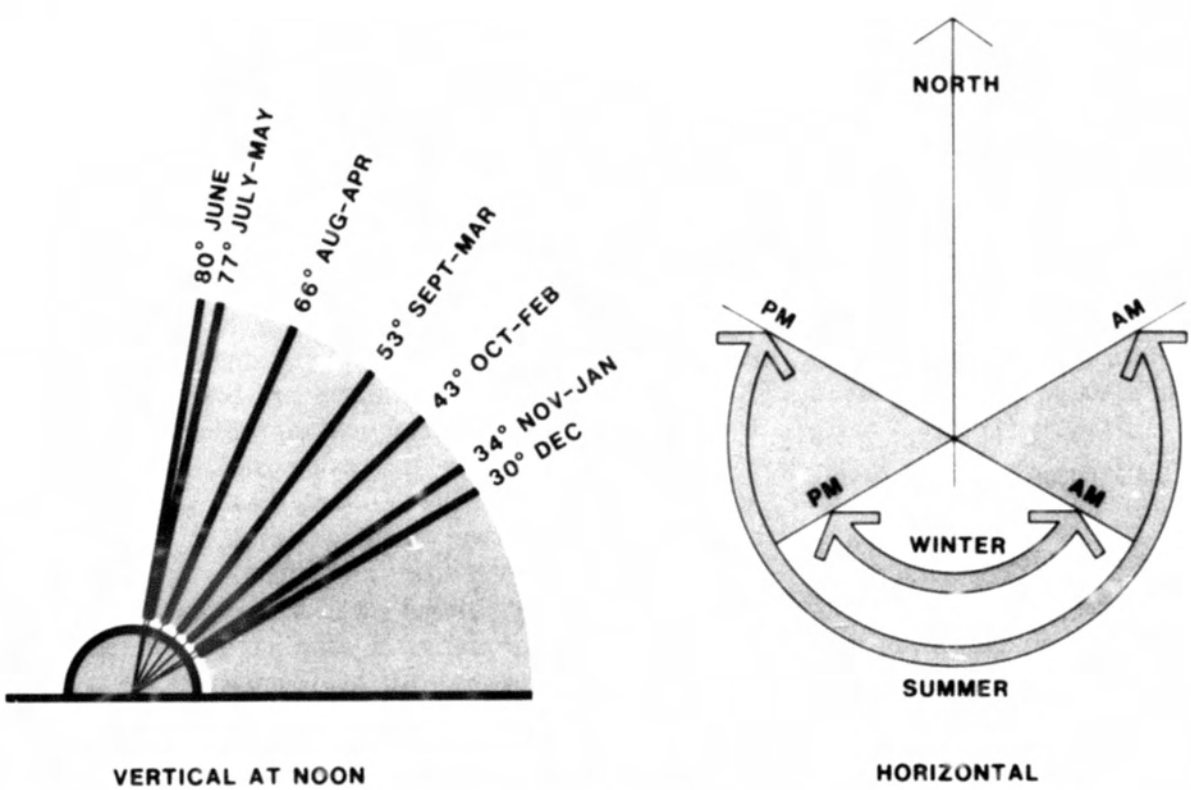


Fig. 3.8. Sun angle diagram.

The amount and intensity of sunlight reaching Oak Ridge vary greatly throughout the year. Heavy cloud cover associated with long-duration, low-pressure fronts accounts for up to one-third of the winter sky conditions. An additional third of the winter weather is derived from arctic fronts that also bring snow and rain but that are brief and quickly yield to clear skies and cold temperatures. The challenge in making effective use of winter sunlight is to capture radiation that is both low in intensity and irregular in occurrence. Intensity and duration of sunlight peak in the summer months when space heating is not needed. Strings of cloudy days are rare in the summer. Solar intensity is, however, somewhat diminished by the moisture content of the air. This humidity-induced natural diffusion enhances the natural light's daylighting usefulness (by decreasing contrast and glare). In the summer, weather fronts centered in the Gulf of Mexico send moisture-laden southerly winds through the region, saturating the air until a rainstorm breaks and the cycle begins again.

Oak Ridge is one of the country's calmest wind areas. Because of this, providing relief from the summer's humidity through ventilation is difficult. The atmosphere can be considered to be in an inversion status about 36% of the time. The daily up- and down-valley winds, however, provide some diurnal exchange. An all-season wind rose for the Oak Ridge area is depicted from data collected from 1957 to 1969 (Figs. 3.9 and 3.10). Seasonal wind roses show that seasonal differences in the prevailing wind directions are insignificant, although there are differences in the frequency and speed of the seasonal winds. The prevailing wind directions are northeasterly (up-valley) and southwesterly (down-valley). This

Fig. 3.9. Wind direction diagram depicting annual prevailing wind frequency.

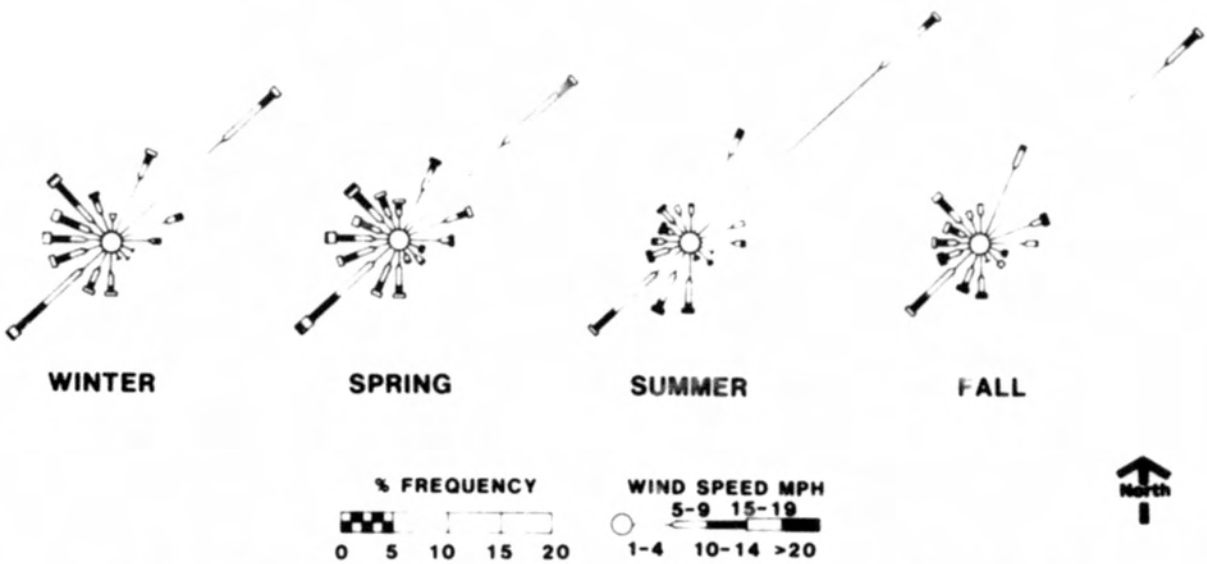


Fig. 3.10. Seasonal wind roses depicting prevailing directions, frequencies, and speeds.

pronounced bimodal wind pattern is diurnal: the up-valley draft prevails during the inversion conditions of late evening through mid-morning.

Construction of a network of meteorological observation towers was finished during 1985 with the completion of two new towers at the Y-12 Plant. This network consists of

- one 60-m tower at ORGDP (tower 1),
- one 100-m tower (tower 2) and two 30-m towers (towers 3 and 4) on the ORNL site,
- one 100-m tower (tower 5) and one 60-m tower (tower 6) on the Y-12 Plant site,
- one rain collector and ground-level wind vanes (tower 7) on the National Oceanic and Atmospheric Administration (NOAA) site,
- one 50-m tower (tower 8), one 33-m tower (tower 9), and one 10-m tower (tower 10) at Walker Branch watershed,
- one 35-m tower (tower 11) in the 0800 area of ORNL, and
- one 110-m tower (tower 12) on the Clinch River Breeder Reactor Project (CRBRP) site.

The Y-12 towers (towers 5 and 6) were completed in late 1985. Towers 7 through 11 are equipped for research; however, the real-time data could be used as needed but are not useful for routine plant release calculations. The CRBRP tower (tower 12) data collection system is inoperative; thus current data are not available. The locations of these towers on the ORR are shown on the map in Fig. 3.11. Figure 3.12 shows the wind roses at the 10-, 30-, and 100-m levels, respectively, for the 100-m meteorological tower (2).

Examination of the annual wind roses reveals that the prevailing winds are almost equally split into two directions that are 180° apart: one prevailing direction is from the SW to WSW sector, and

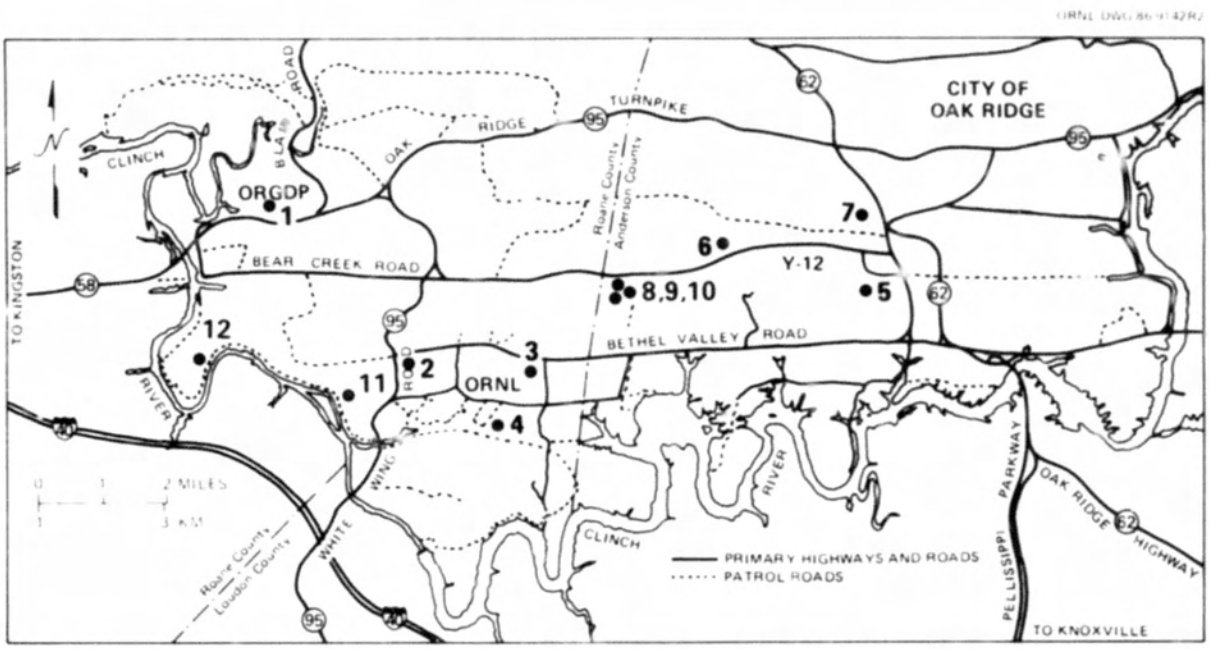


Fig. 3.11. Locations of meteorological towers on the Oak Ridge Reservation.

the other is from the NE to ENE sector. The reason the winds are so strongly aligned along these directions is due to the channeling effect induced by the ridge and valley structure of the area. Ridges and valleys within the ORR are oriented along a WSW-ENE line (with respect to true north). This orientation causes the winds at the lower layers of the atmosphere to flow along the valleys without crossing the ridges. Note that the alignment of winds is not so pronounced at tower 1, which is located in a relatively open area where the ridges are not as high or structured. Another feature clearly observed on the wind roses is that the wind speeds increase with height (tower level) at each of the towers. On the average the wind speeds can be expected to increase steadily from ground level to 100 m.

3.3.6 Flora

The general vegetative cover of the ORR is about 80% forest. Plant communities on and near Reservation lands are characteristic of those found in the intermountain regions of central and southern Appalachia. The dominant deciduous forest is an oak/hickory association. Extensive stands of yellow pine and mixed hardwoods (maple, hickory, sourwood, dogwood, redbud, hackberry, elder, sycamore, oak, elm, tulip tree, sweet gum, and yellow poplar) typify the area. Yellow poplars often form nearly pure stands on well-drained bottomlands, sinkholes, and lower slopes. Willow, sycamore, and boxelder are found along stream banks and are dominant on poorly drained floodplains. Coniferous forests are largely cedar, hemlock, white pine, and shortleaf

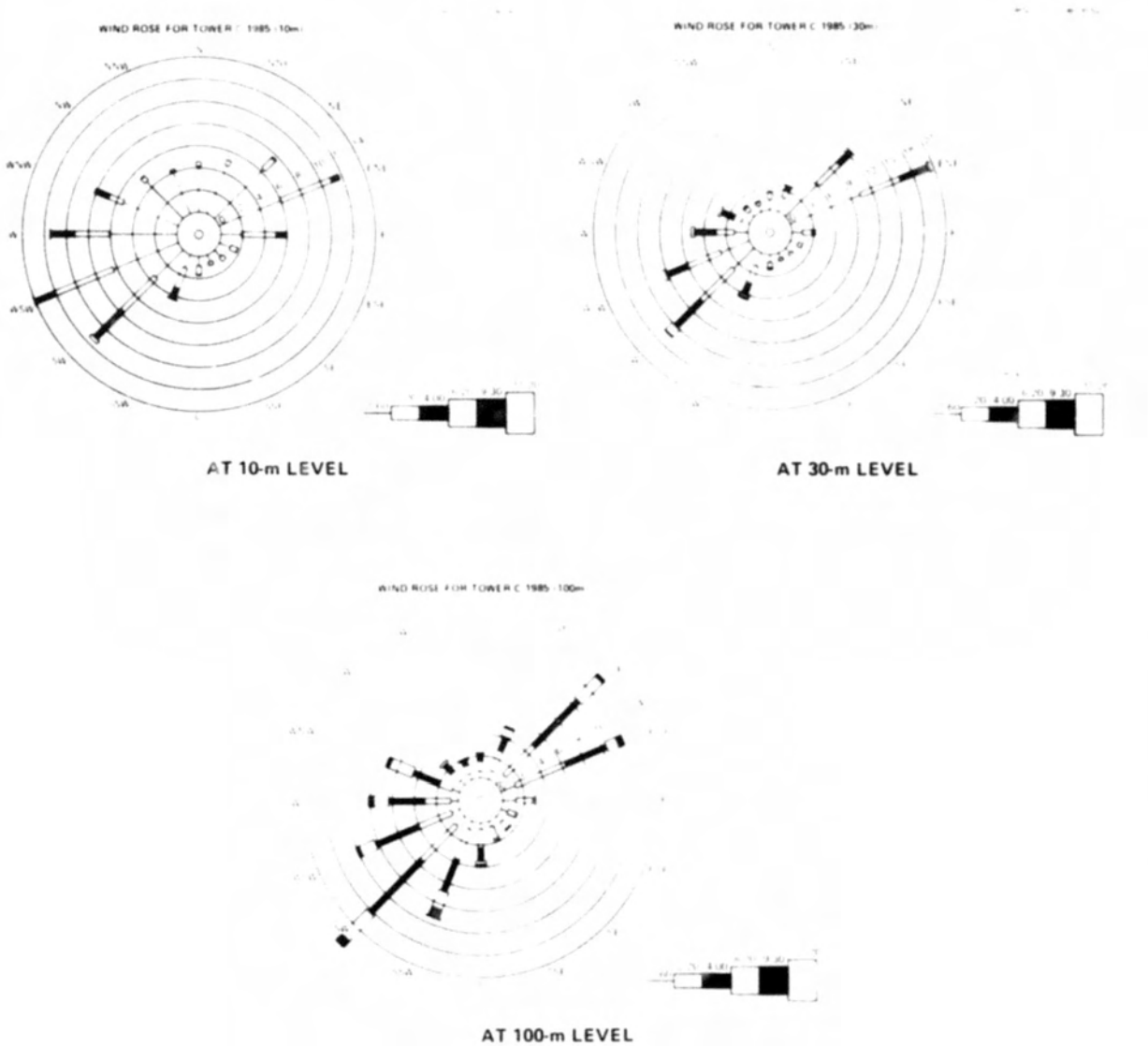


Fig. 3.12. 1985 annual wind roses for meteorological tower 2.

pine. Most of the Reservation's open fields [about 2024 ha (5000 acres)] were planted in shortleaf and loblolly pine between 1947 and 1956. Smaller areas have since been planted in white and Virginia pine as well as white ash, black locust, red maple, eastern red cedar, black walnut, river birch, sycamore, and poplar.

The ORR forest is managed and maintained as a multiuse area. The forested land provides health and safety buffers, research areas, wildlife habitats, habitats for endangered plants, and revenue from timber harvests. Environmentally, the forest provides the needed ecological balance for evapotranspiration of water, erosion control, and purification of the air. Aesthetically, the forest provides natural serenity and beauty in contrast to the encroaching facilities.

Management of the forest includes maintenance of both natural and planted stands through silvicultural treatments; protection of these stands from wildfire, insects, and diseases; and Reservation access. The forest has been inventoried, mapped, and subdivided into 35 management compartments (Figs. 3.13 and 3.14 and Table 3.5). An important aspect of the forest management (FM) process is the administration of the various forest-related activities and interfaces with the numerous programs that use the forested land areas.

The forest itself does not impose any constraints on expansion for future development. While the forested lands provide many opportunities for other uses, they also interface with various other resources and programs (such as the NERP; endangered plants; aquatic habitats; certain historical, cultural, or archaeological features; various research projects; health, safety, and environmental restrictions; or security and safeguard requirements) as well as certain natural features that do impose various constraints.

For additional information about the FM function, see Sect. 3.6.1.2.

3.4 FACILITIES

Facilities within the ORR, consisting of buildings, structures, utilities, and transportation systems, represent approximately $8 billion in current-year dollars (Fig. 2.5). Most of the buildings and structures are located within the three major plant sites (Fig. 3.15). However, several DOE-owned or leased buildings and structures are outside the Reservation (referred to as off site). These facilities, as well as on-site ancillary buildings, are described according to assigned responsibility.

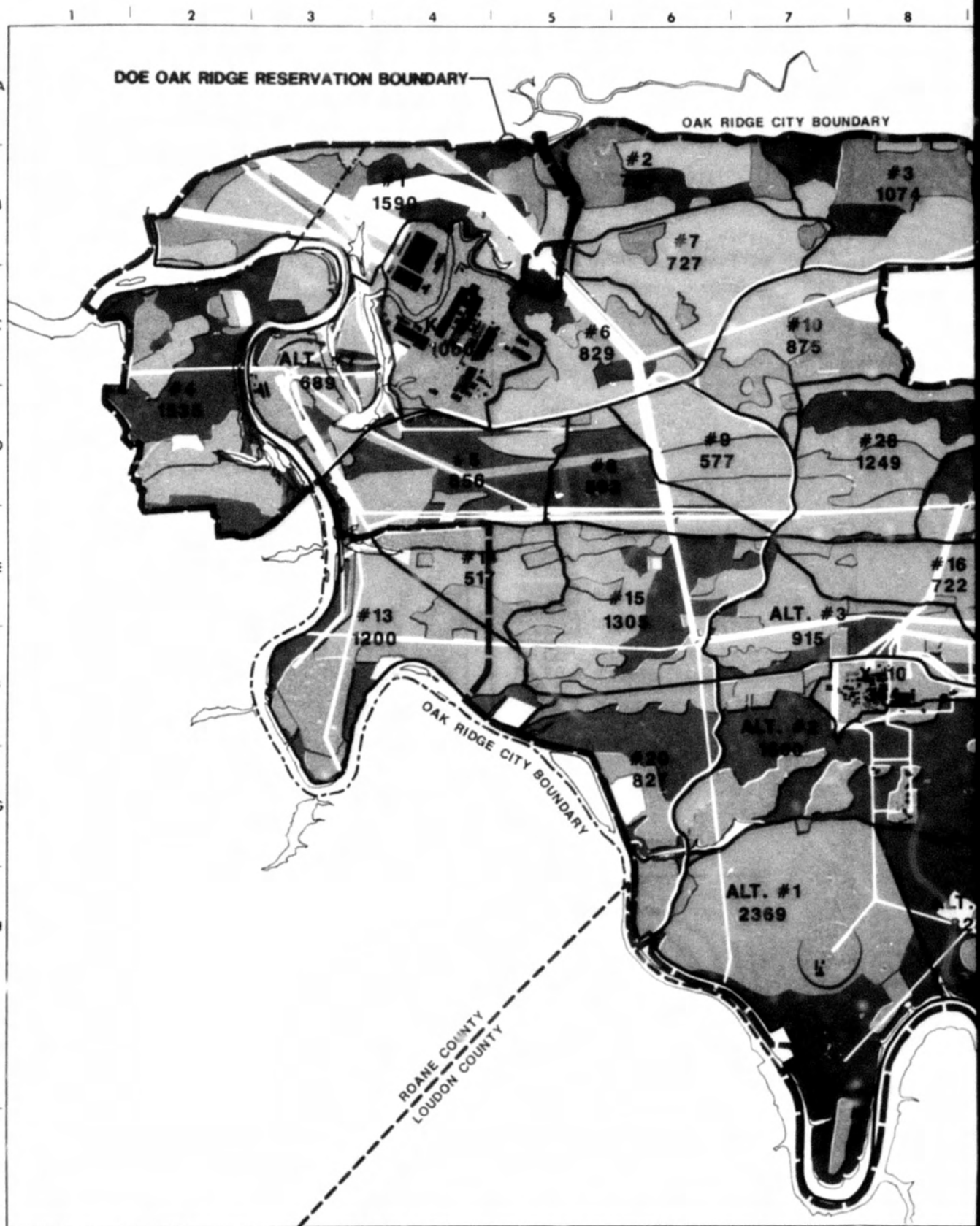
The major utility systems serving the ORR are electrical power, raw and treated water, natural gas, and telecommunications. These are addressed in this document as they affect the Reservation lands outside plant perimeter fences (details of these and other systems inside the perimeter fences are addressed in the SDP for each major plant). Transportation systems include major highways, service roads, access and patrol roads, railroads, and water. All of these major systems are vital lifelines of the Oak Ridge operations.

3.4.1 Buildings and Structures

The 880 buildings on the ORR contain more than 2.06 million m^2 (22.18 million ft^2) (Table 3.6). Relatively few buildings and structures are not addressed by the ORGDP, ORNL, and Y-12 SDPs.

At this point, it is important to note that a continuing emphasis is being placed on the optimum utilization of facilities and funding for maintenance and support. To this end, a preliminary assessment was conducted to identify major plant facilities within the ORR that might be candidates for budget reductions. No facilities at Y-12 were determined to be candidates. At ORNL, a $600,000 increase for program costs is predicted by FY 1988, with subsequent savings of about $200,000 per year resulting from shutting down two facilities and removing 18 buildings and structures. An annual savings of $384,000 was estimated for ORGDP through removal of 53 facilities. A more in-depth review and analysis is under way to promote optimization and cost-effective use of facilities.

The on-site buildings and structures outside the major plant sites consist of the Scarboro Facility, Clark Center Recreational Park, Central Training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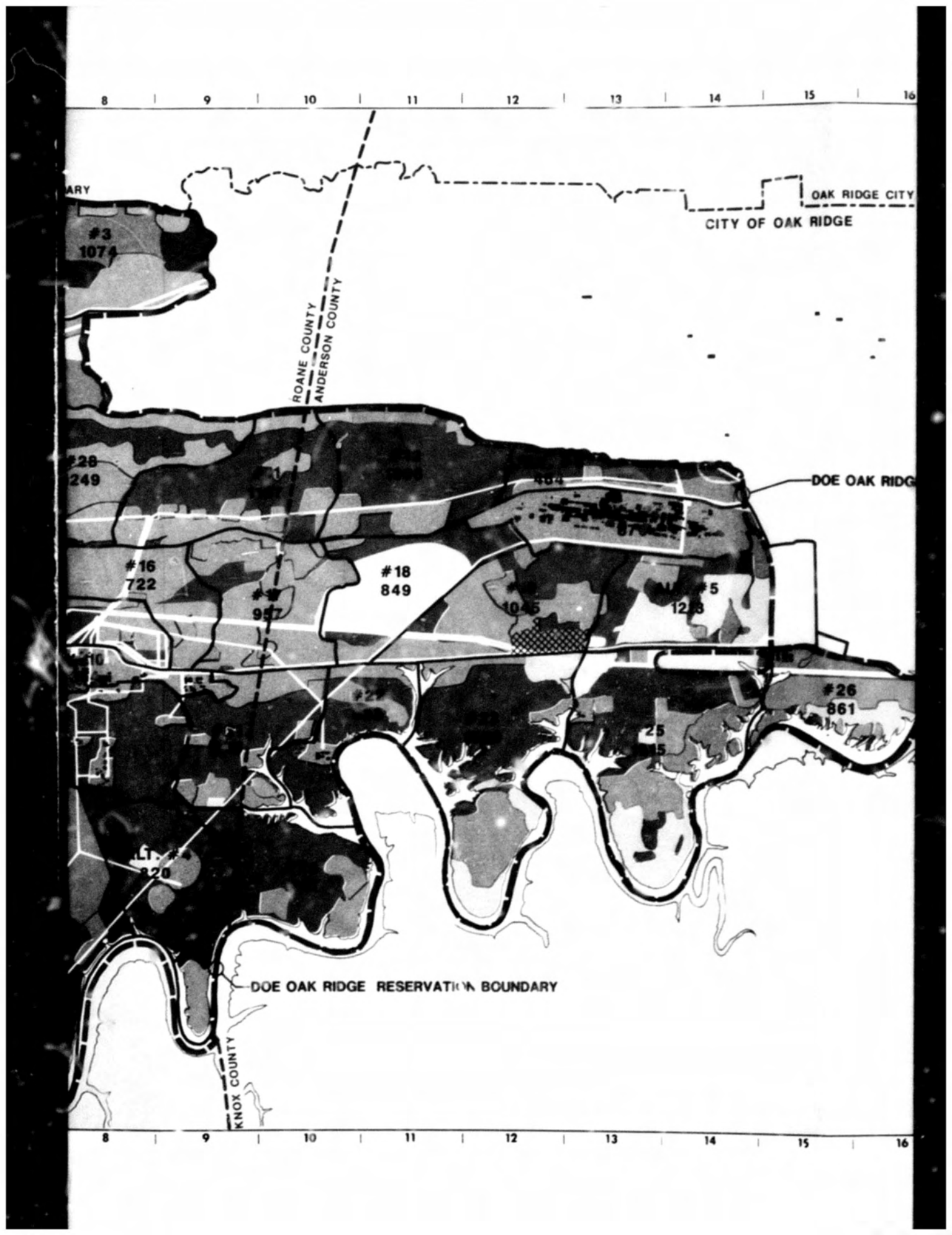
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DOE OAK RIDG
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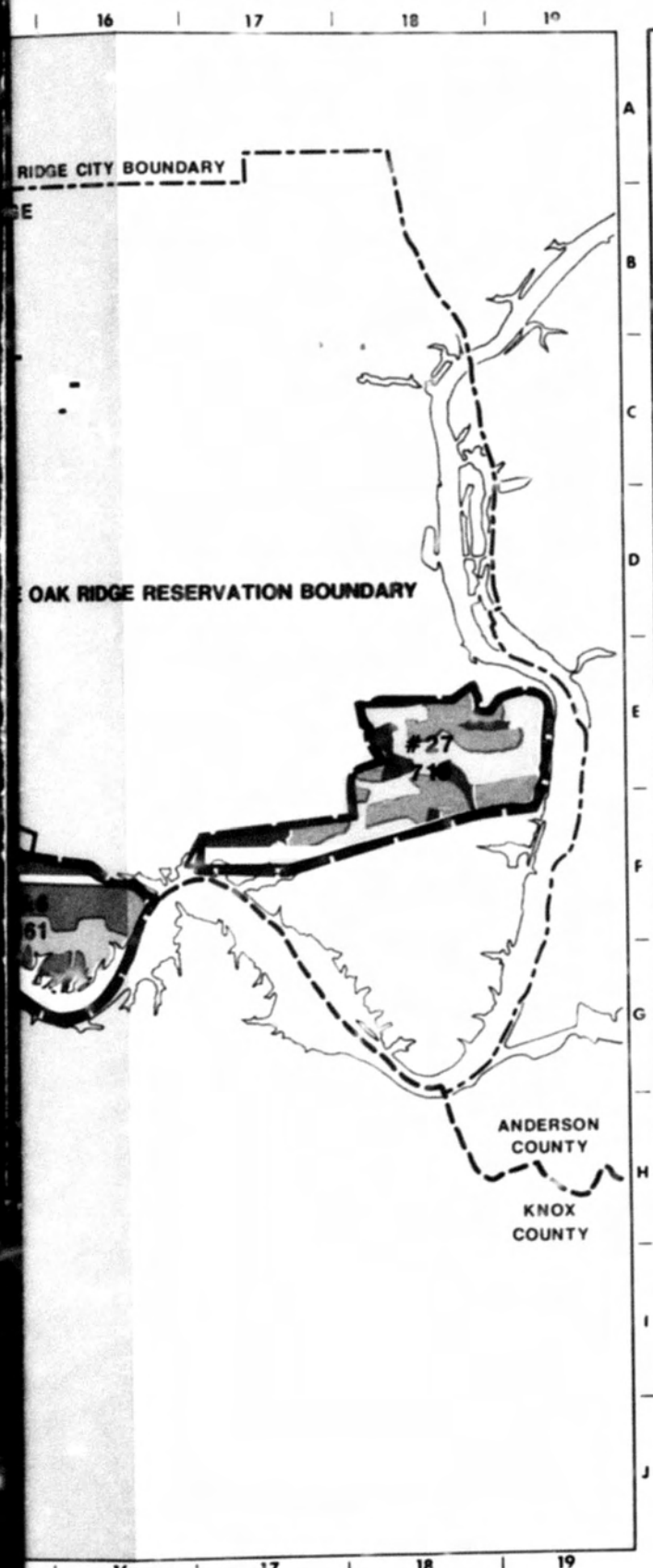
722
#18
849
#26
861
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL–DWG 86-14643



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- NATURAL STANDS
- TIMBER STAND IMPROVEMENT AREAS
- SELECTION CUT AREAS
- NATURAL AREAS (SET ASIDE BY NERP)
- PLANTED STANDS
- BUILDING AND PLANT AREAS
- OPEN FIELDS (PASTURE/HAY PRODUCTION)
- #12 / 1096 — F.M. COMPARTMENT NUMBER/ACREAGE
- SLUDGE SITE

kilometers 0 1 2 3

0 1 2 miles

NORTH

TRUE GRID

Date NOV. 1986 Rev.

FIG. 3.13

FORESTRY

ORNL PHOTO 2671-85

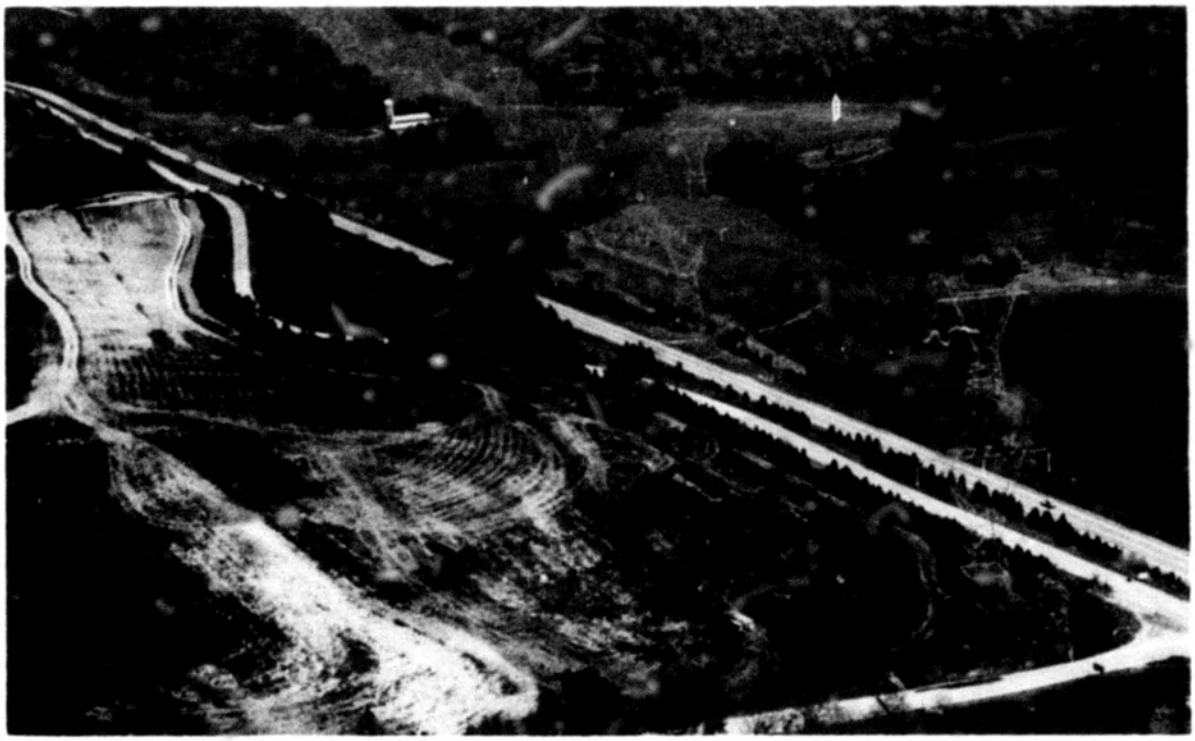


Fig. 3.14. Forest management area on the north side of Bethel Valley Road (looking southeast). The site is currently used for the sludge farming operation.

Facility, Freels' Cabin, the Transportation Safeguards Division maintenance facility, some ancillary structures, and two vacant security guard facilities. The off-site buildings and structures consist of the ORO, OSTI, and ORAU facilities, the American Museum of Science and Energy, and the prime contractor's "Townsite" facilities, as well as other disparate facilities. With the exception of the Federal Office Building (FOB) and space leased from the private sector, all buildings and structures used for DOE functions are situated on DOE-owned parcels of land. The parcels will be discussed along with the various facilities and their programmatic uses.

3.4.1.1 Oak Ridge Operations

The ORO offices occupy approximately 95% of the FOB (Fig. 2.9), which is owned and operated by the General Services Administration (GSA). This facility, as large as it is [approximately 10,500 m^2 (113,000 ft^2)], is inadequate to fulfill the space requirements for the ORO functions. Consequently, ORO has occupied space in three other locations:

1. approximately 1,675 m^2 (18,000 ft^2) in a DOE-owned facility it shares with ORAU (Building 2714) located immediately south of the FOB (Fig. 3.19);

Table 3.5. Forest Management activity areas[a]
(acres)

Compartment	Total area	Plantation	Natural				Miscellaneous[c]	Fields
			TSI[b]	Timber harvested	Natural	Total		
1	1,447	284	725	246	0	971	438	0
2	792	158	617	297	0	914	17	0
3	1,074	210	691	382	0	1,073	173	0
4	1,535	334	998	230	10	1,238	182	11
5	856	122	617	17	0	634	117	0
6	808	260	401	157	0	558	147	0
7	727	461	194	69	0	263	72	0
8	593	86	440	12	0	452	67	0
9	577	269	259	162	0	421	49	0
10	875	128	700	370	8	1,078	47	0
11	1,167	135	918	63	0	981	114	0
12	1,096	113	865	48	0	913	118	0
13	1,200	331	692	195	28	915	149	0
14	517	198	256	88	12	356	51	0
15	1,305	293	898	198	10	1,106	114	0
16	722	50	566	406	0	972	106	0
17	957	234	584	212	4	800	135	0
18	849	27	264	0	461	725	97	0
19	1,045	66	642	154	0	796	272	65
20	827	284	444	150	65	659	34	0
21	805	90	646	12	10	668	59	0
22	633	28	494	57	0	551	54	0
23	1,580	18	1,068	0	0	1,068	343	151
24	1,207	28	932	109	0	1,041	247	0
25	1,673	0	1,115	0	48	1,163	163	347
26	861	0	237	250	0	487	399	225
27	719	1	302	159	0	461	74	342
28	1,249	613	636	270	0	906	0	0
ALT-1	2,369	10	2,044	940	0	2,984	315	0
ALT-2	1,600	40	1,250	65	0	1,315	245	0
ALT-3	915	74	344	289	0	633	208	0
ALT-4	820	0	733	37	40	810	47	0
ALT-5	934	60	389	11	0	400	121	364
ALT-6	464	5	359	0	0	359	100	0
ALT-7	689	161	186	0	0	186	342	0
Totals	35,487	5,171	22,506	5,655	696	28,857	5,216	1,505

[a]To convert acres to hectares, divide by 2.47.
[b]Timber stand improvements.
[c]Includes utility right-of-ways, impoundments, and the Scarboro Facility.

Table 3.6. Buildings on the Oak Ridge Reservation

Facility	Buildings			
	No.	Area		Cost ($)
		m^2	(ft^2)	
Oak Ridge Operations	7	17,841	(191,834)	3,593,610
Oak Ridge National Laboratory	242	254,686	(2,738,561)	175,212,128
Oak Ridge Gaseous Diffusion Plant	249	1,134,460	(12,198,494)	266,898,097
Y-12 Plant	319	602,374	(6,477,138)	302,296,064
Oak Ridge Associated Universities	48	32,845	(353,169)	10,396,961
Museum	2	5,152	(55,400)	3,790,975
Construction/ Maintenance	13	15,385	(165,430)	4,744,879
Total	880	2,062,743	(22,180,016)	766,932,714

Source: Real Property Inventory System, July 10, 1986.

2. 1,210 m^2 (13,000 ft^2) of office space leased by GSA from the private sector in the Commerce Building; and
3. approximately 1,210 m^2 (13,000 ft^2) of office space leased by DOE from the private sector in the Downtown Concourse.

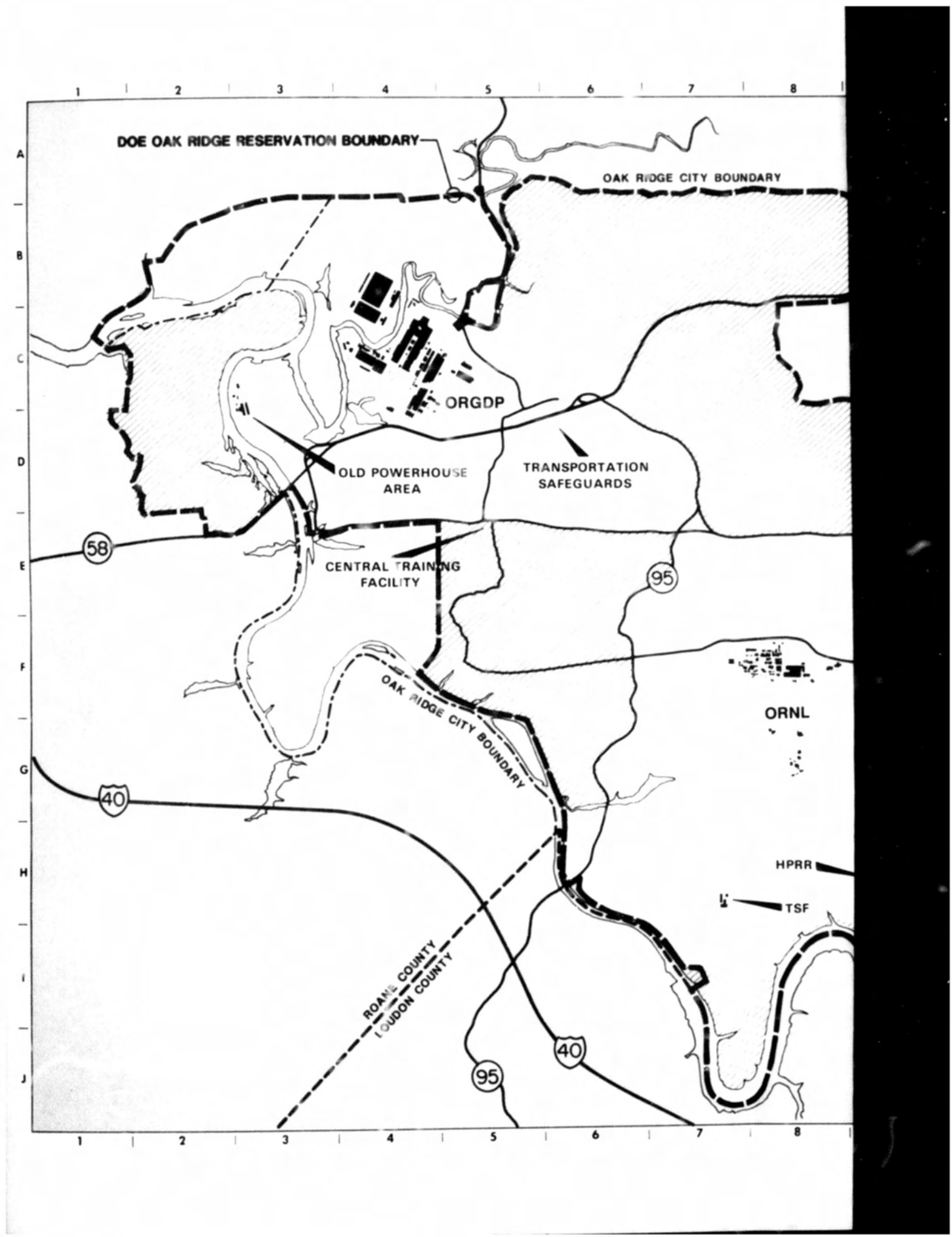
The FOB and the leased space are "Class A" facilities, defined as permanent space constructed (renewed, renovated, or rehabilitated) for the function served.

The DOE-owned building (2714) (Fig. 3.16), located immediately south of the FOB, is an old four-wing, one-story facility constructed of masonry tile for office and laboratory use. Because of its age and design, the building is considered a "Class B" facility. This building is located on a 4.9-ha (12-acre) tract and is used as an administrative support area.

In addition, a few personnel are located in scattered locations in facilities occupied by other contractors' programs (such as construction personnel located at Y-12).

3.4.1.2 Office of Scientific and Technical Information

The OSTI consists of two masonry buildings (Fig. 3.17) constructed in the 1940s as warehouses. The main OSTI function is located in Building 1916T-1. The other building (1916T-2) is shared with Rust Engineering, ORAU, and the prime contractor and houses OSTI's subcontractor for distribution and storage (warehousing). Portions of Building 1916T-1 were converted to office space in the 1950s, and additional bays were added in the 1950s and 1960s. Currently, the building has one office bay and seven other bays [1,860 m^2 (20,000 ft^2) each] wit a total space of 13,950 m^2 (150,000 ft^2). These buildings are located on a 2.8-ha (7-acre) tract that parallels the Oak Ridge Turnpike approximately 4.8 km (3 miles) east of the FOB. Because of their age and configuration, these are considered "Class B" buildings and are deemed adequate for current functions.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OAK RIDGE CITY BOUNDARY
ORGDP
OLD POWERHOUSE AREA
TRANSPORTATION SAFEGUARDS
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CENTRAL TRAINING FACILITY
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OAK RIDGE CITY BOUNDARY
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HPRR
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ROANE COUNTY
LOUDON COUNTY
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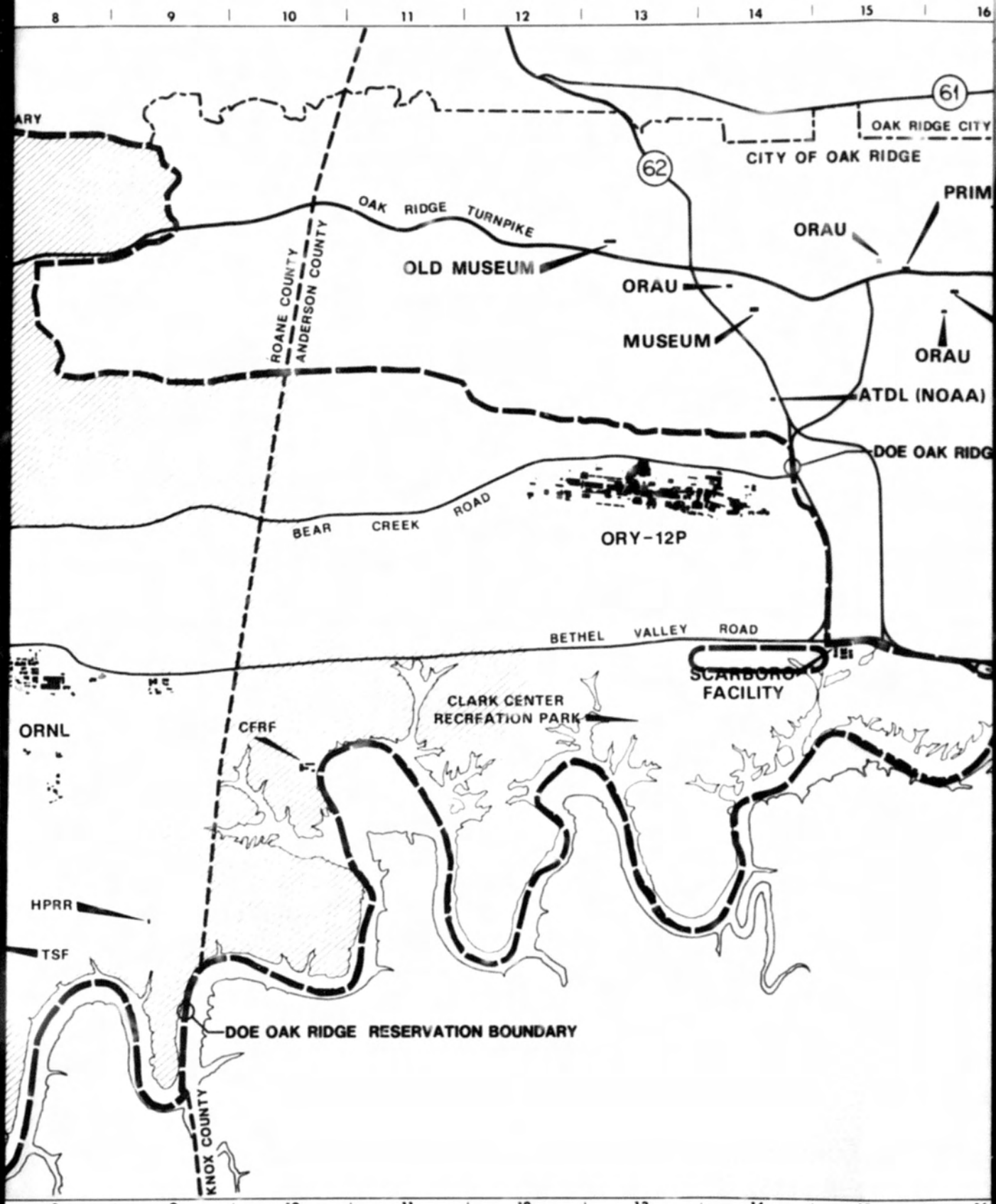
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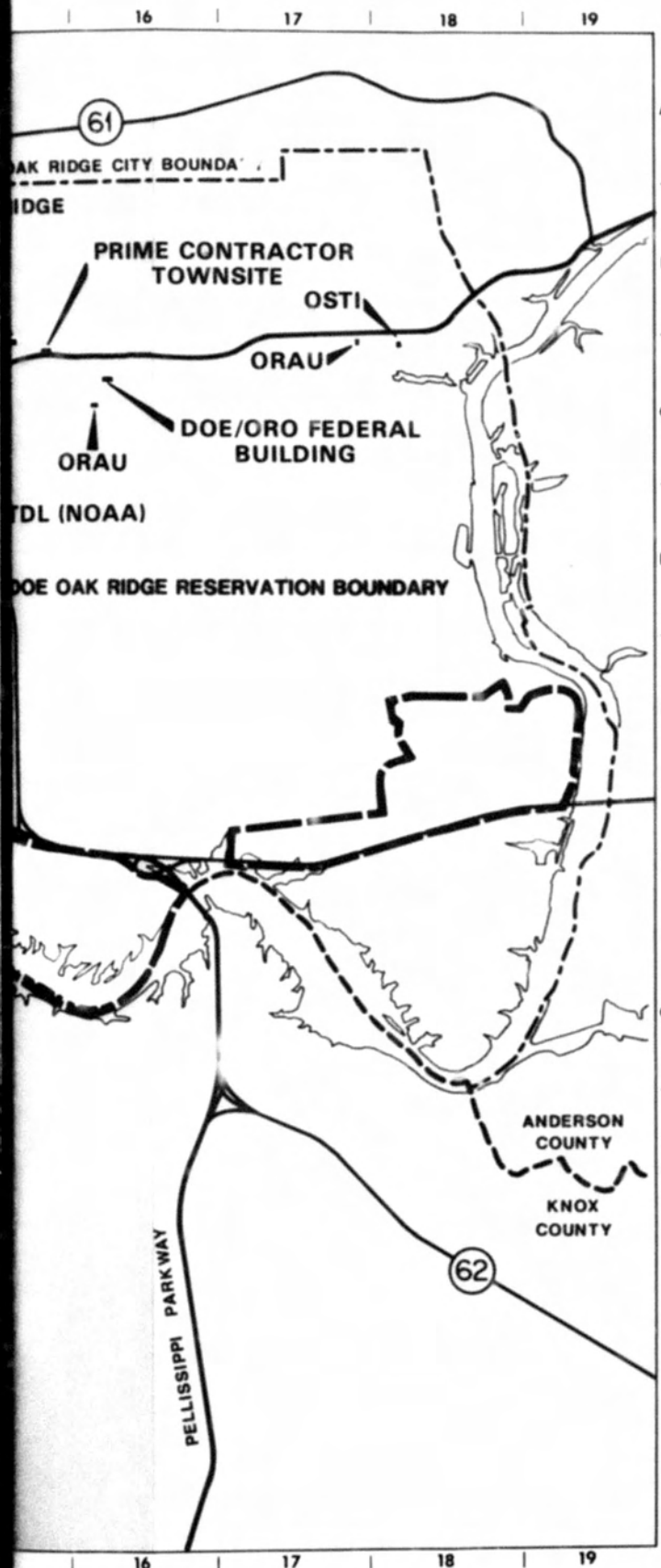
OAK RIDGE CITY
CITY OF OAK RIDGE
OAK RIDGE TURNPIKE
ROANE COUNTY
ANDERSON COUNTY
OLD MUSEUM
ORAU
MUSEUM
ATDL (NOAA)
DOE OAK RIDG
BEAR CREEK ROAD
ORY-12P
BETHEL VALLEY ROAD
CLARK CENTER RECREATION PARK
ORNL
CFRF
HPRR
TSF
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL DWG 86-14639



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

NATIONAL ENVIRONMENTAL RESEARCH PARK

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date **NOV. 1986** Rev. 1

FIG. 3.15

FACILITIES

Y/PH-217516

Fig. 3.16. Building 2714 (Oak Ridge Operations and Oak Ridge Associated Universities) (looking northwest toward the Oak Ridge Turnpike).

Y/PH-217505

Fig. 3.17. Office of Scientific and Technical Information (looking northeast).

3.4.1.3 Oak Ridge Associated Universities

ORAU occupies numerous buildings and structures in five locations plus some facilities assigned to others. The main campus, which contains four buildings (Fig. 3.18), is privately owned by ORAU. Immediately to the west and contiguous to the campus is a recently completed hotel-convention center complex that complements ORAU's research and training functions. Extensive research is being carried out on campus for DOE and others.

ORAU's machine shop, carpenter shop, maintenance shop, shipping and receiving, and purchasing offices are located off campus in DOE-owned OSTI facilities (Building 1916T-2) (Fig. 3.17). The space being used is assigned to Rust Engineering and consists of 3,500 m^2 (37,660 ft^2); this is considered adequate for ORAU's needs at this time and for the foreseeable future.

ORAU's Manpower, Education, Research, and Training (MERT) program is housed in buildings shared by ORO (Fig. 3.16) that are located on Laboratory Road, south of the FOB. The MERT program uses two wings of Building 2714, which contains 2,976 m^2 (32,000 ft^2), plus another building located adjacent but south of Laboratory Road and Building 2714. Both buildings are considered "Class B" facilities because of their age and design configuration.

ORAU's primary research support facility (Fig. 3.19) is located on a 1.2-ha

ORNL PHOTO 5044-86

Fig. 3.18. Oak Ridge Associated Universities, main campus (looking south).

Y/PH-217501

Fig. 3.19. Oak Ridge Associated Universities' medical facility (looking north).

(3-acre) tract of DOE-owned land adjacent to and west of the Methodist Medical Center of Oak Ridge along East Vance Road. This 5,561-m^2 (59,800-ft^2) building is used for biomedical research. It is constructed of masonry and is considered adequate. Because of its age (built in 1944–46 with additions in 1950) and configuration, it is considered a "Class B" building.

The Scarboro Facility, located within the Reservation and south of Y-12 along Bethel Valley Road and east of Scarboro Road (Fig. 3.20), houses ORAU's Medical and Health Sciences Division's Large Animal Research Program. The principal building is an old converted school that was built in 1938; an annex was added in 1964. Together they contain 4,464 m^2 (48,000 ft^2). Several other buildings constructed for animal research, a variety of animal barns, and an animal surgery building complete the complex. This facility was originally occupied by the University of Tennessee's CARL under contract to DOE. Programmatic changes have left most of the ancillary structures vacant, and most of the land, formerly used for pasture, has been administratively reassigned to the prime contractor.

3.4.1.4 Museum

The American Museum of Science and Energy was relocated in 1975 from its original facility (55–59 Jefferson Circle) to a 6.9-ha (17-acre) site contiguous to the ORAU campus along South Tulane Avenue (Fig. 3.21). The new $3.79-million facility is constructed of masonry and contains approximately 5,040 m^2 (55,400 ft^2) (3,087 m^2 for exhibition space and 1,953 m^2 for offices and

ORNL PHOTO 5017-86

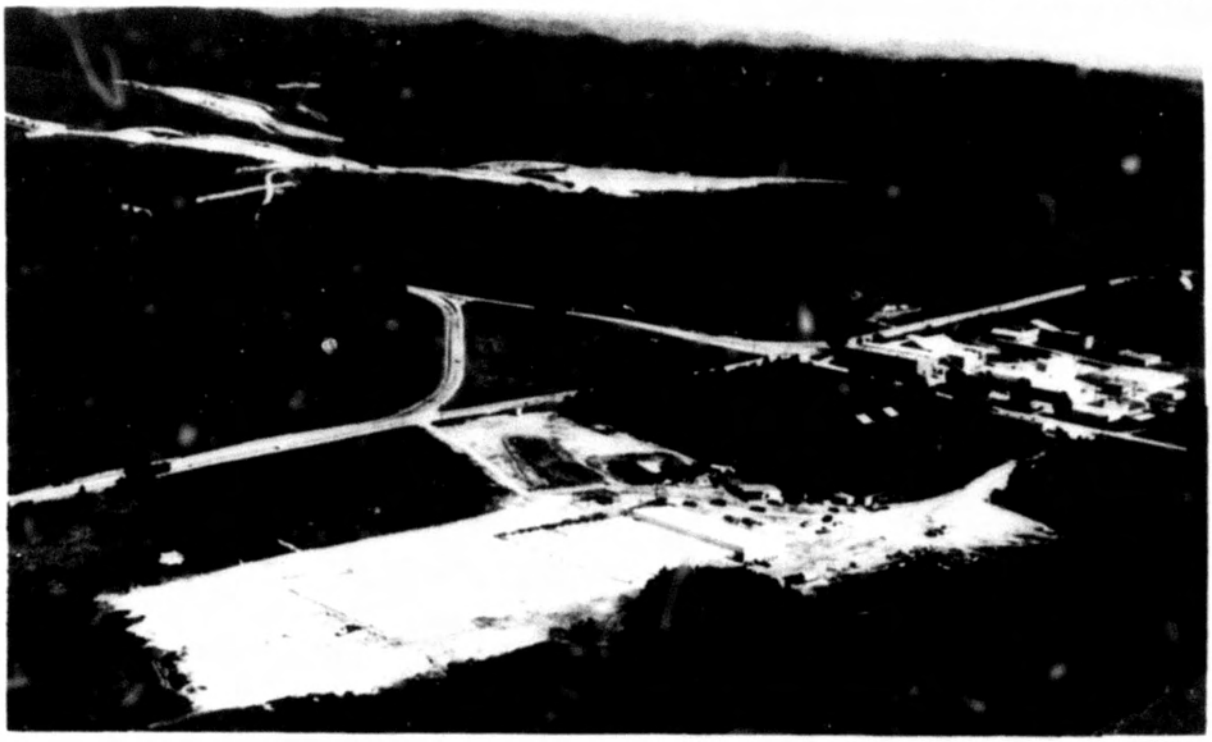


Fig. 3.20. Oak Ridge Associated Universities' Scarboro Facility (looking west).

related space). The building is a "Class A" structure and is considered adequate for its current use. The Museum has warehouse space in the OSTI complex (Building 1916T-2) (Fig. 3.17).

3.4.1.5 Townsite

The prime contractor's administrative support office buildings are located on two adjacent tracts of DOE-owned land containing 1.6 ha (4 acres) at 231-241 Tyrone Road (Fig. 3.22). These consist of two temporary wood-frame buildings (Building 1801T4, Charlotte Hall, and Building 1801T8, Cheyenne Hall) constructed in the late 1940s and two office trailers (Buildings 9983-22 and 9982-23). These buildings house the central employment, auditing, and purchasing functions of the prime contractor. They contain a total area of 4,347 m^2 (46,744 ft^2). The wood frame buildings are "Class B" facilities, and the trailers are "Class C."

3.4.1.6 Others

The former Museum building on Jefferson Circle (Fig. 3.23), located on a 1.2-ha (3-acre) site owned by DOE, is a temporary wood-frame structure constructed in the 1940s. This 4,178-m^2 (46,000-ft^2) building is a "Class B" facility. It has recently been used as the CRBRP office, and a skeleton staff is still in residence.

The NOAA's Atmospheric Turbulence and Diffusion Laboratory (ATDL) is housed in a temporary wood-frame building that was built in the 1940s at 456 South Illinois Avenue (Fig. 3.24). The

Y/PH-217493

Fig. 3.21. American Museum of Science and Energy (looking north).

ORNL PHOTO 5081-86

Fig. 3.22. Townsite (Charlotte Hall) (looking north).

Y/PH-217494

Fig. 3.23. Old site of the American Museum of Science and Energy (looking north).

ORNL PHOTO 5077-86

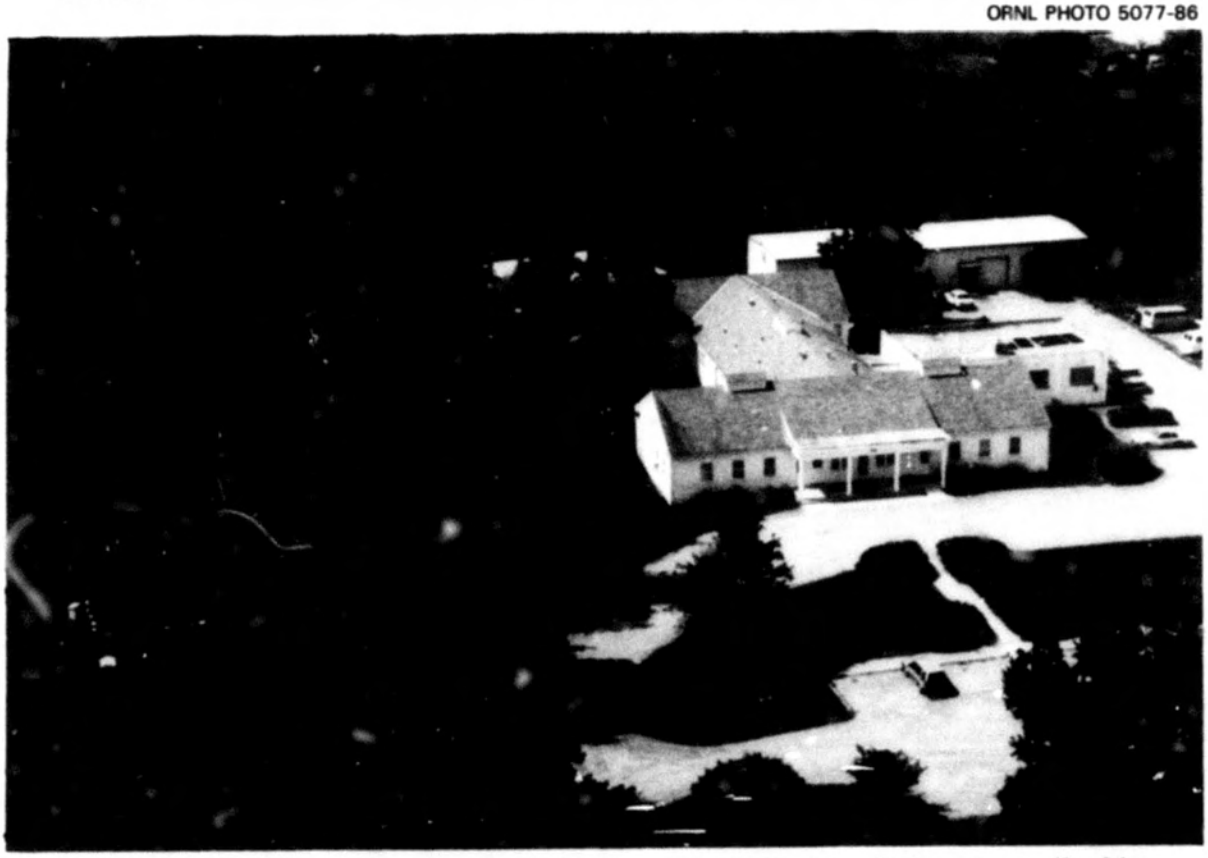


Fig. 3.24. Atmospheric Turbulence and Diffusion Laboratory (looking southwest).

DOE-owned tract of land contains 4.5 ha (11 acres). ATDL conducts meteorological and atmospheric diffusion research supported by DOE and NOAA as an approved ongoing joint effort. It also provides services to other DOE contractors and operates the Weather Instrument Telemetering Monitoring System for DOE.

Only 5% of ATDL's modest $1 million budget is allocated for capital expenses. No construction costs are projected until 1990, when $250,000 is expected to be spent. Beyond that, no future construction costs are projected.

Also included under other miscellaneous structures on the ORR are nine meteorological towers (Fig. 3.11) and three telecommunications towers.

Clark Center Recreational Park, which was originally intended for use by DOE and contractor employees, has been opened to the public. Its limited facilities consist of an office/toilet building, three shelters, another toilet, some portable toilets, a boat ramp, unimproved parking areas, two softball fields, and a paved access road (Fig. 3.25). The 36-ha (90-acre) site is located on an embayment of Melton Hill Lake about 3.2 km (2 miles) south of Y-12 at the west end of Bull Bluff Road.

The Central Training Facility (CTF) is shared by Energy Systems' security force,

Y/PH-217528

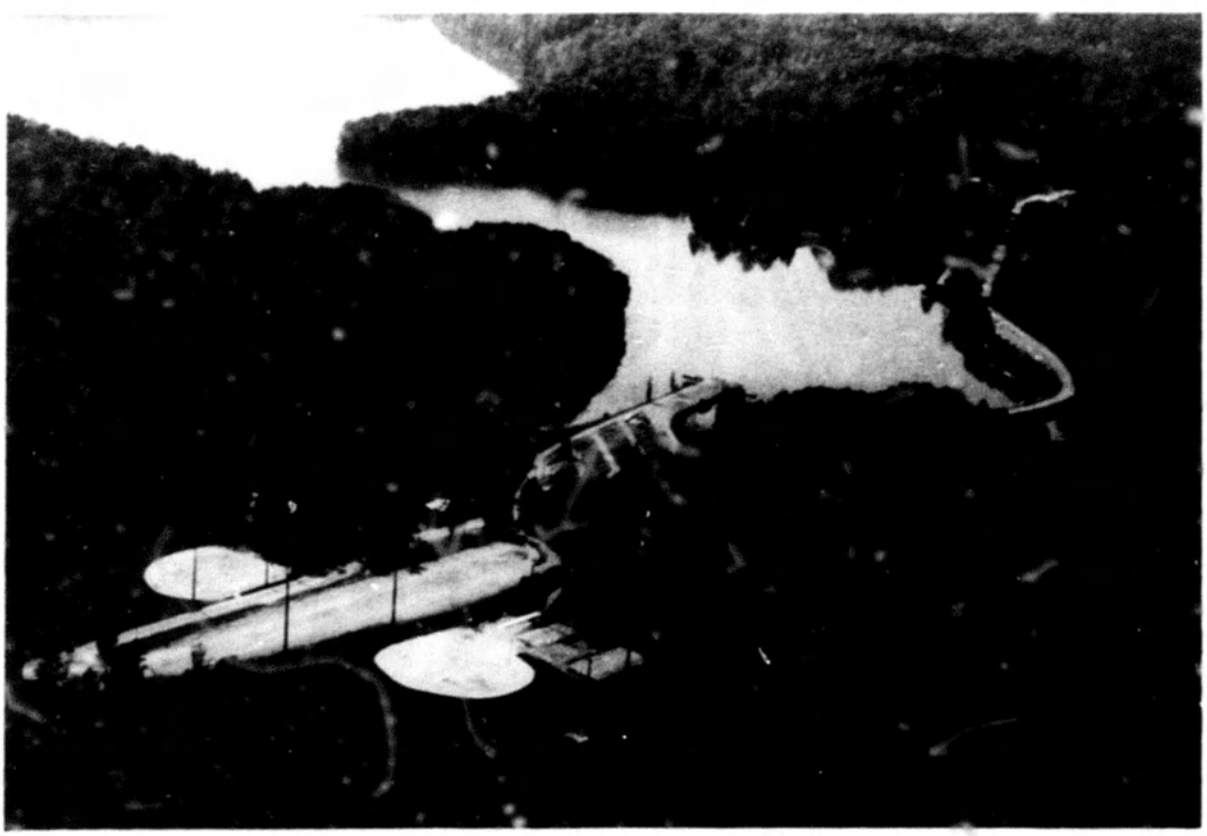


Fig. 3.25. Clark Center Recreational Park (looking south). The park is located south of the Y-12 Plant on Melton Hill Lake.

Transportation Safeguards, and other contractor and agency security personnel. The CTF consists of a small office building, an indoor firing range, a classroom/storage trailer, another storage trailer, on-site parking, fitness facilities (an outdoor track), and numerous outdoor firing ranges (Figs. 3.26 and 3.44). The site, located south of Bear Creek Road less than a mile southeast of ORGDP, currently consists of about 57 ha (140 acres) (including a buffer area). Additional buildings and facilities are planned, as is an expansion of the site along Bear Creek Road and Chestnut Ridge to include an additional 85 ha (210 acres).

The DOE Transportation Safeguards Division's maintenance facility is the former Stone & Webster (OS-3) warehouse, located about 1 mile east of ORGDP along the south side of Highway 58 (Oak Ridge Turnpike) near the intersection of Blair Road (Fig. 3.27). The building is situated on a site of about 8 ha (20 acres) and is currently undergoing major modifications. In addition, major site improvements include security fencing, paved parking, and paved access around the building. Additional expansion is contemplated to include a target range with a safety buffer zone, a fitness facility, and the eventual relocation of office facilities from Y-12. The total site area would constitute approximately 24.7 ha (100 acres).

3.4.2 Utility Systems

Facilities on the ORR are dependent on a wide array of utilities. The major utilities serving the ORR are electrical power,

ORNL PHOTO 5159-86

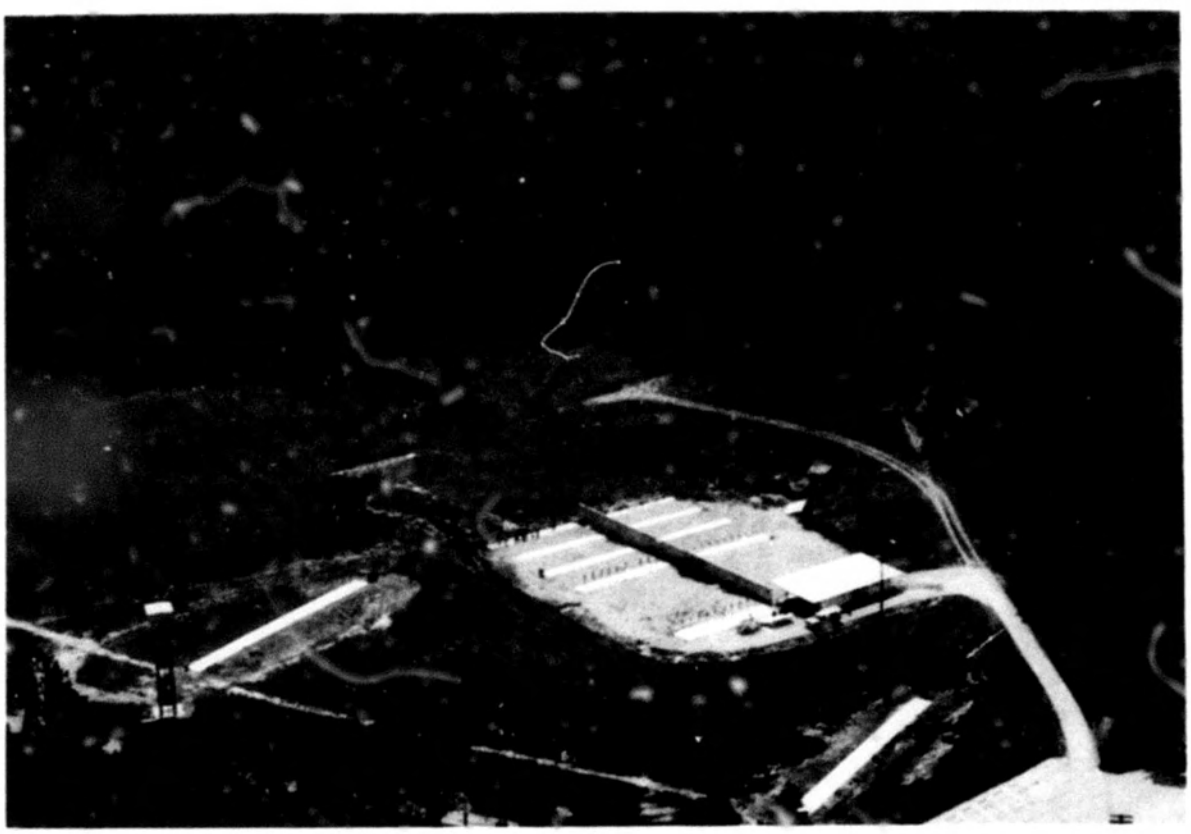


Fig. 3.26. Central Training Facility (looking south).

Y/PH-217635

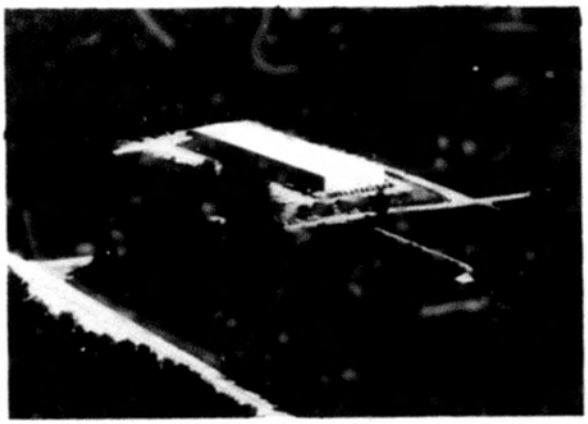


Fig. 3.27. Building used by Transportation Safeguards.

raw and treated water, natural gas, and telecommunications (Table 3.7). In addition, coal is transported to the major plants by truck and used to produce steam. Steam is then transported through a system of pipelines to the user sites within each plant.

Effective management of these utility systems requires that an appropriate amount of land area (right-of-way) be dedicated for their physical location, safety, maintenance, and access. In some cases, utility right-of-ways may also support the management of other resources by providing ground cover for wildlife, by

Table 3.7. Lengths of utilities within the Oak Ridge Reservation

Utility	Length		Easement
	km	(miles)	
Natural gas			
6-in. line	0.76	(0.47)	
14-in. line	1.51	(0.94)	20 ft = 46.57 acres
22-in. line	28.66	(17.80)	6.1 m = 18.85 ha
	30.93	(19.21)	
Electrical			
13.8 kV	14.01	(8.70)	
161 kV	68.26	(42.40)	200 ft = 1,669.09 acres
500 kV	28.58	(17.75)	61 m = 675.74 ha
	110.85	(68.85)	
Telecommunications	58.57	(36.38)	20 ft = 88.19 acres 6.1 m = 35.70 ha
Water (raw and treated)			
4-in. line	2.42	(1.50)	
10-in. line	7.74	(4.81)	
12-in. line	2.82	(1.75)	
16-in. line	9.26	(5.75)	20 ft = 53.61 acres
24-in. line	13.89	(8.63)	6.1 m = 25.75 ha
36-in. line	3.06	(1.90)	
42-in. line	3.06	(1.90)	
	42.25	(26.24)	

providing areas for research, and by sharing access for forestry operation and security patrols.

The utility systems are vital lifelines necessary for the continued operation of DOE facilities on the Reservation. In addition, the City of Oak Ridge is totally dependent on DOE's sanitary water system located near Y-12.

3.4.2.1 Electrical Power

Electrical power is of primary importance to facilities on the ORR (Fig. 3.28). Numerous high-voltage transmission lines from TVA power systems supply the power required to operate the major plants (Fig. 3.29). In addition, transmission lines serving other areas cross the Reservation. The 161-kV primary power system for the ORR is an integral part of the TVA power grid (Fig. 3.30); therefore, system design and operation must be compatible with the TVA system. DOE facilities in the business district of Oak Ridge receive electrical power from the City of Oak Ridge.

All transmission lines (Table 3.8) serving the ORR have been constructed in accordance with TVA standards and specifications and are either 161 or 500 kV. Power is supplied to the Reservation substations at a nominal voltage of 161 kV. Transmission and substation tie lines are shown in the table. Steel towers for either single-circuit or double-circuit lines are self-supporting, four-legged structures; body extensions and variable-length legs are used to provide height variations to fit the towers to the topography. The basic height of the 500-kV line towers is 25.6 m (84 ft), but river crossings, highway crossings, and changes in direction require special towers. Towers for the 500-kV lines on the Reservation vary in height from 24.4 to 57.3 m (80 to 188 ft) with spacing varying from 244 to 518 m (800 to 1700 ft) depending on topography. Steel towers for the 161-kV circuits are normally 18.3 to 27.4 m (60 to 90 ft) in height, and spacing varies from 152 to 488 m (500 to 1600 ft). Spacing for the wood pole structures, sometimes used for the 161-kV circuits, varies from 152 to 366 m (500 to 1200 ft).

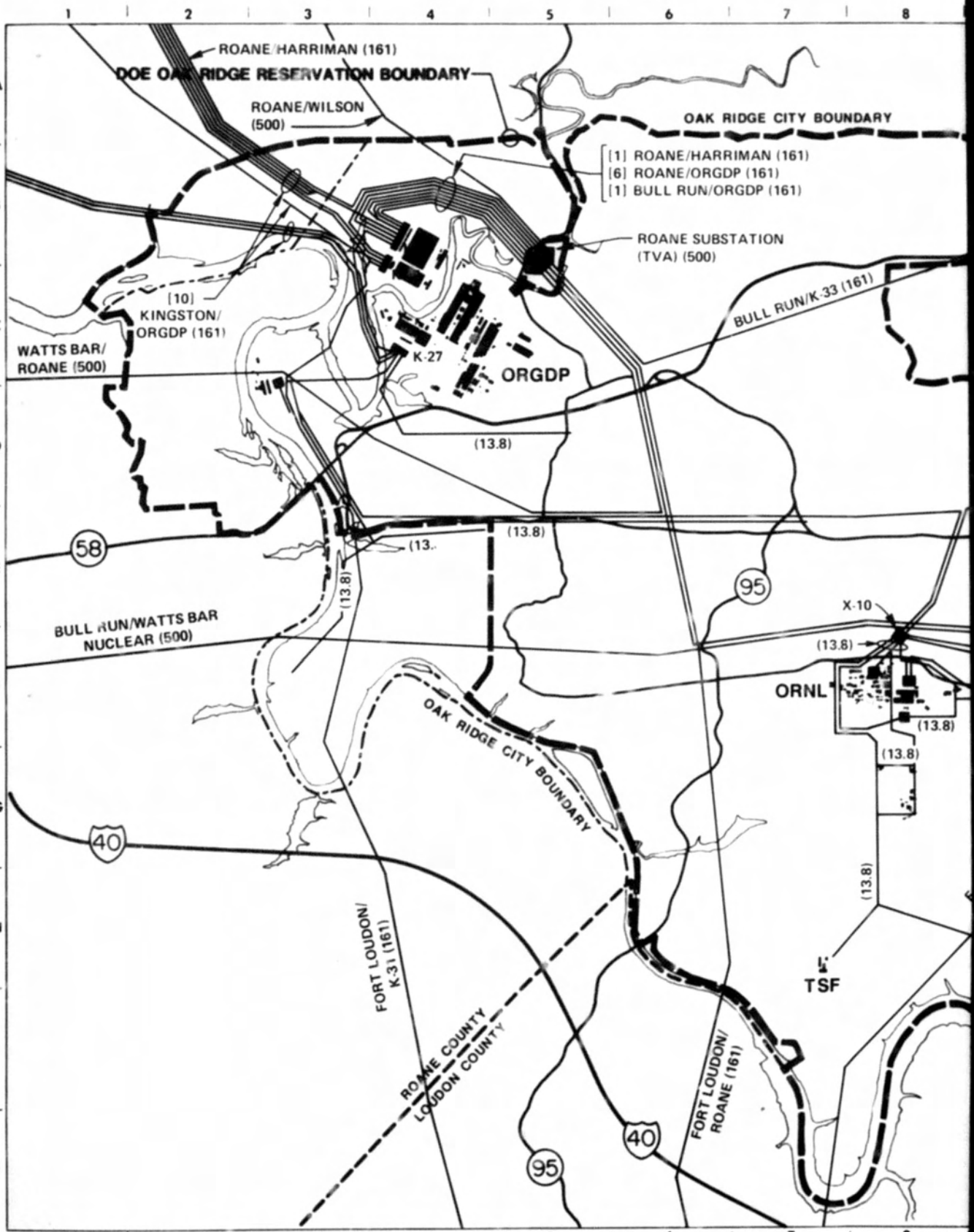
Generally, cleared widths of right-of-ways (Fig. 3.31) for transmission lines are 30.5 m (100 ft) for 161-kV lines and 45.7 m (150 ft) for 500-kV lines. Right-of-ways are cleared of all trees that present a danger to the transmission lines. Trees are designated as dangerous if in falling they would reach within 1.5 m (5 ft) of a 161-kV line or within 3 m (10 ft) of a 500-kV line.

Most of the original right-of-ways on the Reservation were routed through wooded areas; however, more recent lines from the Bull Run Steam Plant are routed over land used primarily for pasture and crops. Most right-of-ways are suitable for travel by four-wheel-drive maintenance vehicles.

All transmission line corridors along ridges are either grassed or covered with low-growing vegetation for erosion control. Corridors across open fields are used in primarily the same way as if the transmission lines were not there, usually for crops or pasture. In other areas on the ORR, corridors are used for equipment storage, parking areas, and other uses not requiring permanent installations. Some right-of-ways are research sites or are habitats for rare plants, so maintenance should be carefully coordinated.

3.4.2.2 Raw and Treated Water

Raw (untreated) water for the DOE facilities is taken from the Clinch River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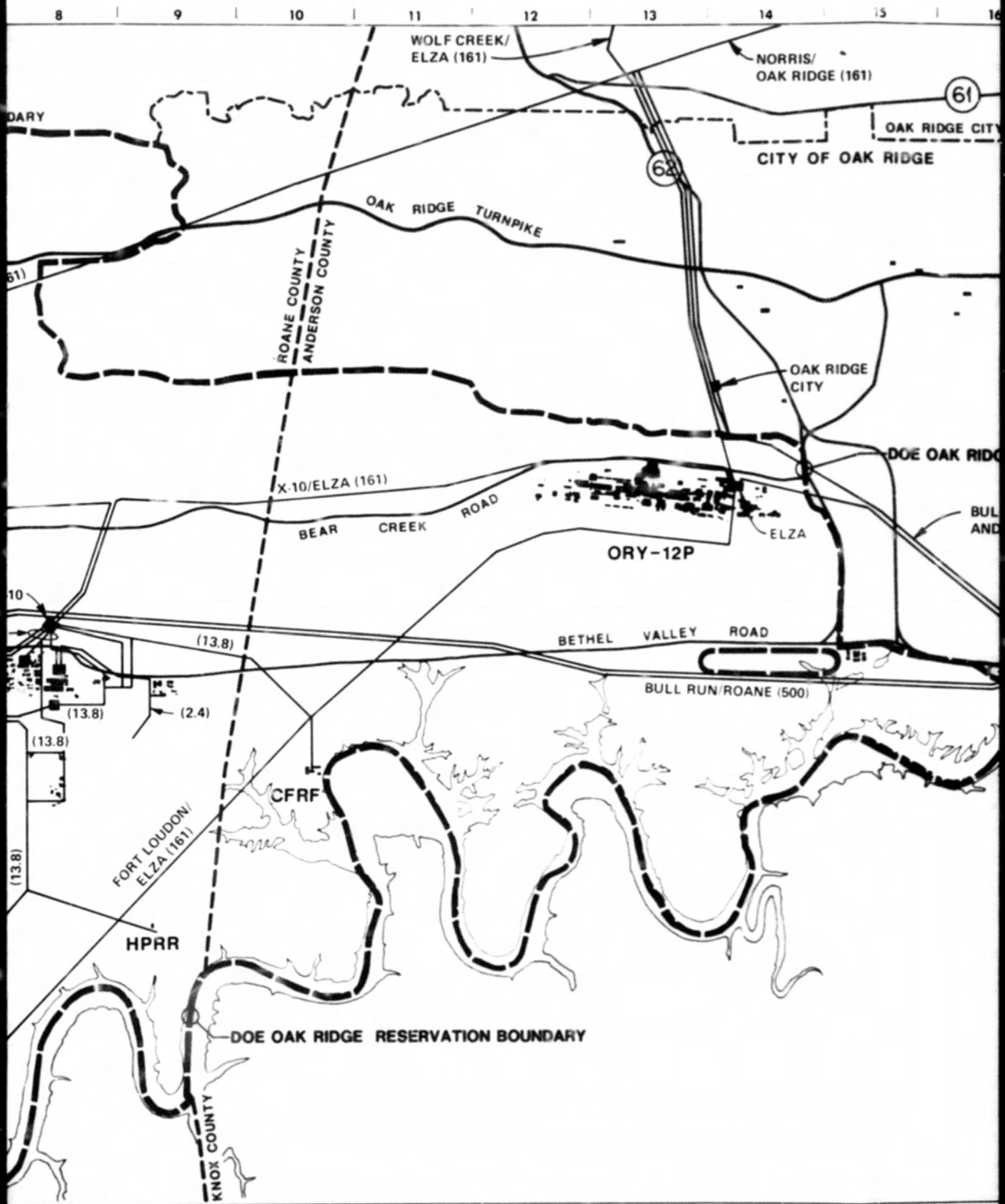
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ROANE COUNTY
ANDERSON COUNTY
OAK RIDGE
CITY
DOE OAK RIDG
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BEAR CREEK ROAD
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AND
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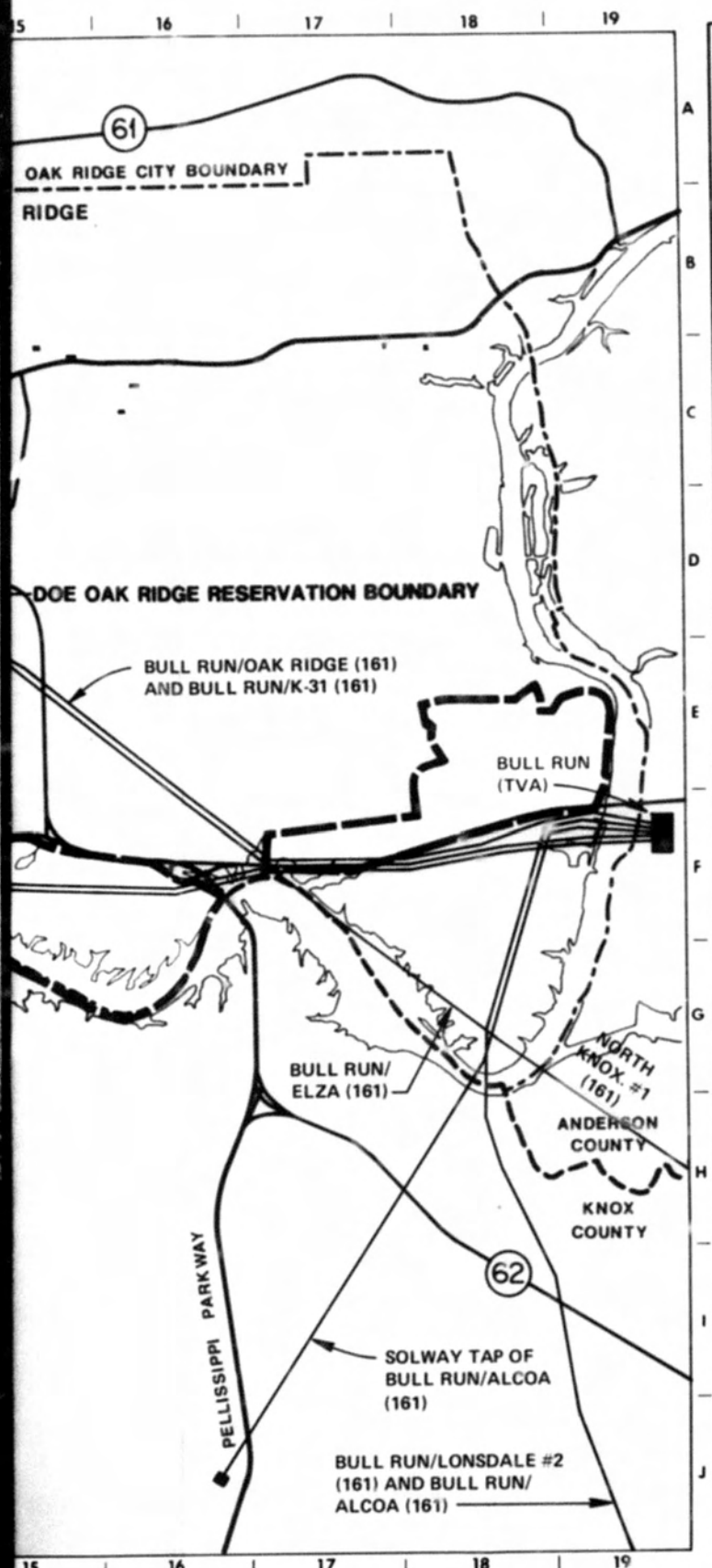
BULL RUN/ROANE (500)
CFRF
FORT LOUDON/
ELZA (161)
HPRR
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY



Resource Management Plan

For The:

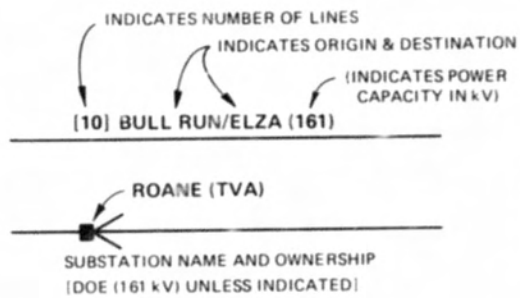
U.S. DEPARTMENT OF ENERGY

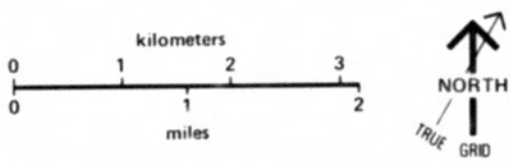
OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:





Date NOV. 1986 Rev. 1

FIG. 3.28

ELECTRICAL

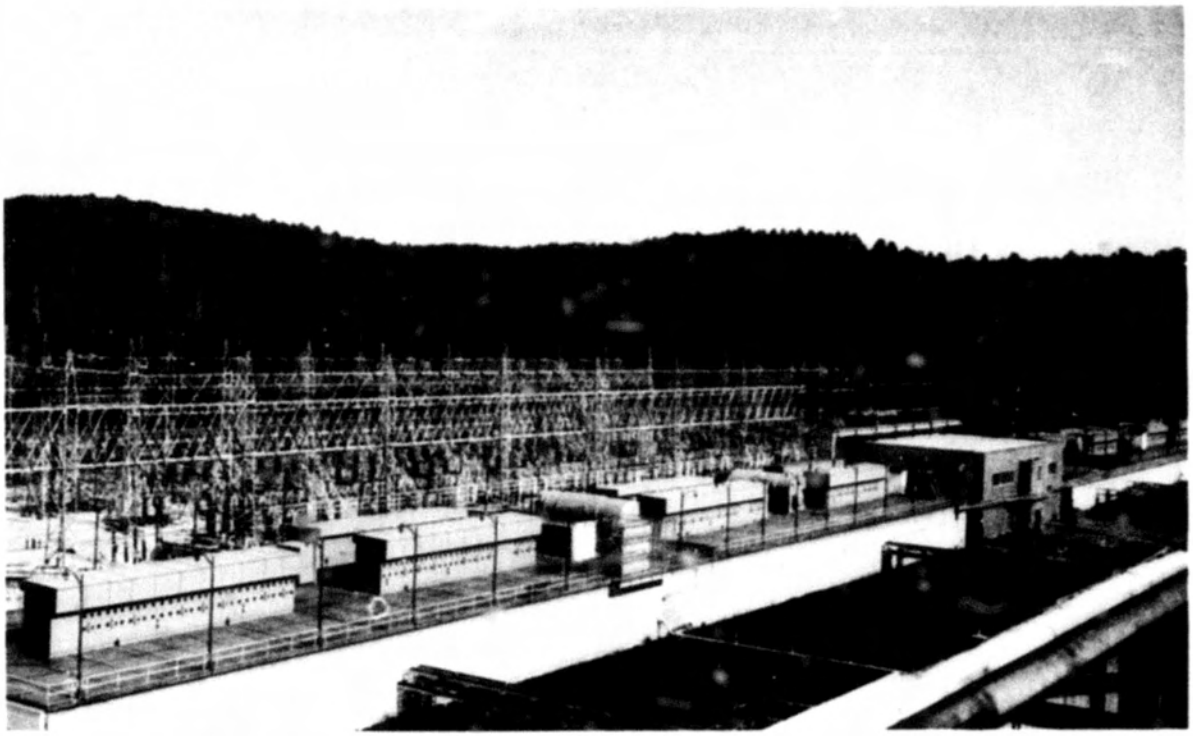


Fig. 3.29. Electrical substation and high-voltage transmission lines.

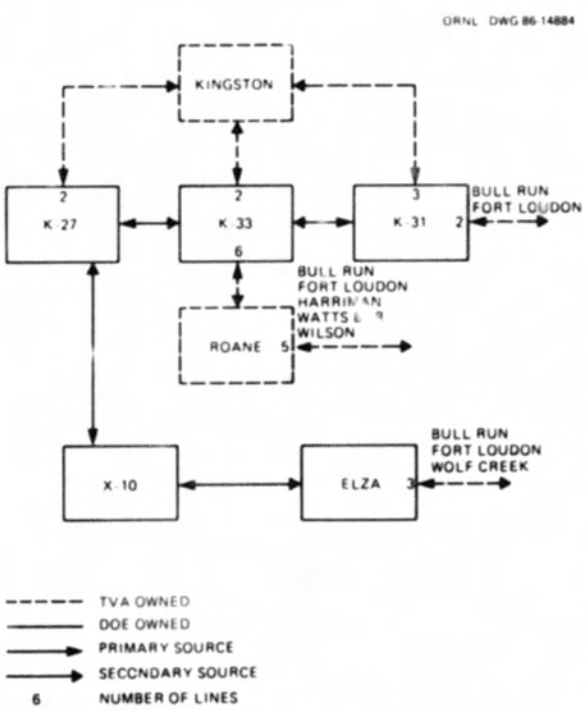


Fig. 3.30. Diagram of the Oak Ridge area 161-kV electrical system.

at three pumping stations and from Poplar Creek at one station (Fig. 3.32). Two of the pumping stations serving ORGDP are located at km 18.5 (mile 11.5) and km 23.3 (mile 14.5) on the Clinch River in waters impounded by Watts Bar Dam. The Poplar Creek station, located approximately 5.6 km (3.5 miles) upstream from the mouth of Poplar Creek, is in standby. The other station at km 67.1 (mile 41.7) on the Clinch River (Melton Hill Lake) provides the water supply for the system that serves Y-12, ORNL, the Scarboro Facility, and the City of Oak Ridge.

The sanitary water system at ORGDP consists of the pumping station at km 23.3 (mile 14.5), a treatment facility located approximately 2.4 km (1.5 miles) south of ORGDP (Fig. 3.33), storage tanks, and distribution lines (Figs. 3.34 and 3.35). Raw water from the Clinch

Table 3.8. Classification of transmission lines on the Oak Ridge Reservation

Description	Voltage (kV)	Length		Tower construction materials
		km	(miles)	
TVA lines crossing the Reservation but not terminating at DOE substations				
Roane/Wilson	500	2.1	(1.3)	Steel
Watts Bar/Roane	500	11.1	(6.9)	Steel
Roane/Harriman	161	4.2	(2.6)	Wood
Norris/Oak Ridge	161	3.5	(2.2)	Wood
Bull Run/Oak Ridge	161	6.1	(3.8)	Steel
Bull Run/North Knox. No. 1	161	3.9	(2.4)	Steel
Bull Run/Lonsdale No. 2	161	3.9	(2.4)	Steel
Bull Run/Alcoa	161	3.9	(2.4)	Steel
Fort Loudon/Roane	161	10.1	(6.3)	Steel
TVA lines terminating at DOE substations				
Bull Run/Elza	161	12.6	(7.8)	Steel/wood
Bull Run/K-31	161	30.6	(19.0)	Steel
Wolf Creek/Elza	161	5.0	(3.1)	Steel
Fort Loudon/Elza	161	14.5	(9.0)	Wood
Fort Loudon/K-31	161	7.6	(4.7)	Wood
Kingston 1/K-27	161	2.6	(1.6)	Steel
Kingston 2/K-27	161	2.6	(1.6)	Steel
Kingston 1/K-31	161	1.3	(0.8)	Steel
Kingston 2/K-31	161	1.3	(0.8)	Steel
Kingston 3/K-31	161	1.0	(0.6)	Steel
Kingston 1/K-33	161	1.0	(0.6)	Steel
Kingston 2/K-33	161	1.0	(0.6)	Steel
Roane 1/K-33	161	2.6	(1.6)	Steel
Roane 2/K-33	161	2.7	(1.7)	Steel
Roane 3/K-33	161	3.1	(1.9)	Steel
Roane 4/K-33	161	3.1	(1.9)	Steel
Roane 5/K-33	161	3.2	(2.0)	Steel
Roane 6/K-33	161	3.2	(2.0)	Steel
DOE substation tie lines				
X-10/Elza	161	9.8	(6.1)	Wood
X-10/K-25	161	11.4	(7.1)	Wood
K-25/K-27	161	1.8	(1.1)	Steel
K-27/K-33	161	2.7	(1.7)	Steel
K-31/K-33	161	0.5	(0.3)	Steel
Elza/Y-12 No. 1	161			Steel/wood
Elza/Y-12 No. 2[a]	161	8.9	(5.5)	Steel/wood
Elza/Y-12 No. 3	161			Steel/wood

[a]Presently de-energized.

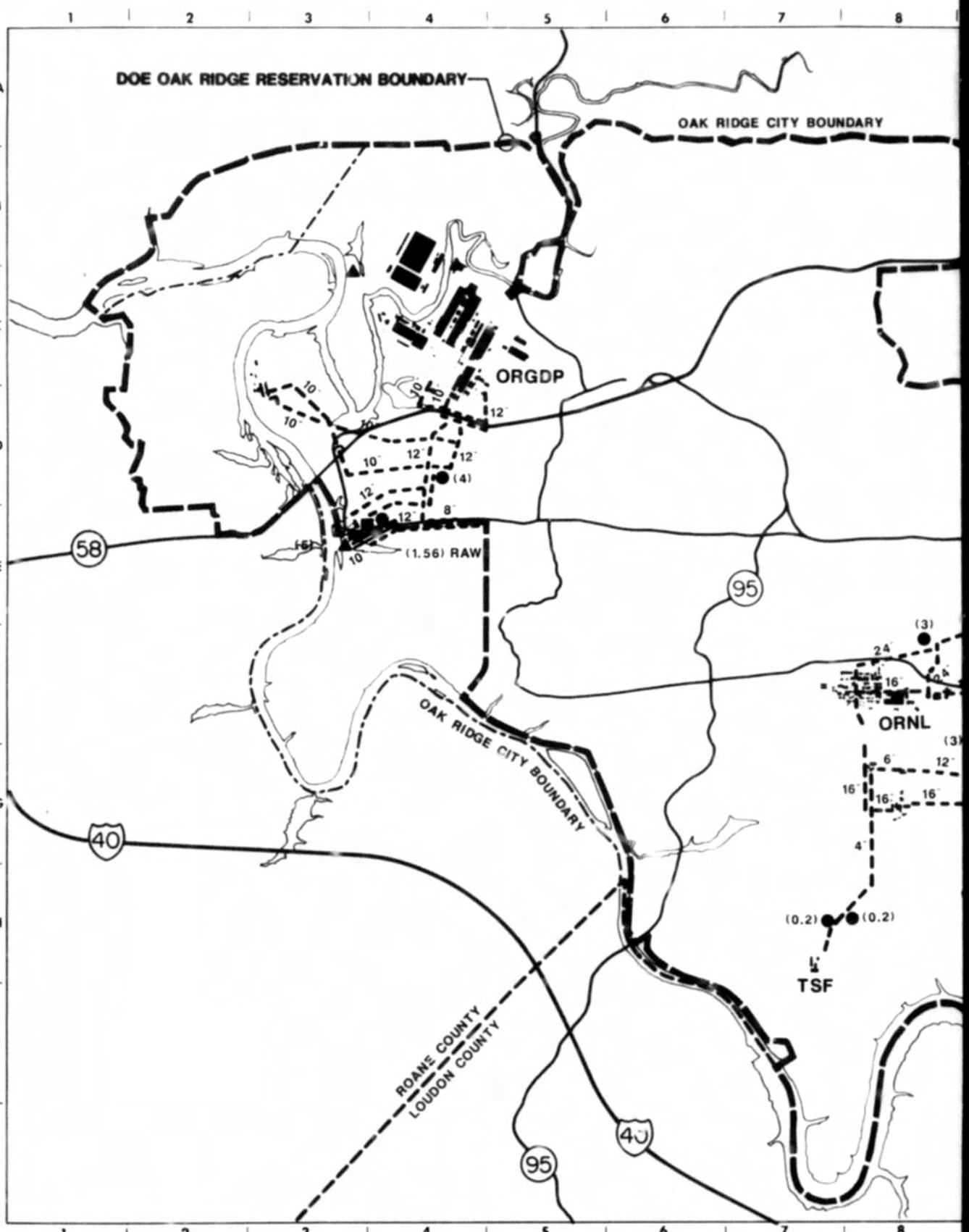
ORNL PHOTO 5007-86

Fig. 3.31. Typical right-of-way for electrical transmission lines (looking east toward Bull Run Steam Plant).

River is pumped to a 568-kL (150,000-gal) storage tank before flowing by gravity to the treatment plant, which has an actual pumping capacity of 16,277 kL/d (4.3 million gal/d) and a filtering capacity of 31,040 kL/d (8.2 million gal/d). Water from the treatment plant is pumped to two storage tanks with 9463- and 5678-kL (2.5-million- and 1.5-million-gal) capacities, respectively. The elevation of the storage tanks on Pine Ridge is sufficient to provide gravity flow of sanitary water to the main plant area and to the Powerhouse area of ORGDP, the Oak Ridge city industrial area, and the former CRBRP site.

Although the primary use of sanitary water in the main plant area is for potable and process purposes, it is also used in the fire water system for the Powerhouse area. The reasons for potable water demand are self-explanatory, and processes requiring sanitary water include such operations as production of steam, preparation of metal treatment and cleaning solutions, chemical processing, laboratory use, laundry purposes, and once-through cooling.

Raw water for the DOE water treatment plant, which is located near Y-12, is supplied from the pumping station on Melton Hill Lake through a 42-in. pipe and a 36-in. pipe for a distance of about 915 m (3000 ft) (Fig. 3.36). The 36-in. ductile cast iron pipe was added in 1982 to provide a backup supply line in the event of failure of the 42-in. reinforced concrete pipe. At the 915-m (3000-ft) point, the


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
ORGDP
(4)
(1.56) RAW
58
95
40
(3)
ORNL
OAK RIDGE CITY BOUNDARY
(0.2)
(0.2)
TSF
ROANE COUNTY
LOUDON COUNTY
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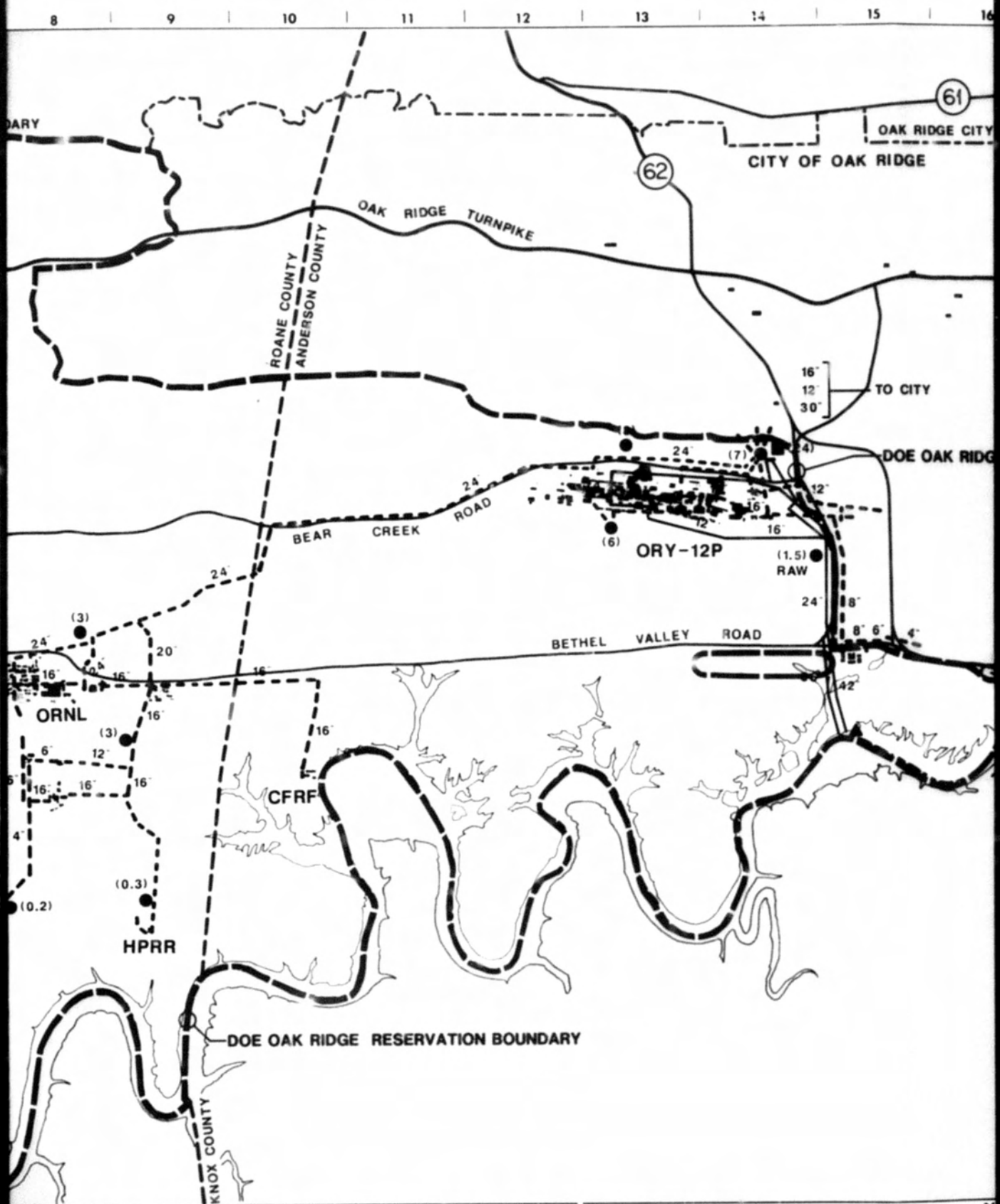
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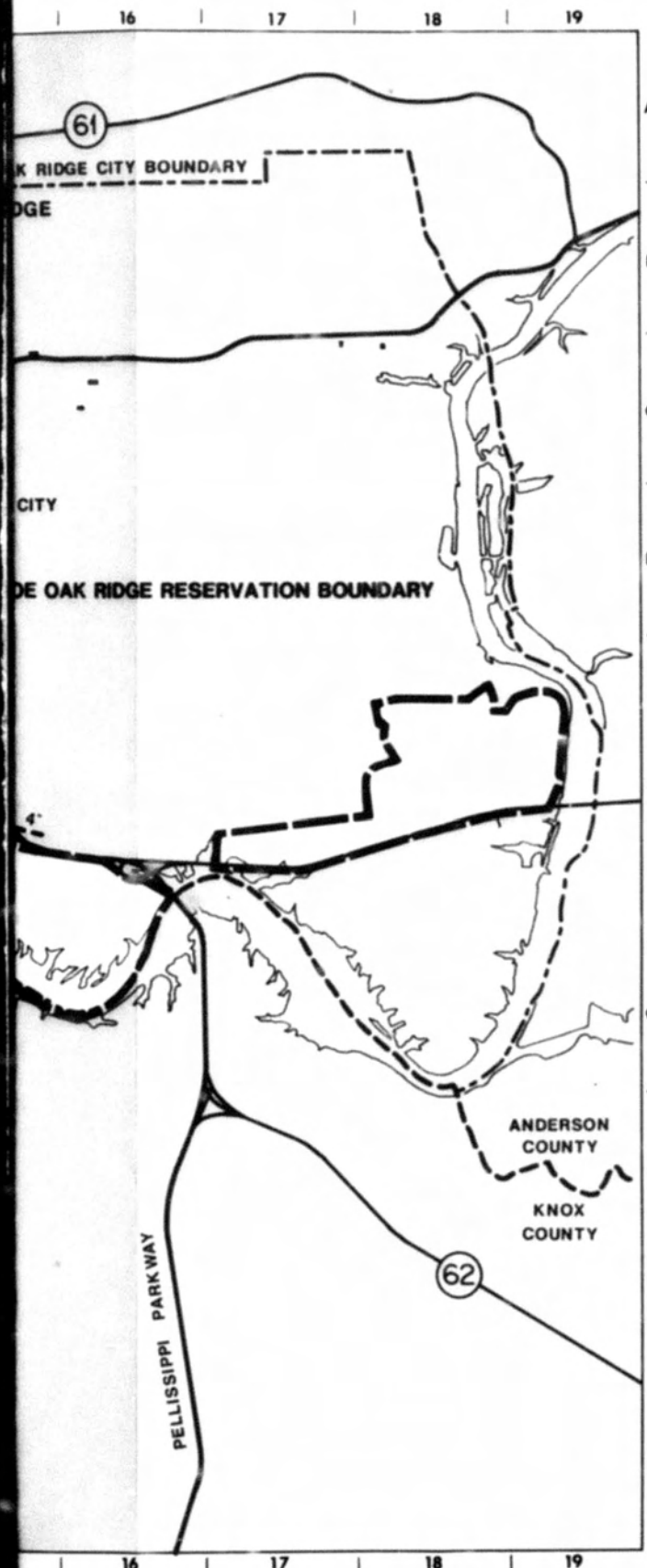
OAK RIDGE CITY
CITY OF OAK RIDGE
OAK RIDGE TURNPIKE
ROANE COUNTY
ANDERSON COUNTY
TO CITY
DOE OAK RIDG
BEAR CREEK ROAD
ORY-12P
RAW
BETHEL VALLEY ROAD
ORNL
CFRF
HPRR
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL DWG 86-14629



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- SANITARY WATER & SIZE
- RAW WATER & SIZE
- TREATMENT PLANT (Mgd)
- RESERVOIR (MILLIONS OF GALLONS)
- RIVER PUMPING STATION

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.32

RAW AND TREATED WATER

ORNL PHOTO 5753-83

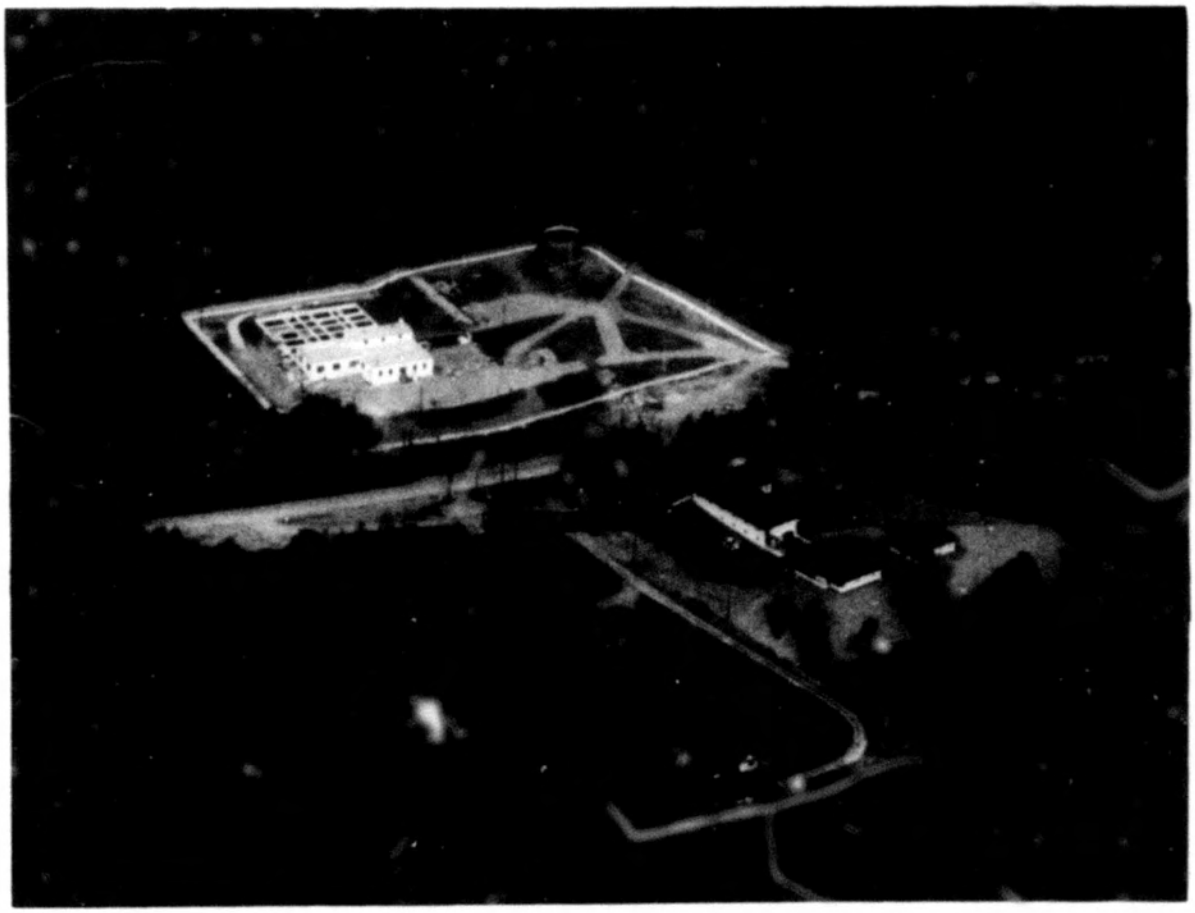


Fig. 3.33. Water treatment facility at Oak Ridge Gaseous Diffusion Plant (looking north toward ORGDP).

lines change to two 24-in. pipelines that carry the water an additional 1.8 km (1.1 miles) to a 5678-kL (1.5-million-gal) storage tank and booster pumping station east of Y-12. From this station, the raw water is pumped about 1,220 m (4,000 ft) to a 90,850-kL/d (24-million-gal/d) treatment facility located on Pine Ridge, just north of Y-12 (Fig. 3.37). This treatment facility supplies sanitary water through two storage reservoirs with a combined capacity of 26,498 kL (7 million gal) to Y-12, ORNL, the Scarboro Facility, and the City of Oak Ridge.

Raw water is routed to Y-12 by the original 1943 16-in. main from the booster station and an 18-in. main from the east 24-in. filtration plant supply line. These lines form a loop of varying pipe sizes through the plant. Raw water is used primarily for ash sluicing at the steam plant and for cooling tower makeup. A daily average of approximately 9085 kL (2.4 million gal) of raw water is used at Y-12.

One 24-in. and two 16-in. water mains extend from the treatment facility to Y-12. Two 5678-kL (1.5-million-gal) reser-

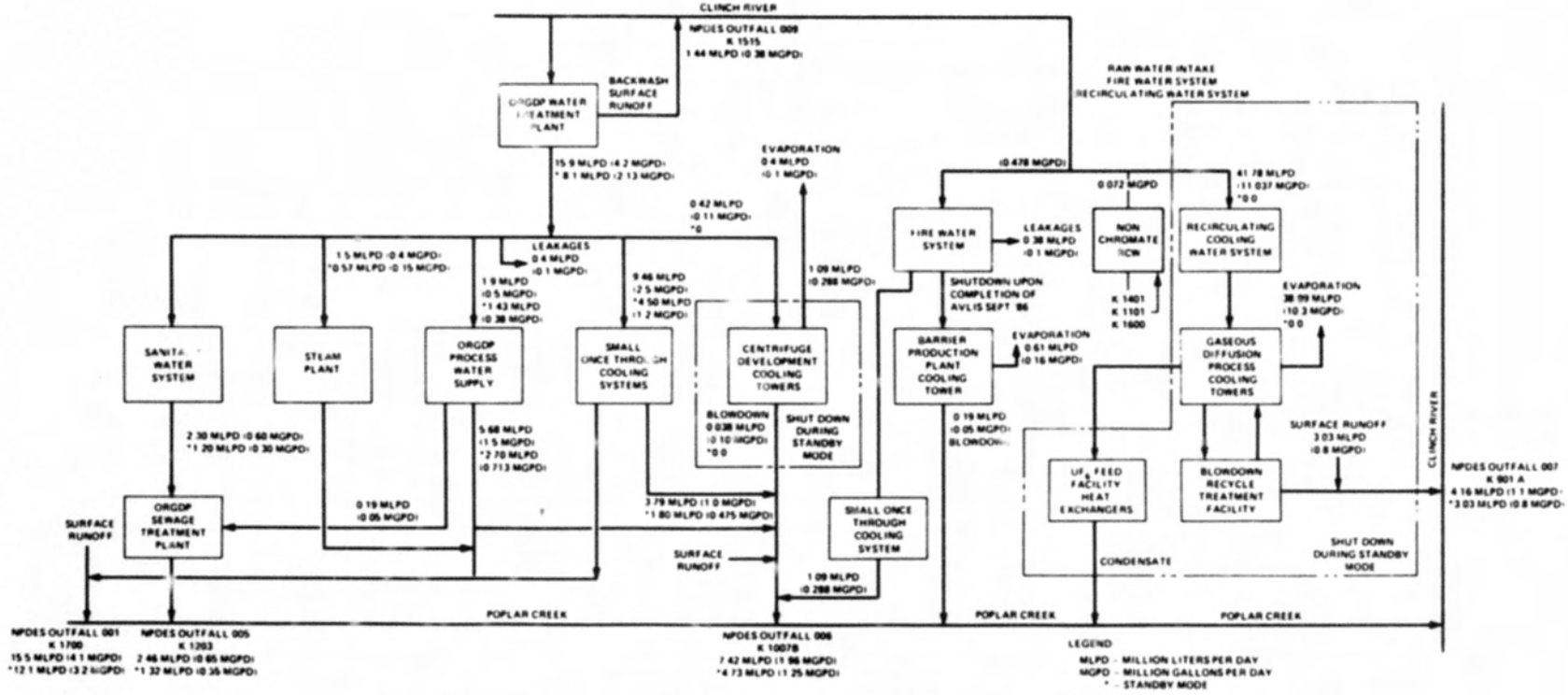


Fig. 3.34. Water supply and discharge for Oak Ridge Gaseous Diffusion Plant.

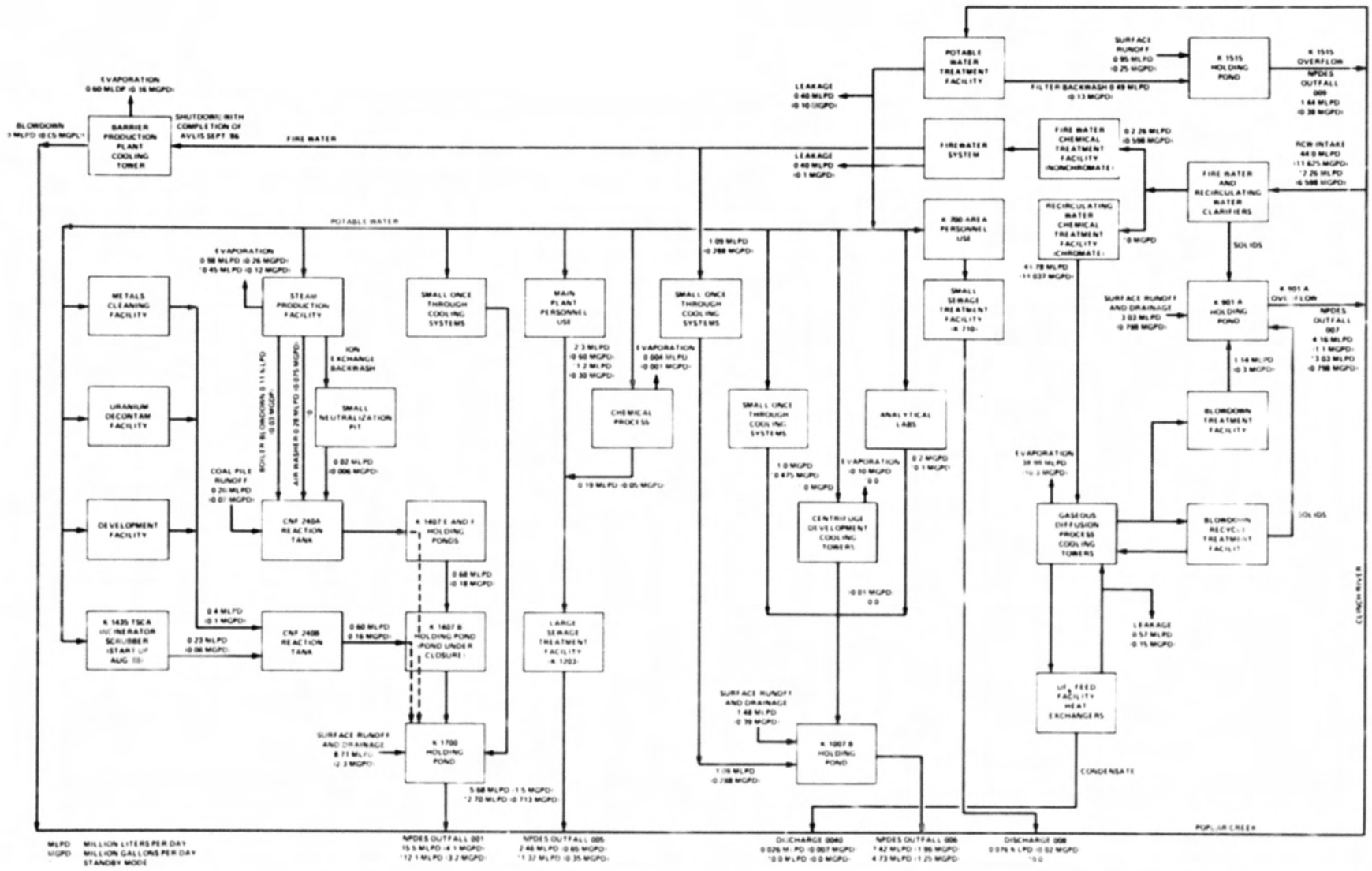


Fig. 3.35. Detailed diagram for water supply and discharge for Oak Ridge Gaseous Diffusion Plant.

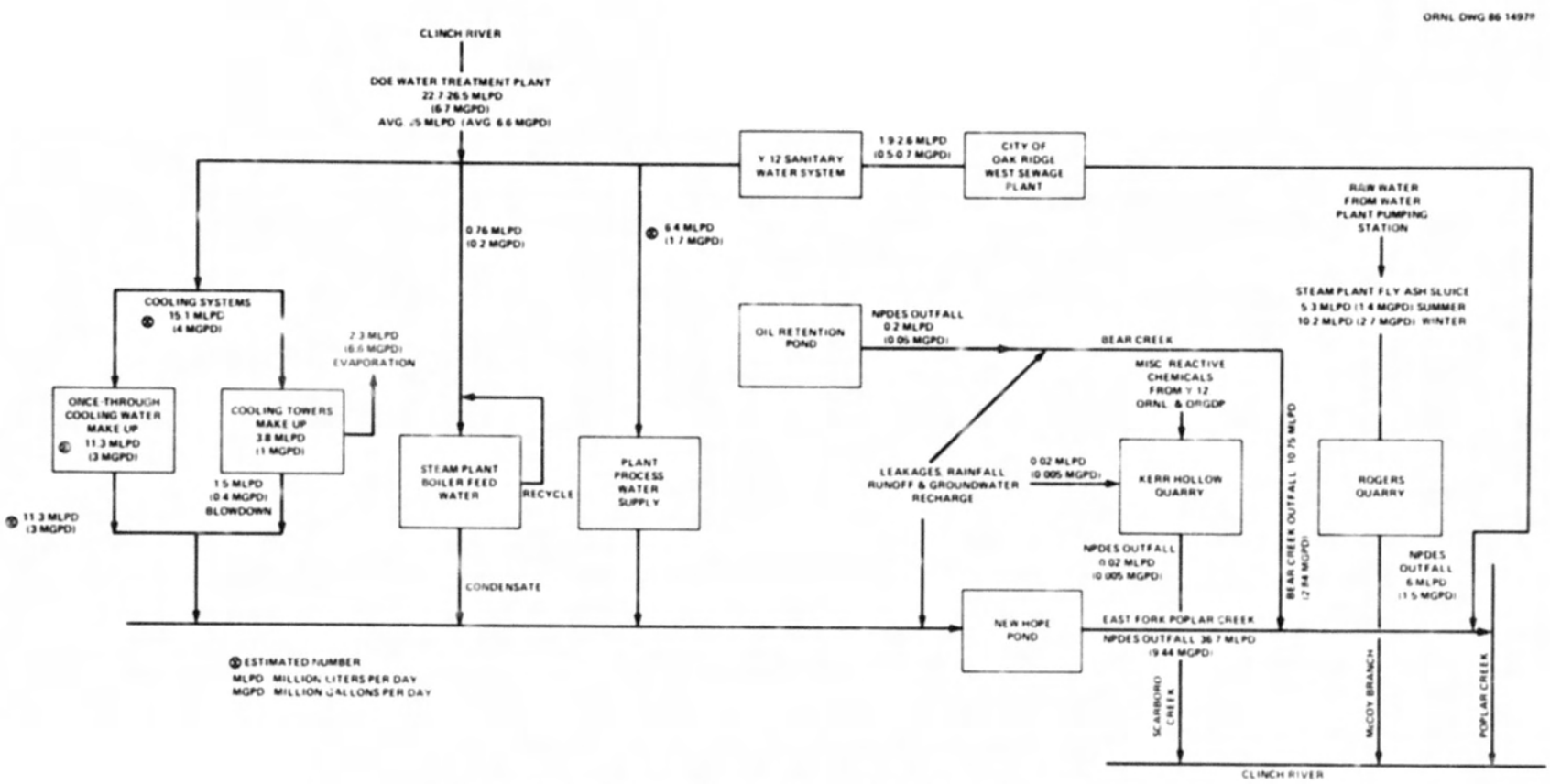


Fig. 3.36. Water supply and discharge for the Y-12 Plant.

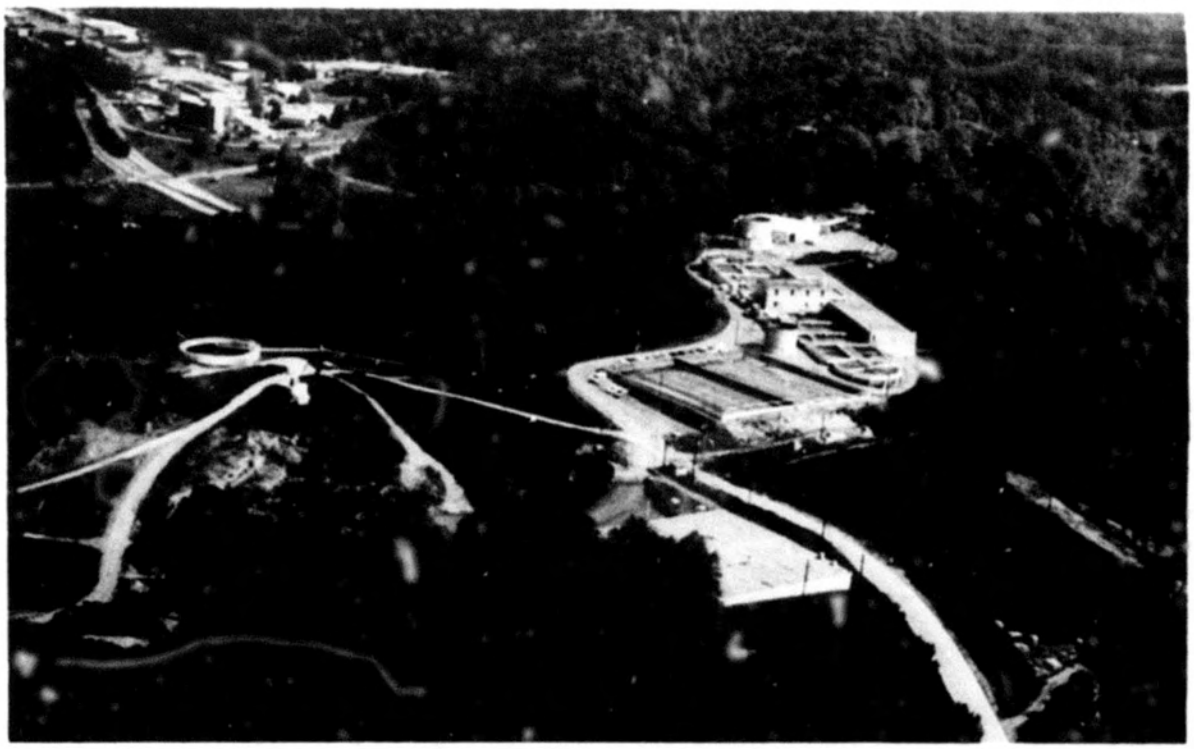


Fig. 3.37. Water treatment plant at Y-12 (looking east).

voir tanks located just north of Bear Creek Road and about midlength of Y-12 connect to the 24-in. main, which also continues to the ORNL booster station and ORNL. Three additional emergency water storage tanks are located on the south side of Y-12 along the South Patrol Road and Chestnut Ridge. Each tank has a capacity of 7571 kL (2 million gal) and is connected to the Y-12 sanitary water distribution system with two 24-in. mains. The storage tanks are isolated from the piping system by motor-operated valves that are interlocked with the plant monitoring system and with low-pressure switches in the plant water system. In the event of low line pressure coinciding with a fire alarm, the valves open and make the stored water available for emergency use. The sanitary water distribution system at Y-12 supplies water for potable purposes, the fire protection system, process facilities, and boiler feed at the steam plant. The average sanitary water usage for the entire plant is approximately 26,500 kL/d (7 million gal/d).

Sanitary water is supplied to ORNL by a 24-in. main from the treatment facility at Y-12 (Fig. 3.38). From the ORNL booster station, the 24-in. main is routed along Bear Creek Road near the Anderson-Roane county line and then in a southwesterly direction across Chestnut Ridge to an 11,356-kL (3-million-gal) reservoir. Another 11,356-kL reservoir located on Haw Ridge is supplied by a 20-in. line connected to the 24-in. main. From these two systems, which are interconnected by check and regulating valves,

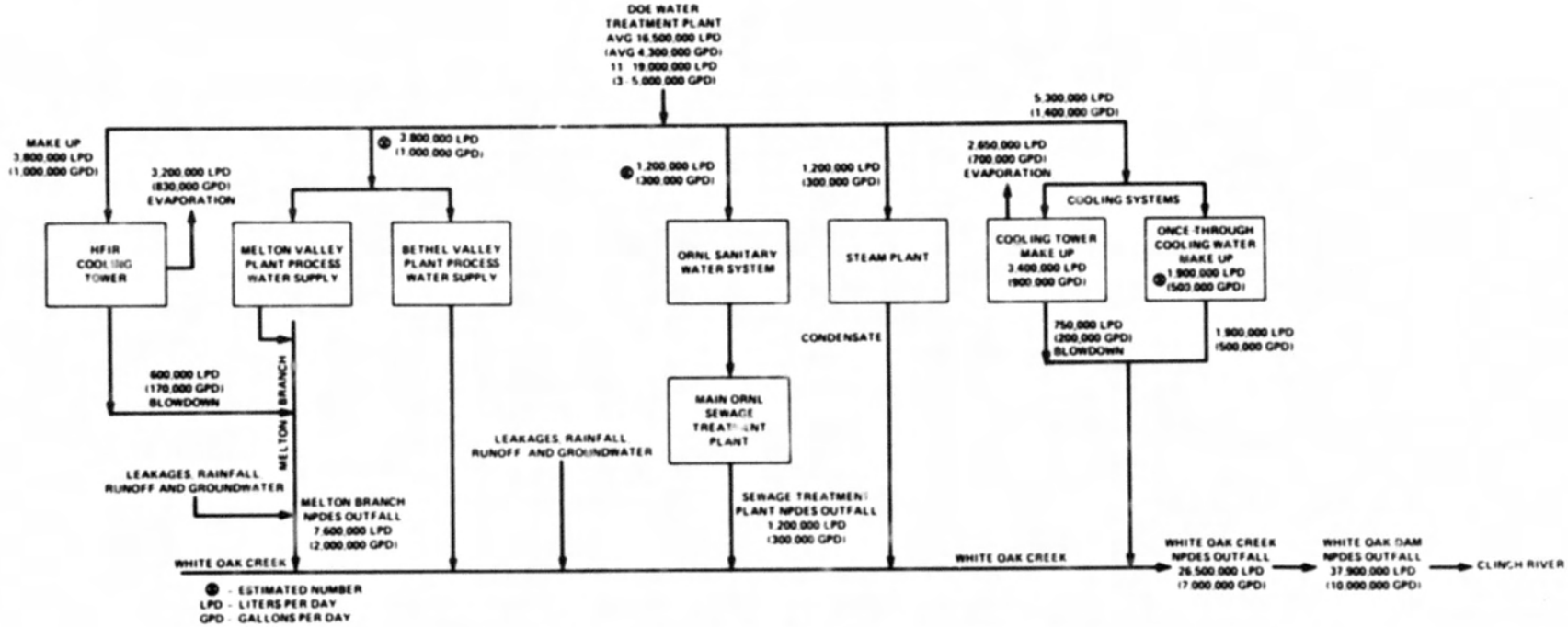


Fig. 3.38. Water supply and discharge for Oak Ridge National Laboratory.

water flows by gravity into the Laboratory's distribution system. Outlying facilities such as the Tower Shielding Facility (TSF), the Health Physics Research Reactor (HPRR), and the Consolidated Fuel Reprocessing Facility are also served via this distribution system as well as through their own storage tanks.

Sanitary water at ORNL is used for potable purposes, fire protection, and process purposes. The average sanitary water usage at ORNL is approximately 16,353 kL/d (4.32 million gal/d).

The Scarboro Facility, located at the intersection of Bethel Valley Road and Scarboro Road, receives its sanitary water from an extension of the Y-12 distribution system. An 8-in. water line is routed from the east end of Y-12 and then along the east side of Scarboro Road to the Scarboro Facility. This 8-in. line also ties to the water line serving Oak Ridge's Valley Industrial Park.

The City of Oak Ridge receives its entire water supply from the DOE treatment facility at Y-12. Three interconnected main lines (12, 16, and 30 in.) leave the treatment facility to form the city's distribution system. The FOB and other DOE facilities within the city limits obtain their sanitary water from the city's distribution system. The Valley Industrial Park, located east of Y-12 along Union Valley Road, is served by a 12-in. water line that is routed along the south side of Bear Creek Road and the west side of Scarboro Road. In FY 1982 the City of Oak Ridge purchased approximately 5.773 million kL (1.525 billion gal) of sanitary water from DOE.

3.4.2.3 Natural Gas

Natural gas is supplied to the ORR by the East Tennessee Natural Gas Company (ETNGC). A 22-in. main enters the Reservation from Knox County and crosses Melton Hill Lake at Clinch River km 66.7 (mile 41.4) to Valve Station C located along Bethel Valley Road about 0.32 km (0.2 miles) west of Scarboro Road (Fig. 3.39). From Station C, the main extends 8.5 km (5.3 miles) west along Bethel Valley Road to Station B, north of ORNL, and then turns northwesterly across Chestnut Ridge and Pine Ridge for an additional 6.4 km (4.0 miles) to Station A near State Highway 58 and Blair Road. Two mains continue across the Reservation from Station A, one in a northwesterly direction along Blair Road to Harriman and the other in a southwesterly direction to Lenoir City.

ETNGC owns, operates, and maintains the main line and the three pressure-reducing stations. Flow meters equipped with recorders are installed at each station and are serviced each day. DOE has delegated management responsibility to ORGDP, which includes maintaining flow conditions within the contract limitations.

The contracted quantity of gas furnished upon demand cannot exceed 39,200 m^3/d (1.4 million ft^3/d). ETNGC can authorize additional usage to a maximum of 213,752 m^3/d (7.634 million ft^3/d). However, authorization for additional usage can be cancelled with a 4-h notice. In addition, a penalty charge is imposed on DOE for an unauthorized overrun volume exceeding 3% per day.

ETNGC main line pressure of 450 to 600 psig is first reduced to 250 psig for Stations A and C. Then the pressure is further reduced to 65 to 125 psig at Stations A and C for distribution to ORGDP and Y-12. Station B reduces the pressure to 100 psig before distribution is made to ORNL.

From Station C, an abandoned 22-in. main extends west along State Highway 58 and then to the Powerhouse area. A 6-in. branch line from the 22-in. main serves the northeast section of ORGDP. In 1982 ORGDP used approximately 2.9 million m^3 (105 million ft^3) of natural gas.

A 14-in. line is routed from Station C to the southeast corner of the Y-12 perimeter fence. From this point, an 8-in. line feeds the steam plant and a 6-in. branch line serves process buildings and laboratories in the east portion of Y-12. The west portion of the plant is served by 4-in. and 2-in. headers from the steam plant. Approximately 689,000 m^3 (24.6 million ft^3) of natural gas was used at Y-12 in 1982.

Natural gas is routed from Station B via a 6-in. line (primarily above ground) to the ORNL steam plant, where the pressure is reduced to 20 psig. The gas pressure to the main area is 5 psig for low-pressure-system distribution and is further reduced at points of special use. ORNL used approximately 3.5 million m^3 (125 million ft^3) of natural gas in 1982.

3.4.2.4 Telecommunications

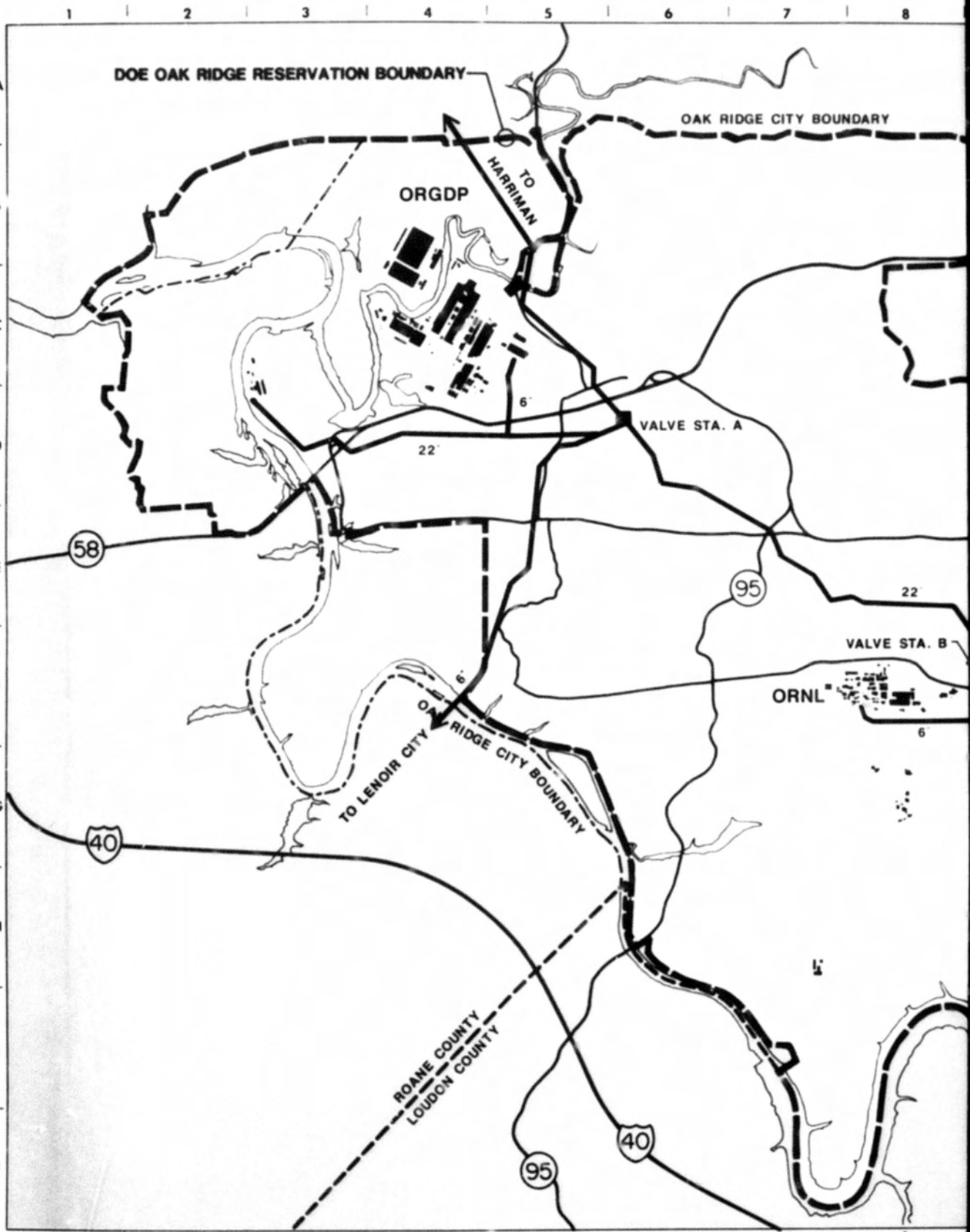
Telecommunications on the ORR is organized into seven programs: (1) voice communications, (2) data communications, (3) frequency-spectrum-dependent activity, (4) teleconferencing, (5) safety, surveillance, and energy conservation, (6) communications security (COMSEC), and (7) national security and emergency preparedness. Figure 3.40 shows the location of telecommunications components on the ORR.

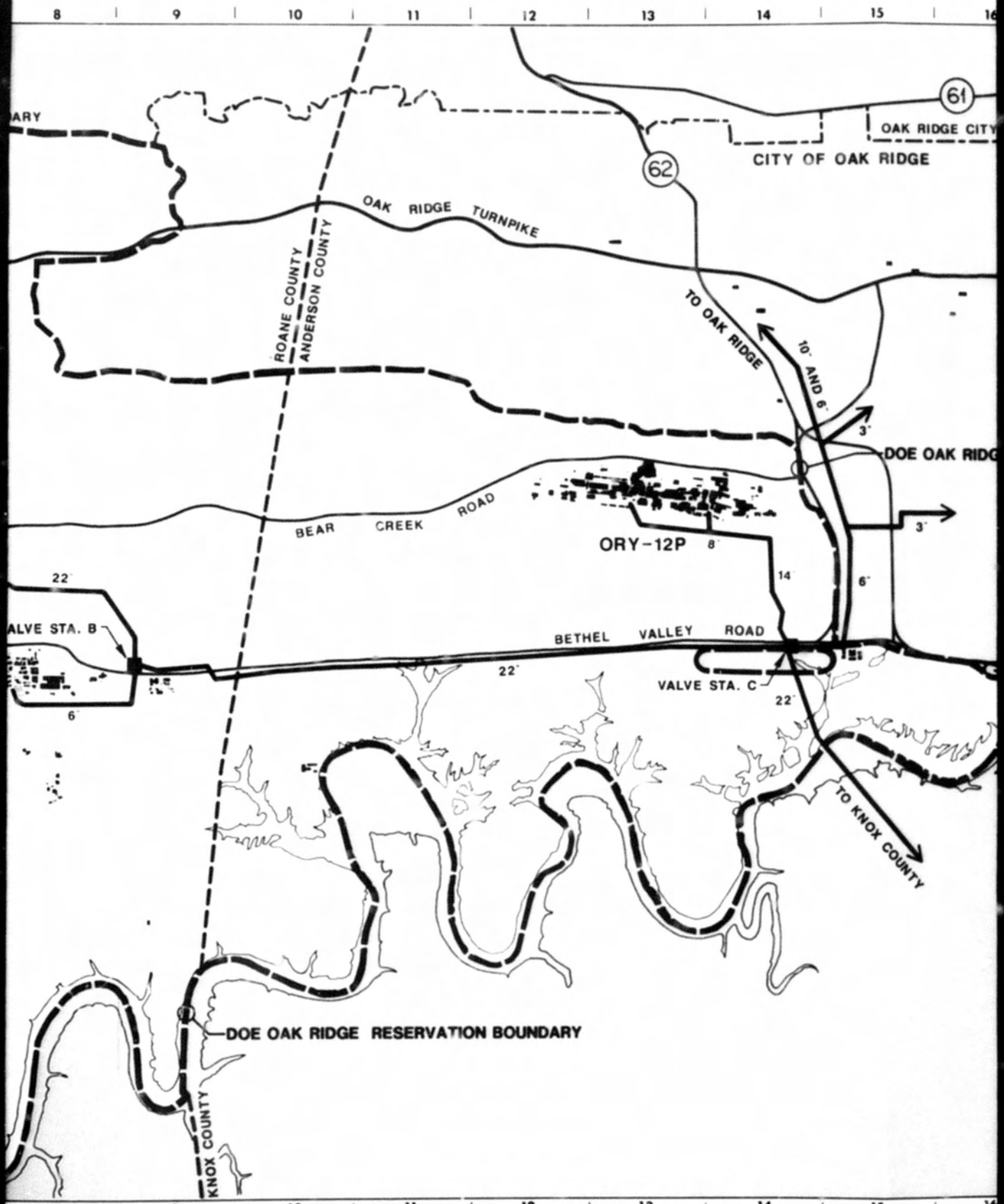
In addition to DOE and the operating contractor, other organizations that have telecommunications responsibilities on the ORR include South Central Bell (SCB), AT&T, and other communications vendors.

Voice communications. In January 1979, SCB installed a new telephone system to serve DOE facilities in Oak Ridge. A system of buried cable, repeater lines, and subscriber line carriers connects the DOE facilities to SCB's central office in the Oak Ridge business district. The system provides two-way voice channels on two pairs of wires (one pair for transmission in each direction). The DOE facilities are linked by a trunking system that ensures that no facility is totally cut off from communications with other DOE facilities and other areas. Figure 3.41 shows the distances between the various DOE facilities and SCB's central office.

The Official Oak Ridge Telephone System (OORTS) serves over 35 major organizations in addition to DOE and the primary operating contractor. These include other governmental agencies with offices in Oak Ridge such as the Civil Service Commission, the Commerce Department, other government contractors, architect-engineering firms, and other companies. At the three major facility sites, there are 14,480 main stations and 2,499 telephone extensions. Most have the capability to access the Oak Ridge calling area, Knoxville, and the Federal Telecommunications System network. In addition to switched-voice facilities, the OORTS also includes over 7500 two- and four-wire private line circuits that are dedicated to a variety of voice, data, security, and other applications.

Data communications. An unclassified intersite broadband communications network originates at ORNL and connects that site with Y-12, ORGDP, ORO, and OSTI via coaxial cable. (A spare cable, which has not been activated, connects


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
TO HARRIMAN
ORGDP
6"
VALVE STA. A
22"
58
95
22"
VALVE STA. B
ORNL
6"
6"
OAK RIDGE CITY BOUNDARY
TO LENOIR CITY
40
ROANE COUNTY
LOUDON COUNTY
40
95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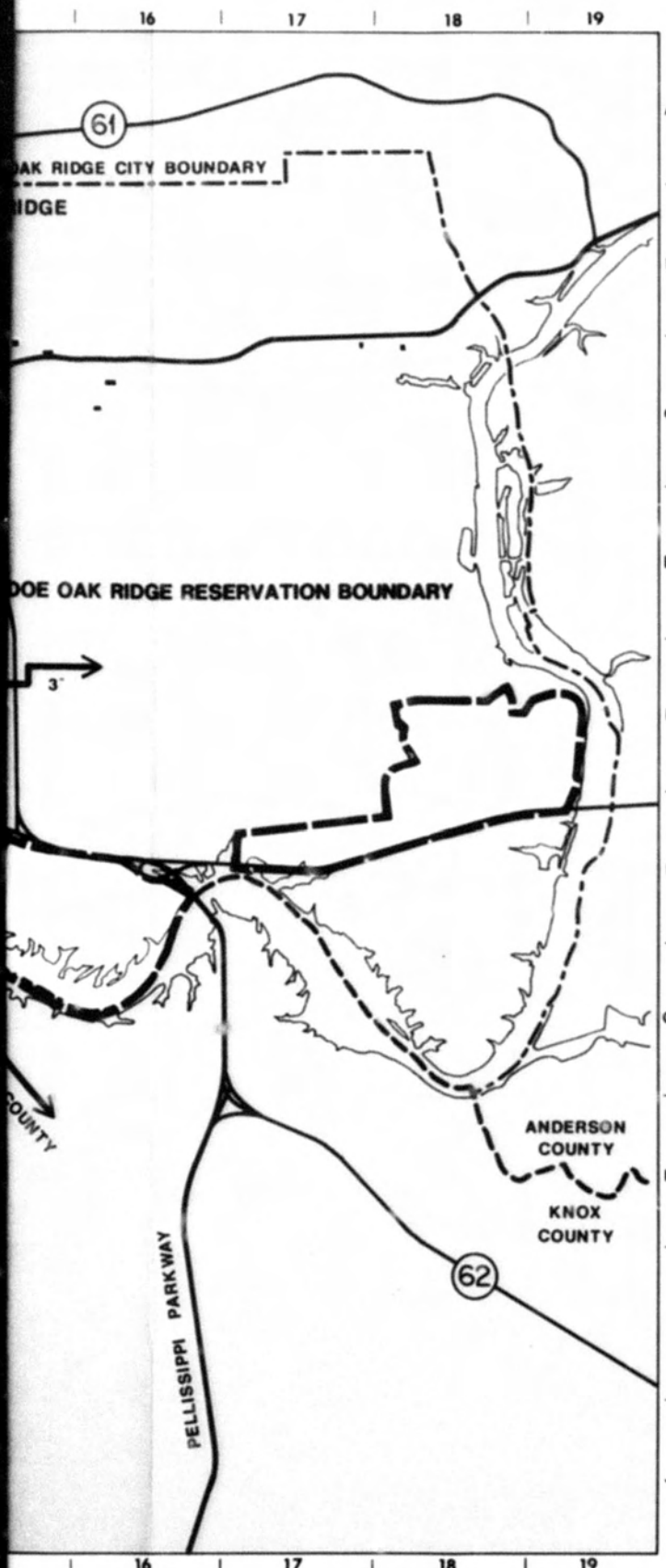
OAK RIDGE CITY
CITY OF OAK RIDGE
OAK RIDGE TURNPIKE
ROANE COUNTY
ANDERSON COUNTY
TO OAK RIDGE
10" AND 6"
3"
DOE OAK RIDG
BEAR CREEK ROAD
ORY-12P
8"
14"
6"
3"
22"
VALVE STA. B
BETHEL VALLEY ROAD
22"
VALVE STA. C
22"
6"
TO KNOX COUNTY
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL DWG 86-14631



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

22" NATURAL GAS & SIZE

VALVE STATION

kilometers 0 1 2 3

0 1 2 miles

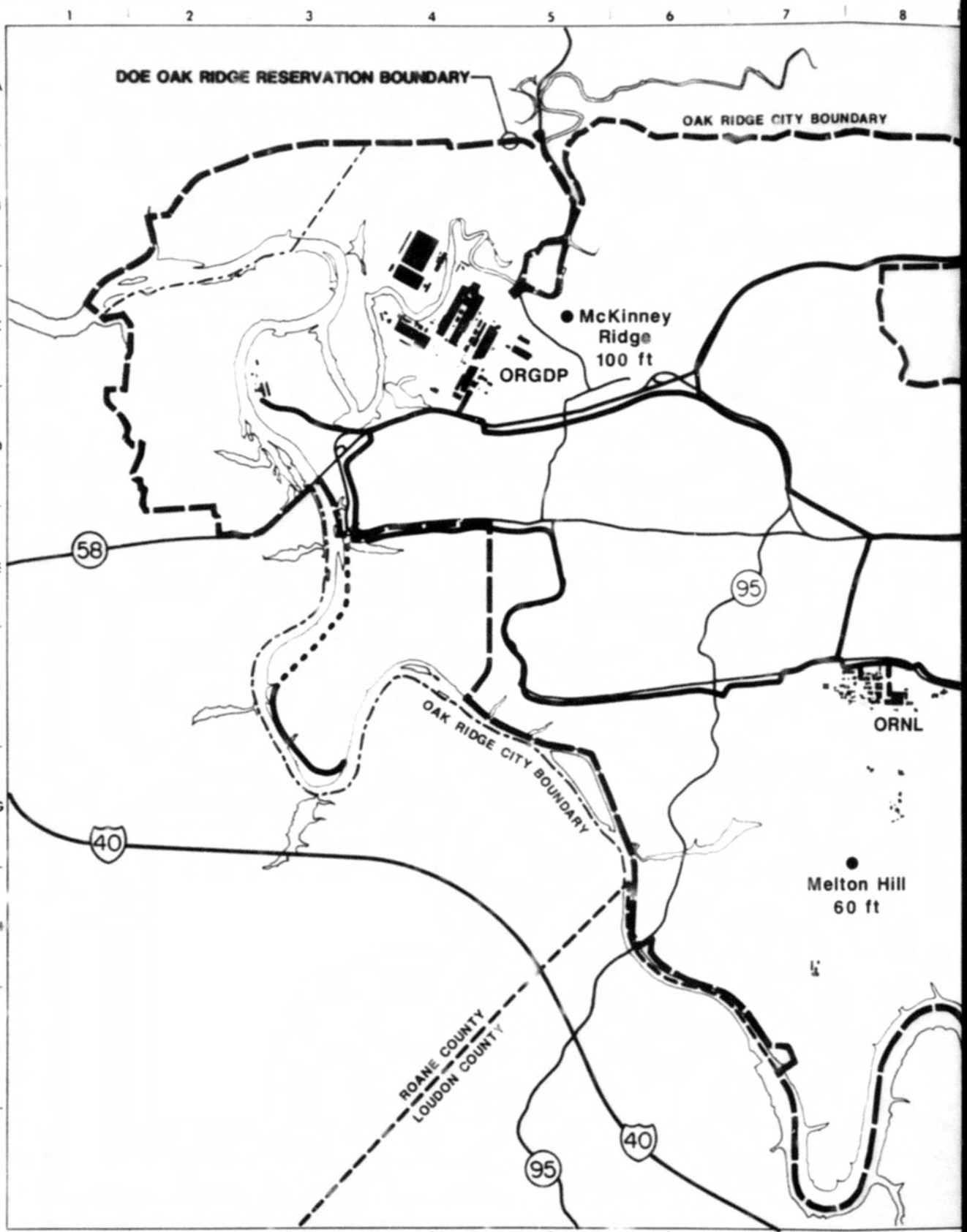
NORTH

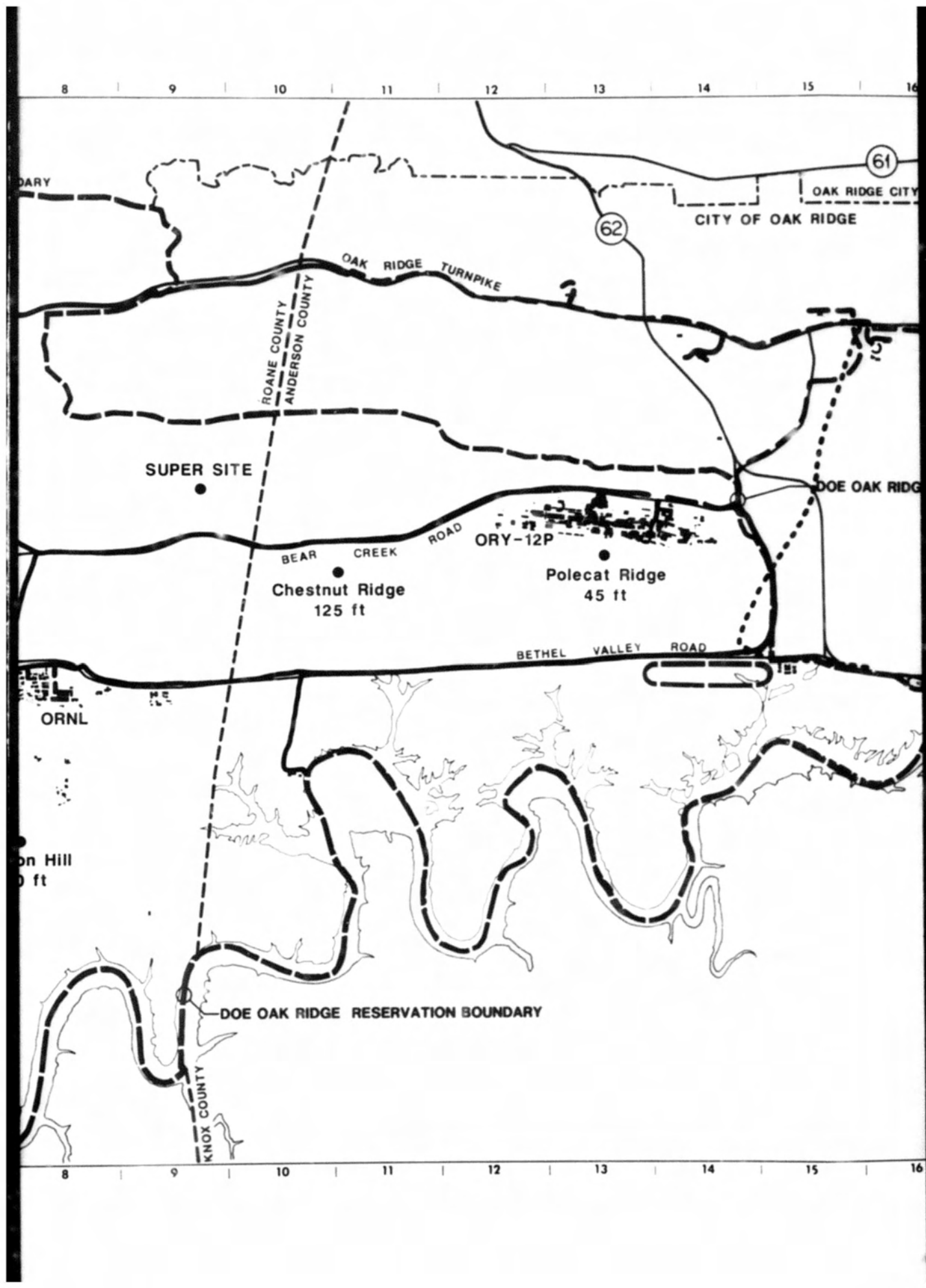
TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.39

NATURAL GAS


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
McKinney Ridge 100 ft
ORGDP
58
95
ORNL
OAK RIDGE CITY BOUNDARY
40
Melton Hill 60 ft
ROANE COUNTY
LOUDON COUNTY
40
95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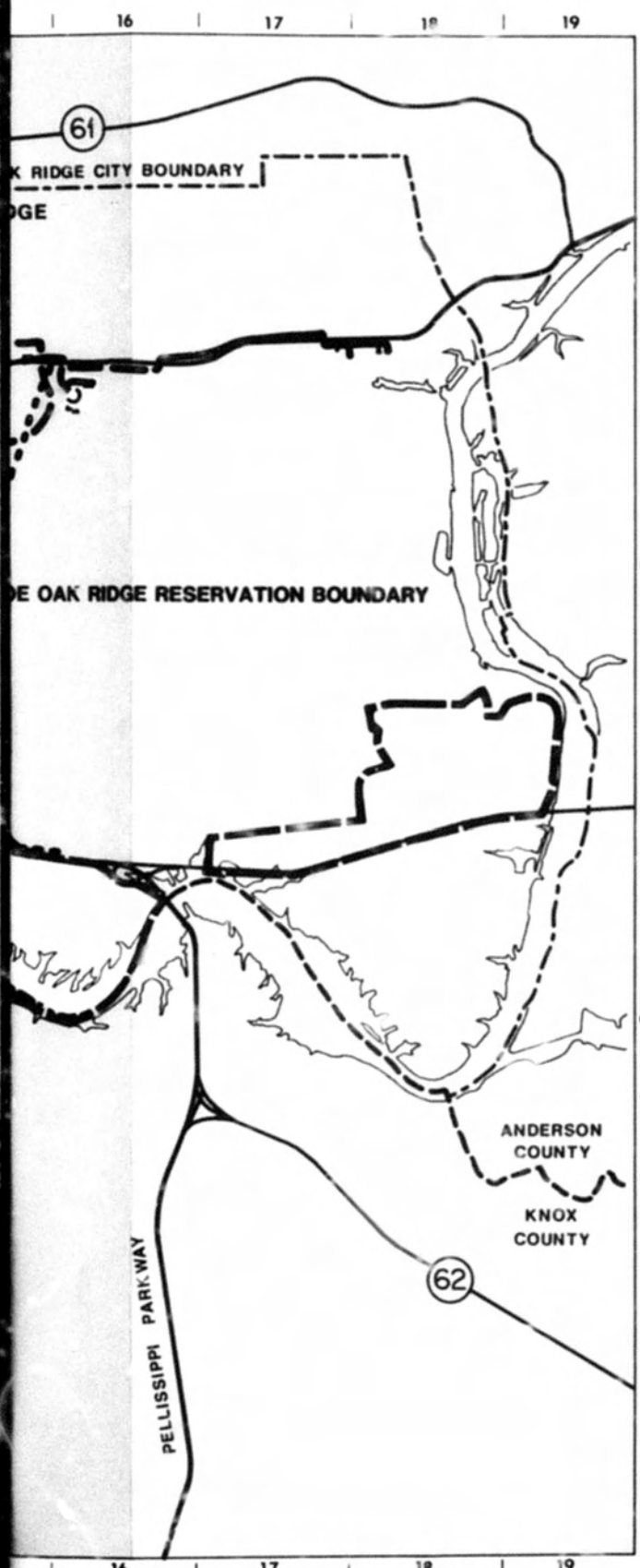
OAK RIDGE CITY
CITY OF OAK RIDGE
OAK RIDGE TURNPIKE
ROANE COUNTY
ANDERSON COUNTY
SUPER SITE
DOE OAK RIDG
BEAR CREEK ROAD
ORY-12P
Chestnut Ridge
125 ft
Polecat Ridge
45 ft
BETHEL VALLEY ROAD
ORNL
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL DWG 86-14627



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- CONDUIT
- BURIED CABLE
- AERIAL CABLE
- SATELLITE DISH
- 125ft — RADIO TOWER LOCATIONS AND TOWER HEIGHTS
  1. Back-up sites are located within each plant area
  2. "SUPER SITE" in block D9 is potential site for 500' antenna for proposed trunking system

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.40

TELECOMMUNICATIONS

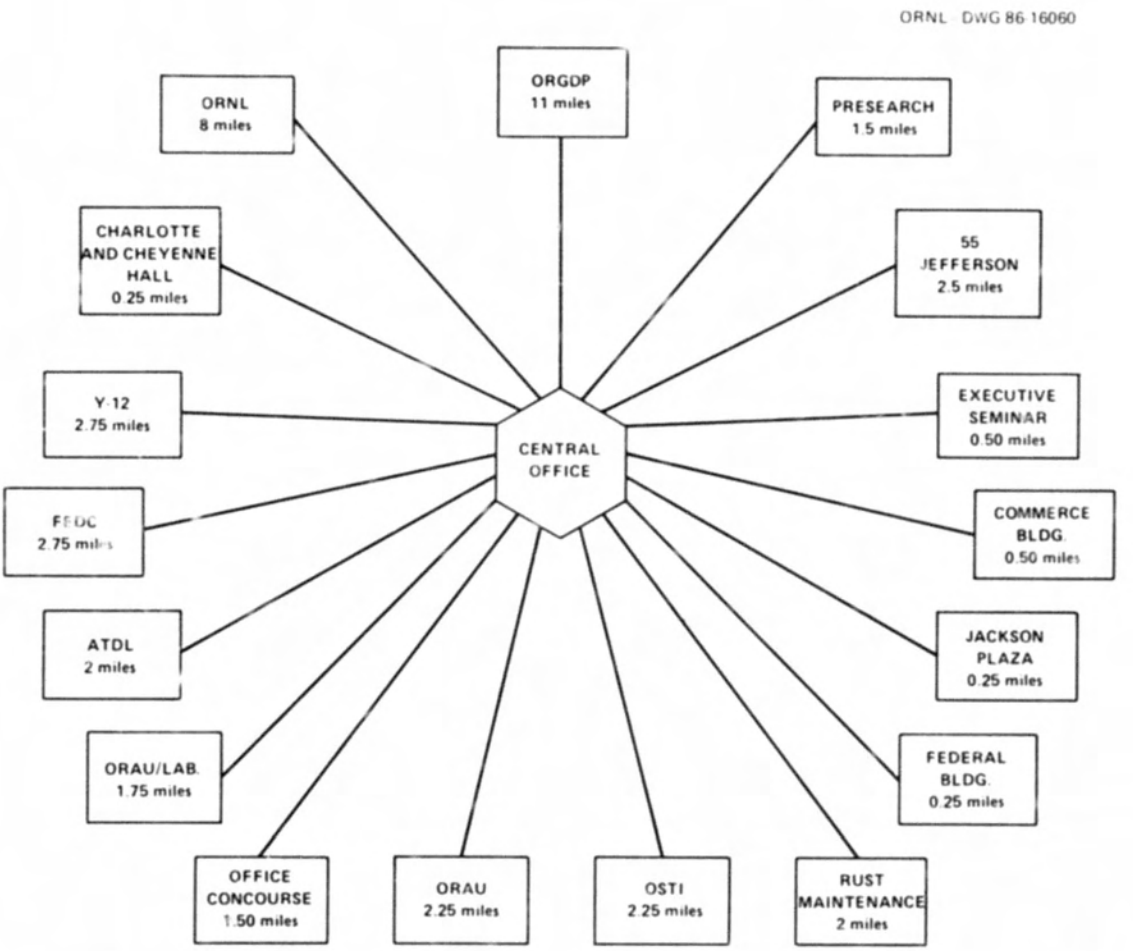


Fig. 3.41. Distances to South Central Bell's central office. To convert miles to kilometers, multiply by 1.61.

ORNL with Y-12 and ORGDP.) This network consists of 37 6-MHz-wide channels, each of which can accommodate from 1 to 80 subchannels. Two-way communications capability is accomplished using 21 forward and 16 reverse channels. The existing broadband network, which can provide high-speed synchronous computer-to-computer connections, is capable of supporting over 12,000 terminal devices and many TV channels and T-1 channels.

Services currently available on the broadband network include text management, video, electronic mail, computer-aided design/manufacturing, mainframe-to-mainframe communication, and limited personal computer networking.

Frequency-spectrum-dependent activity. These diverse activities include mobile radio networks; microwave radio systems; industrial, scientific, and medical (ISM) systems; and miscellaneous industrial, scientific, and medical (MISM) systems. Over 90% of the spectrum-dependent assets are used in land mobile radio service at the three major facilities and the FOB. In this service, 32 networks use 55 high-frequency, very-high-frequency,

and ultra-high-frequency band frequencies. Additional networks in these same bands are for one-way radio paging and remote control of overhead cranes. ISM and MISM systems are commonly used in ultrasonic cleaning machines, arc welding machines, induction furnaces, and in fusion energy research and particle physics.

Teleconferencing. Limited capability is currently available at the major facilities. Teleconferencing between sites is planned for the future. Two video channels on the Intersite Broadband Network will be reserved for this purpose.

Safety, surveillance, and energy conservation systems. These systems are primarily associated with the individual facilities on the ORR. They include fire alarms, fire monitoring systems, public address systems, personnel access control, waste operations data acquisition, microwave television, radio-frequency cable television, radiation monitoring and alarms, and power-dispatching systems.

Communications security. ORGDP and Y-12 have COMSEC equipment to protect intra- and interfacility data communications. In addition, a single encrypted line is planned for the protection of data communications between ORNL and the Class VI computer at ORGDP.

National security and emergency preparedness. This includes communications among ambulance personnel, a central dispatcher, medical and security personnel at the ORR facilities, and area hospitals. In addition, a mutual aid frequency is available to connect these personnel with area fire fighters.

3.4.3 Transportation Systems

Transportation systems are necessary to move the large number of people and goods to, from, and within the ORR. Approximately 18,000 employees travel in and around the Reservation daily, commuting to and from work; also, a great deal of traffic in people and goods moves between plants. In addition, some external-to-external traffic moves through the ORR. It is essential that the means of access be maintained properly to continue the effective utilization of these facilities. Transportation systems within the Reservation include highways, access roads, and railroads (see Table 3.9). Effective management of these systems requires that an appropriate amount of

Table 3.9. Lengths of transportation systems within the Oak Ridge Reservation

Transportation system	Length		Easement[a]	
	km	(miles)		
4 lane - primary	7.41	(4.60)	200 ft = 111.52 acres	714.55 acres
2 lane - primary	62.80	(39.00)	100 ft = 472.73 acres	
2 lane - secondary	34.61	(21.50)	50 ft = 130.30 acres	
Railroads	23.51	(14.60)	50 ft = 88.48 acres	88.48 acres
Total	104.82	(65.10)[b]		

[a]To convert feet to meters, divide by 3.28. To convert acres to hectares, divide by 2.47.

[b]Total does not include railroads.

land (right-of-ways) be dedicated for access, location, maintenance, and safety.

3.4.3.1 Highways and Access Roads

Two interstate highways, I-40 and I-75, and U.S. Highways 11, 25W, 27, and 70 provide the major interstate and intrastate access to the ORR (Fig. 3.42). In addition, several state highways (58, 61, 62, 95, and 162) provide access to the Reservation from surrounding communities. State Highways 58 and 95 are the two main state routes within the ORR. Although only a small portion of State Highway 62 crosses the Reservation, it is a major route for traffic to and from Knoxville and other communities.

Other important routes on the ORR that are directly related to operation of the DOE facilities and that are owned and maintained by DOE include Bear Creek Road and Bethel Valley Road. These roads move high densities of traffic from the state highways to ORGDP, Y-12, and ORNL. Bear Creek Road lies just north of Y-12 in an east-west direction; it connects with Highways 58 and 95 at the west end and with Scarboro Road at the east end. Bethel Valley Road also runs east to west along the north side of ORNL from Highway 95 at the west end to Scarboro Road and Highway 62 to the east. The extension of Bethel Valley Road east of Highway 62 changes to Edgemoor Road, which intersects U.S. Highway 25W.

Because of the separate locations of the DOE facilities, several different routes and types of roadways are used for access to each facility. In addition, several major facilities maintain large parking areas and interior access roads. Therefore, a separate description of transportation connections is provided for each major facility. Primary and secondary roads are paved and have designated right-of-ways. (Table 3.10 gives a complete listing.) Other roads used primarily for patrol roads, cemetery access, landfill operations, FM, research functions, and other restricted uses are usually narrow, unpaved roads limited to use by DOE and to others on a need-to-use basis. As can be seen in Fig. 3.42, these secondary (access) roads run throughout the ORR. Approximately 24 miles (38.6 km) of improved (paved) secondary roads are located outside the three major plant facilities: 19.3 miles (31.1 km) adjacent to the major facilities and 4.6 miles (7.4 km) of old (abandoned) Bethel Valley Road. Unimproved access roads (exclusive of access trails along utility right-of-ways) constitute an additional 107 miles (172.3 km) of roads.

Highway 58 and Blair Road provide direct access to ORGDP. On May 15, 1982, DOE decided to close the Bailey Bridge on Blair Road to vehicular traffic. Studies conducted for DOE, which was responsible for maintaining the bridge, indicated the structure was unsafe, especially for use by large trucks. All traffic using Blair Road was then rerouted around ORGDP on Perimeter Road. Later, state, county, and DOE representatives met and agreed to turn Blair Road over to the state. The state has included the bridge and the Blair Road-Highway 58 intersection in its long-range plans for upgrading. The Powerhouse area, which is located southwest of the main plant, is also accessible from Highway 58. All interior roads and parking facilities are described in the ORGDP SDP.

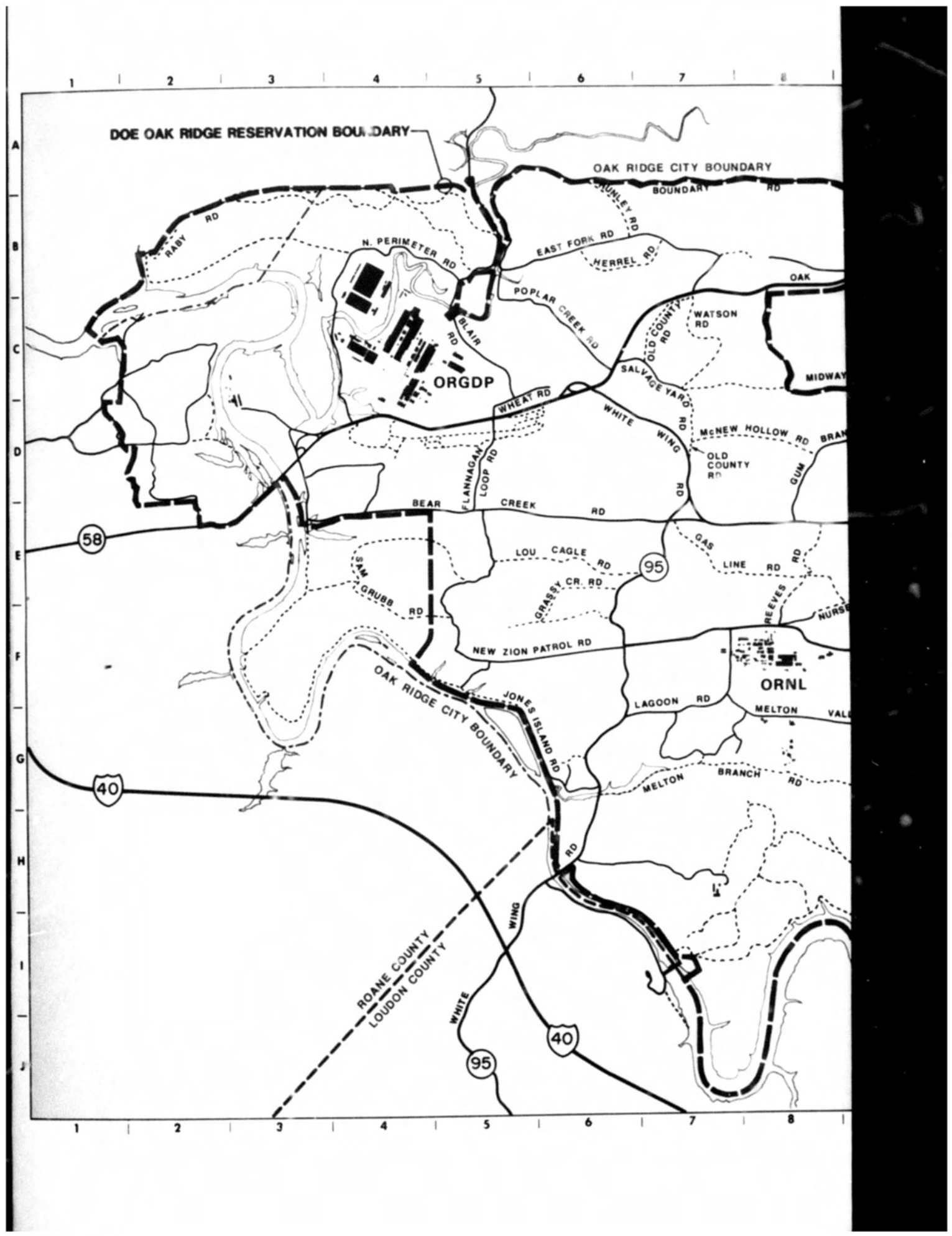
Access to Y-12 is provided by State Highways 62 and 95, Scarboro Road, and Bear Creek Road. Because of increased security and safeguards concerns, major

Table 3.10. Important arterials in the Oak Ridge area[a]

Description	From	To	Approximate length		No. of lanes	Approximate existing width			
						Paved		Right-of-way	
			km	(miles)		m	(ft)	m	(ft)
S-58	Clinch River	S-95	5.3	(3.3)	2, 4	6.7–13.4	(22–44)	91.5	(300)
S-62	S-162	S-95	5.8	(3.6)	2	7.3–8.8	(24–29)	*b*	*b*
S-95	I-40	S-58	8.9	(5.5)	2	7.3	(24)	*b*	*b*
	S-58	Begin 4-lane	5.0	(3.1)	2	7.3	(24)	*b*	*b*
	Begin 4-lane	S-62	7.1	(4.4)	4	13.4	(44)	36.6	(120)
	S-62	S-61	8.4	(5.2)	4	13.4	(44)	36.6	(120)
S-162	I-40	S-62			4	14.6	(48)	91.5	(300)
Bethel Valley Rd.	S-95	Scarboro Rd.	11.1	(6.9)	2	7.3–8.8	(24–29)	30.5	(100)
Bear Creek Rd.	Central Training Facility	Scarboro Rd.	16.1	(10.0)	4	7.3–13.4	(24–44)	30.5	(100)
Blair Rd.	Poplar Creek Rd.	S-58	3.7	(2.3)	2	7.3–8.8	(24–29)	30.5	(100)

[a]University of Tennessee, Civil Engineering Department, *Clinton-Oak Ridge Transportation Study: 1967-1987, Vol. 1.* Prepared for the Tennessee Department of Highways, Research and Planning Division (Revised).

[b]Not available.


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
BOUNDARY RD
HUNLEY RD
RABY RD
N. PERIMETER RD
EAST FORK RD
HERREL RD
OAK
POPLAR CREEK RD
BLAIR RD
ORGDP
OLD COUNTY RD
WATSON RD
MIDWAY
SALVAGE YARD
WHEAT RD
WHITE WING RD
McNEW HOLLOW RD
OLD COUNTY RD
GUM
FLANNAGAN LOOP RD
BEAR CREEK RD
58
LOU CAGLE RD
95
GAS LINE RD
SAM GRUBB RD
GRASSY CR. RD
REEVES
NURSE
NEW ZION PATROL RD
ORNL
OAK RIDGE CITY BOUNDARY
JONES ISLAND RD
LAGOON RD
MELTON
MELTON BRANCH RD
40
WING RD
ROANE COUNTY
LOUDON COUNTY
WHITE
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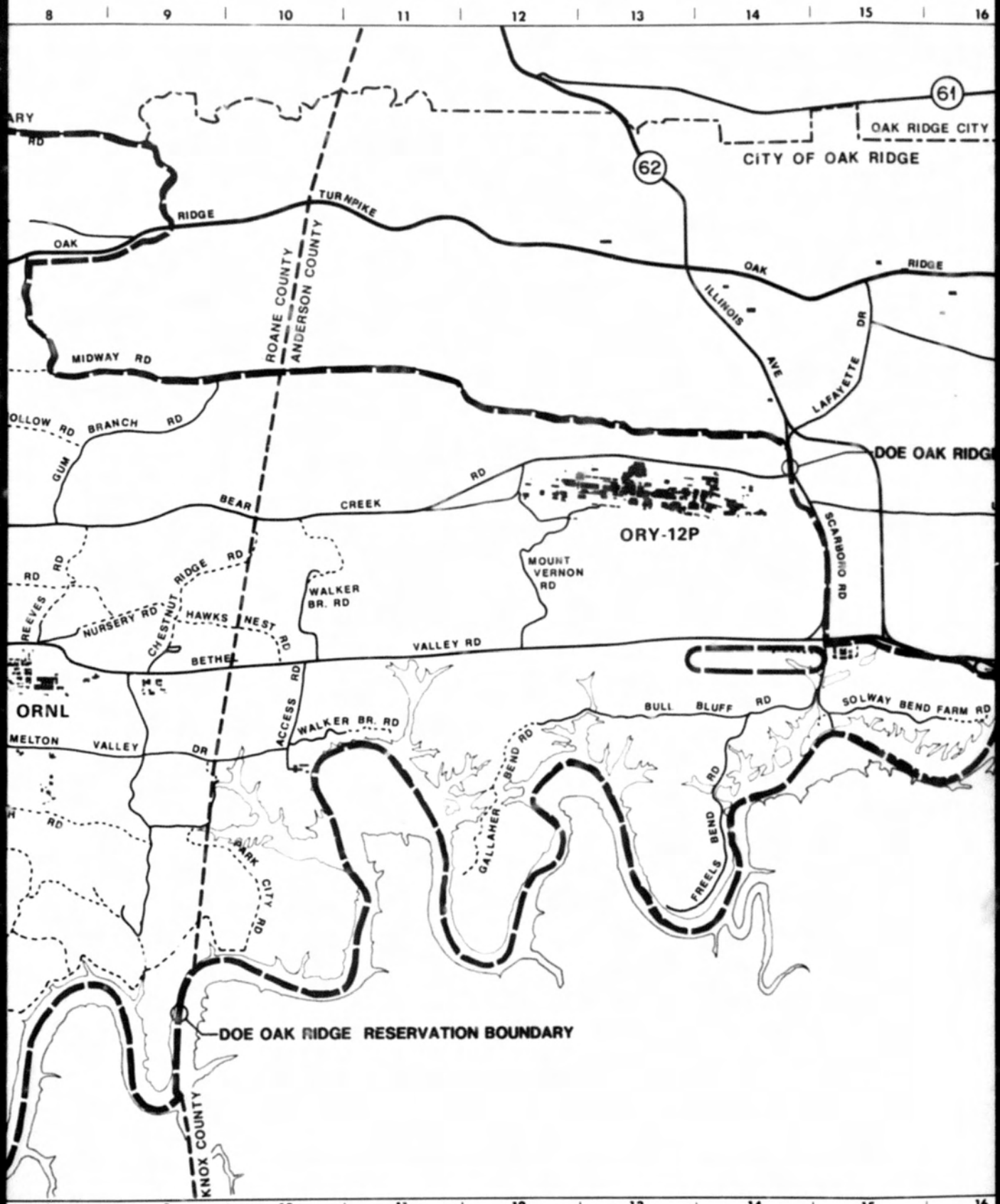
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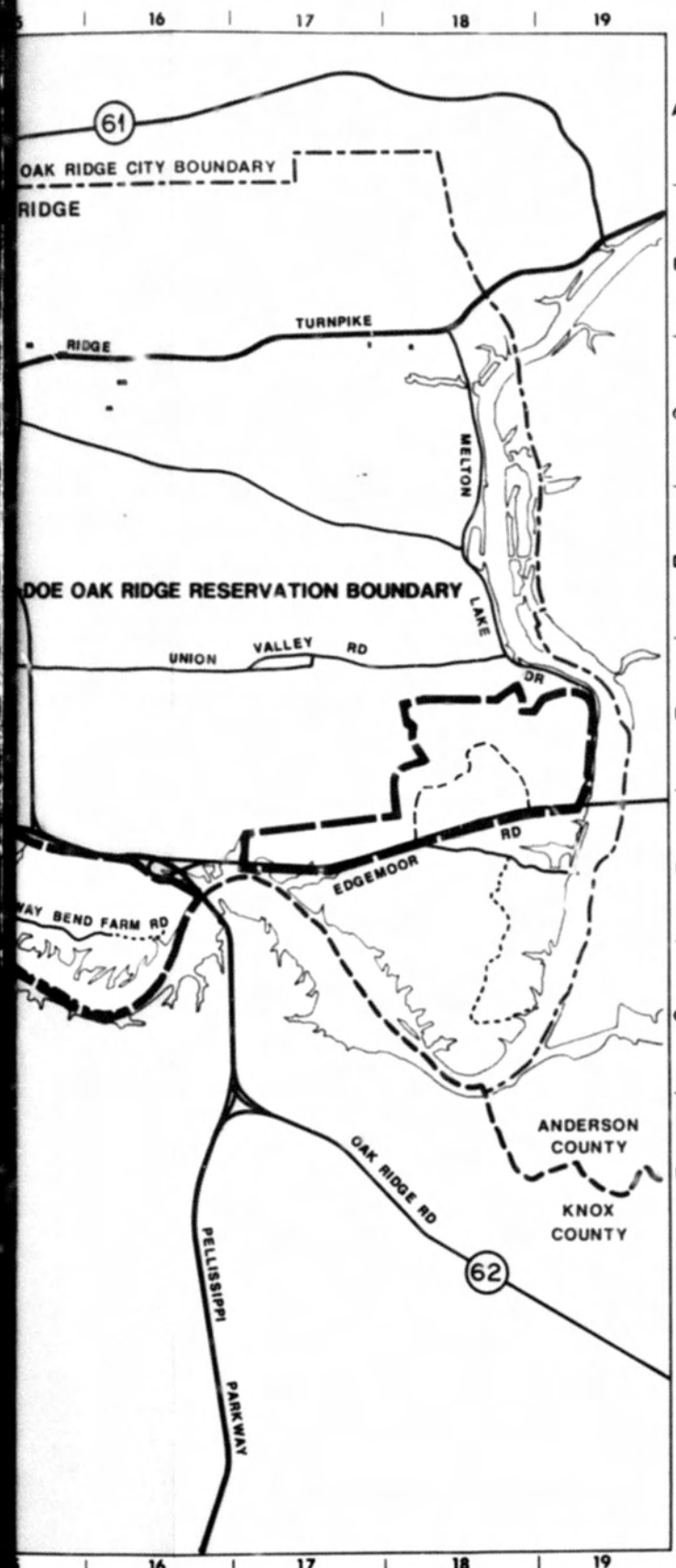
OAK RIDGE CITY
CITY OF OAK RIDGE
TURNPIKE
OAK RIDGE
ROANE COUNTY
ANDERSON COUNTY
MIDWAY RD
ILLINOIS AVE
LAFAYETTE DR
DOE OAK RIDGE
BEAR CREEK RD
ORY-12P
SCARBORO RD
MOUNT VERNON RD
WALKER BR. RD
NURSERY RD
CHESTNUT RIDGE RD
HAWKS NEST RD
REEVES RD
VALLEY RD
BETHEL
ORNL
ACCESS RD
BULL BLUFF RD
SOLWAY BEND FARM RD
MELTON VALLEY DR
GALLAHER BEND RD
FREELS BEND RD
BARK CITY RD
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL-DWG. 86-14861



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- INTERSTATE HIGHWAY
- STATE HIGHWAY
- PAVED ROADS
- UNPAVED ROADS

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.42

HIGHWAYS AND ACCESS ROADS

improvements are currently being made to Bear Creek Road in the vicinity of Y-12. The use of Bear Creek Road is limited to official business; public use is not permitted. All interior roads and parking facilities are described in the Y-12 SDP.

Direct access to the main area of ORNL is by Bethel Valley Road. Melton Valley Drive provides access to the High Flux Isotope Reactor (HFIR) and other outlying facilities and areas. All interior roads and parking facilities are described in the ORNL SDP.

The Scarboro Facility is located on Bethel Valley Road near Scarboro Road. Access is provided by Bethel Valley Road. DOE facilities in the business district of Oak Ridge are readily accessible from the Oak Ridge Turnpike (Highway 95) and from numerous local arterials that channel traffic from Highways 62 and 95.

The roadway system directly impacts many other resouces. As a land use, the primary and secondary roads occupy more than 283 ha (700 acres) (approximately 2%) of the land resource. The amount of traffic generated continues to increase, as do the speed and intensity of use. This increases the possibility of vehicular accidents as well as vehicular-wildlife collisions, thus impacting the Environmental, Health, and Safety Resource. The roadways and drainage structures impact the Hydrology and Water Conservation Resources by altering or constricting the drainage basins and affecting water quality. The visual quality of the woodland edges is influenced by the cuts and fills left by roadway construction and by the many road signs.

3.4.3.2 Railroads

Norfolk Southern Railway and CSX Transportation [Seaboard System Railway, Inc. (formerly the Louisville and Nashville Railroad Company)] serve the ORR (Fig. 3.43). Norfolk Southern transports goods and materials for ORGDP, and CSX provides this service at Y-12. ORNL does not have rail service.

The spur line serving ORGDP extends approximately 7.7 km (4.8 miles) from Norfolk Southern's branch line at Blair to the plant's perimeter fence near the Blair Road Bridge (Bailey) crossing Poplar Creek. From the fence, DOE owns and maintains approximately 15.1 km (9.4 miles) of railroad.

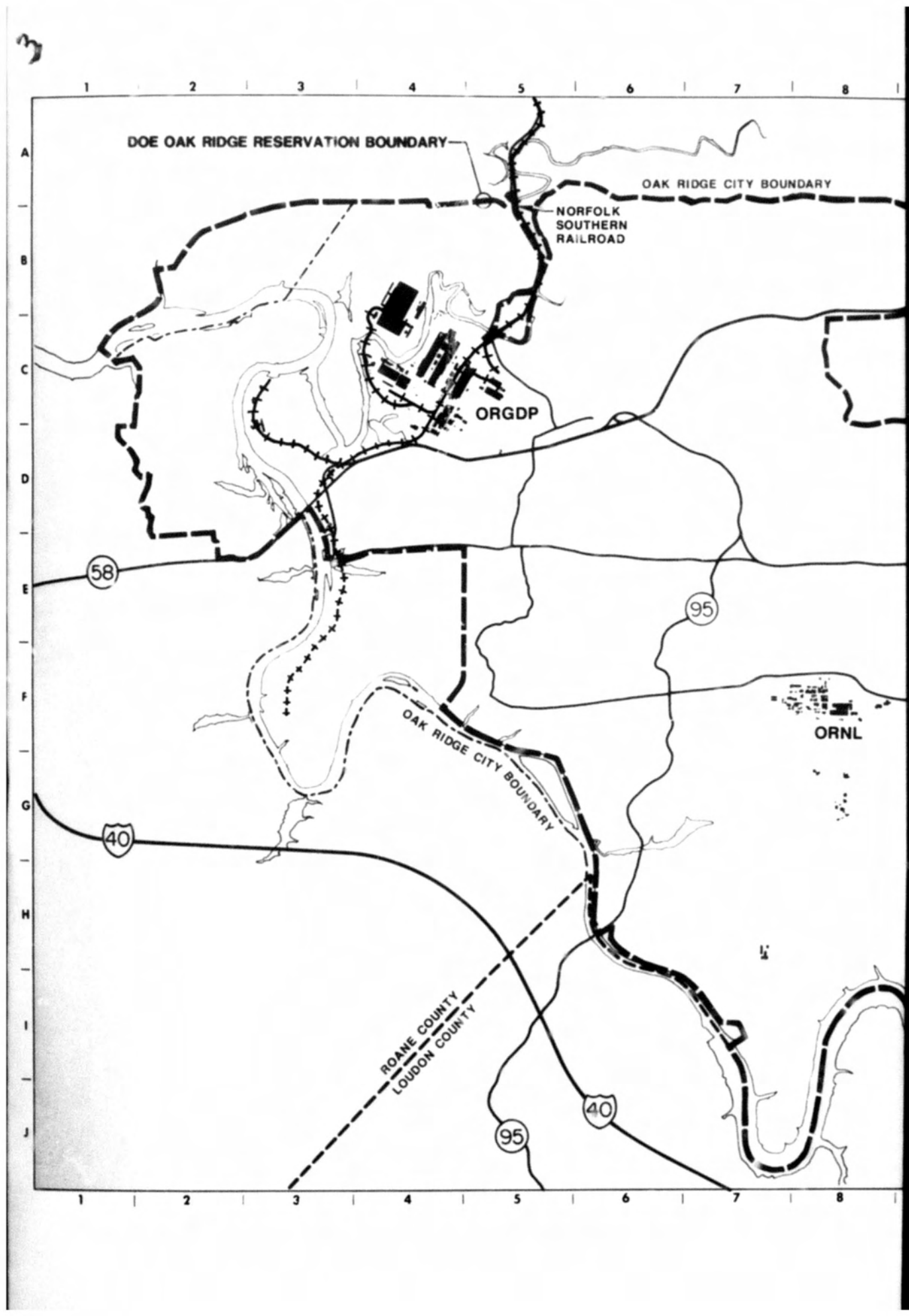
The CSX Transporation spur line extends about 7.4 km (4.6 miles) west from the main line at Elza (Community) to the point of DOE ownership near Scarboro Road and the northeast corner of Y-12. From this point, DOE owns and maintains approximately 12 km (7.5 miles) of railroad.

Plans were formulated and engineering documents were prepared to build an extension off the ORGDP spur to serve the former CRBRP site. The site is a prime industrial site, and the future possibility of this extension still exists.

As a land use, railroads occupy approximately 36 ha (89 acres) of Reservation land (much less than 1%). The impacts from this land use are in direct proportion to its relative magnitude and limited use—very small.

3.4.3.3 Water

The only other transportation system within the ORR is the barge facility located south of State Highway 58 on the east bank of the navigable Clinch River. This facility is maintained in operable condition, but it is rarely used. The barge provides an alternative means for receiving equipment too large or heavy to transport by rail or truck.


DOE OAK RIDGE RESERVATION BOUNDARY
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NORFOLK SOUTHERN RAILROAD
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ROANE COUNTY
LOUDON COUNTY
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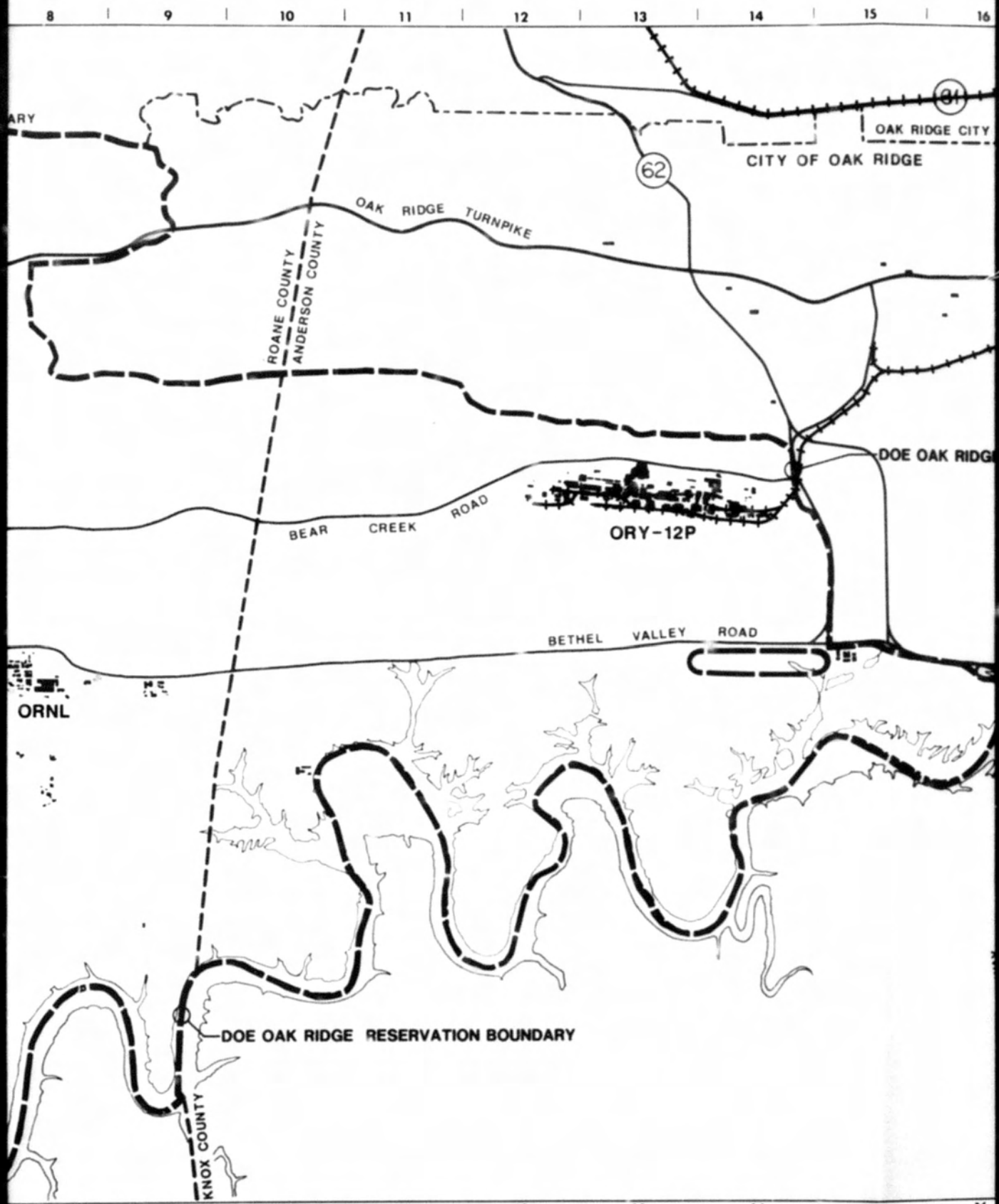
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ROANE COUNTY
ANDERSON COUNTY
DOE OAK RIDGE
BEAR CREEK ROAD
ORY-12P
BETHEL VALLEY ROAD
ORNL
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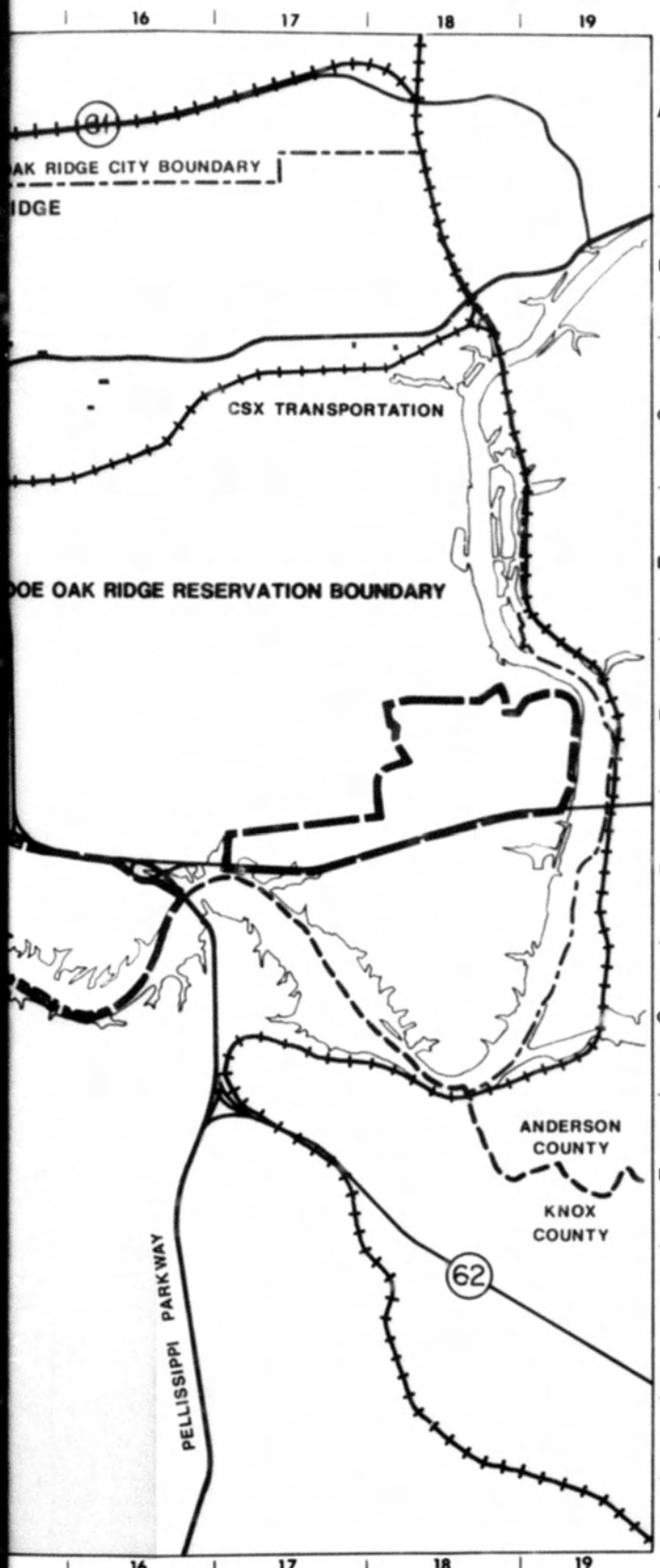
KNOX COUNTY

ORNL DWG 86-14628



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

RAILROADS

PROPOSED EXTENSION

kilometers 0 1 2 3

0 1 2 miles

NORTH

TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.43

RAILROADS

As a land use, the only impact is a visible one as the barge facility can be clearly seen by travelers from Highway 58. Functionally it has little, if any, value.

3.4.4 Protection and Security Systems

All physical facilities used by the various plant protection and security groups are identified and discussed in detail in the SDP for each major plant (ORGDP, ORNL, and Y-12). Most facilities are within the primary plant's fenced area; however, the target ranges are outside the fence but within the buffer zones of the main plant areas. Small arms ranges are located on the east end of Y-12 and north of the west end of ORNL; a major facility shared by all three plants is south of ORGDP and south of Bear Creek Road (Fig. 3.44).

A fire protection plan has been developed that involves the three plants' fire departments and the City of Oak Ridge's fire department; it outlines responsibilities and identifies who takes the lead role for various locations (Fig. 3.45).

The security forces at the various facilities are mainly concerned with security at the individual facility and, to a lesser extent, with security in the buffer zone around the plant. DOE has a separate security contractor (other than the pri-

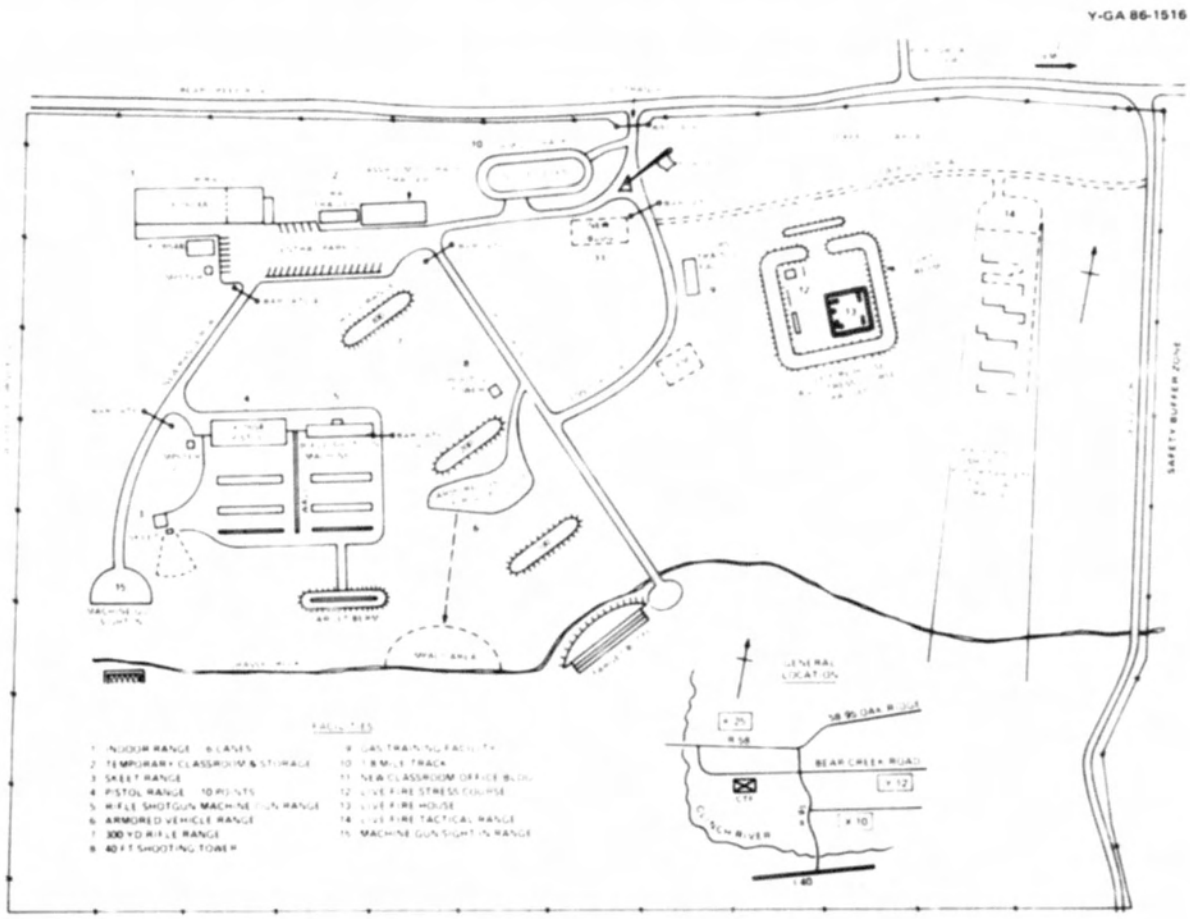


Fig. 3.44. Central Training Facility south of Oak Ridge Gaseous Diffusion Plant.


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
ORGDP
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OAK RIDGE CITY BOUNDARY
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ROANE COUNTY
LOUDON COUNTY
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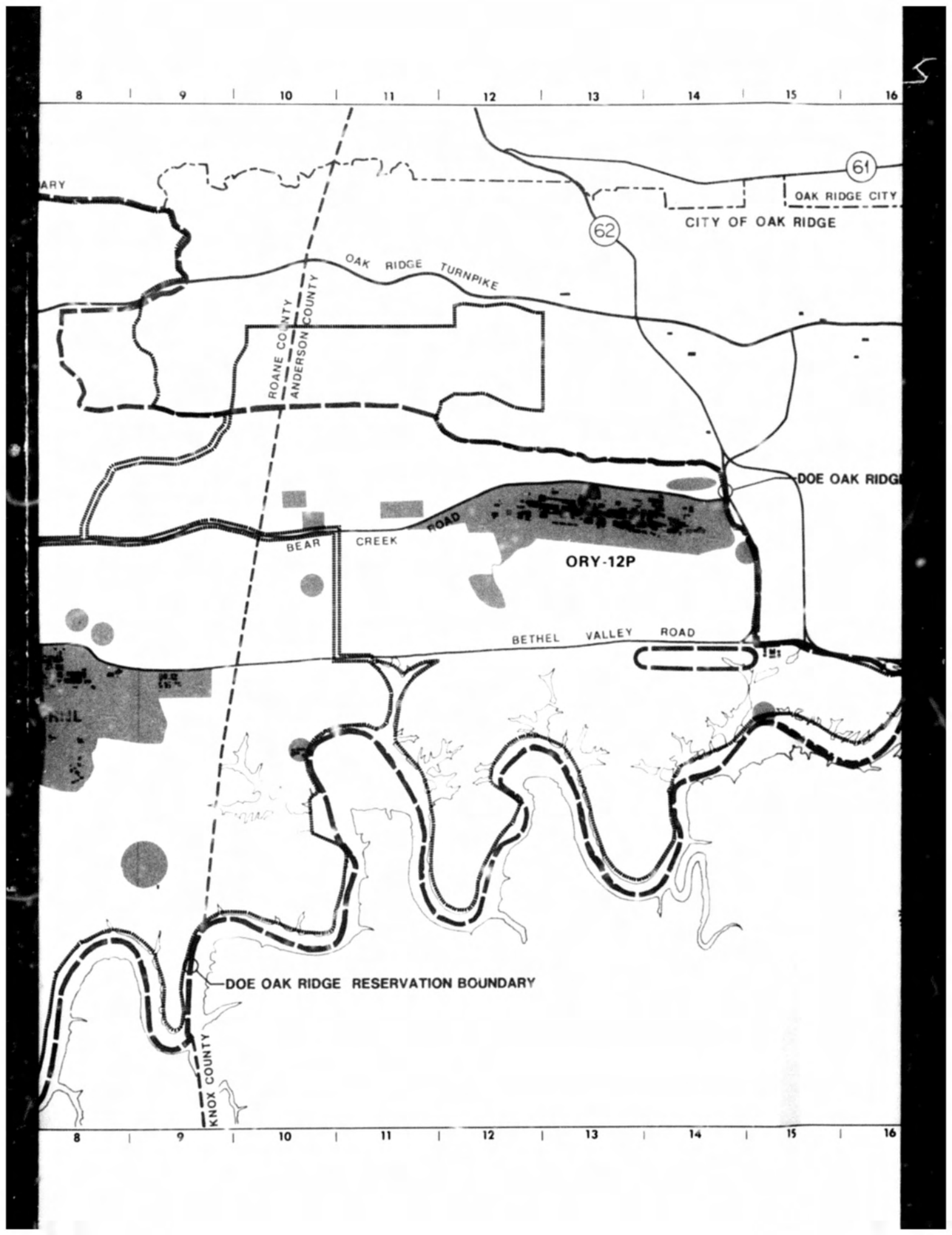
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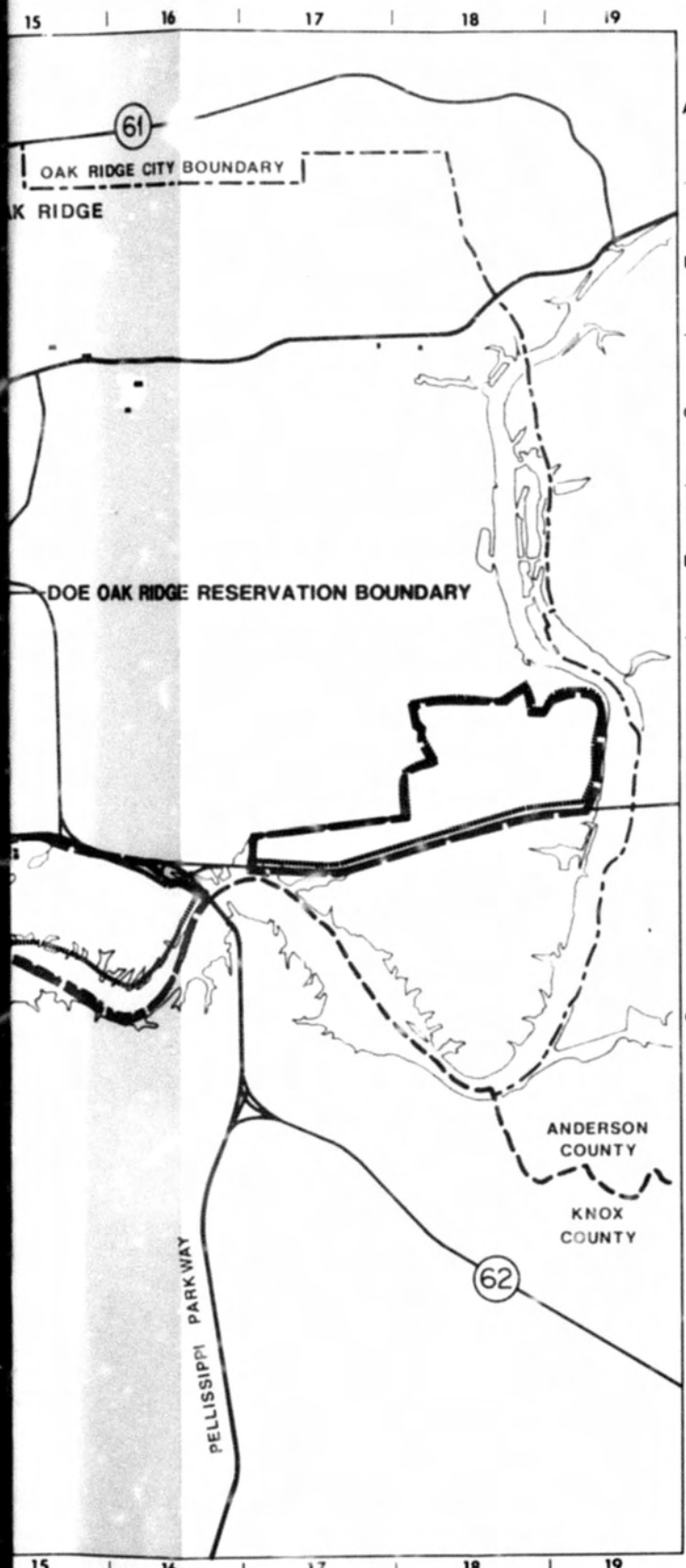
ROANE COUNTY
ANDERSON COUNTY
DOE OAK RIDGE
BEAR CREEK ROAD
ORY-12P
BETHEL VALLEY ROAD
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL DWG 86-14633



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

PRIMARY AREAS

DOE Installation has lead role in firefighting. Other DOE Installations may be requested to assist

SECONDARY AREAS

City of Oak Ridge has lead role and DOE Installations assist in firefighting

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.45

DOE PRIMARY FIRE PROTECTION AREAS

FOREST FIREFIGHTING ASSISTANCE AREAS

mary contractor) that has limited responsibilities (primarily for the FOB and OSTI with some duties on Bear Creek Road at Y-12).

The physical impacts of the protection and security systems as a land use are primarily the land areas utilized by the target ranges and their required buffer areas. The two remaining guard stations, one on the Oak Ridge Turnpike (Highway 95) and the other on Scarboro Road near the northeast corner of Y-12, are vacant; they are located near and within the road right-of-ways and thus impose a visual impact. A third guard station on Bethel Valley Road east of the Scarboro Facility has recently been excessed and disposed of along with the surrounding property. Its visual impact still exists.

The five general levels of access within the ORR are illustrated in Fig. 3.46. The least restrictive are areas open to the general public. These include the major transportation corridors, Clark Center Recreational Park, the graphite reactor, overlooks, cemeteries, the Museum, and visitor reception areas at each major plant facility. The next level of access is restricted to need. The only physical controls are barricades (Fig. 3.47 and Table 3.11) that restrict vehicles at the entrances of the various unimproved access roads. This restriction applies to most of the forested land areas of the ORR. No fences restrict personnel access to these areas, but fences may be used to retain cattle or around cemeteries to define the dedicated space. The next level of access is the security buffer zone, which may or may not be fenced with three strands of barbed wire with appropriate warning signs attached. The primary purpose of this buffer is to designate and control unauthorized trespassing. Property control areas are surrounded by chain-link fencing and may or may not have a manned portal. The primary purpose of this level of access is to protect property from vandalism, pilfering, and theft. Administrative control areas include the main plant facilities, which are enclosed by chain-link fences with guarded portals. These areas usually contain various levels of security access and are patrolled and guarded around the clock.

3.5 POPULATION AND CIRCULATION

The current employment level for the ORR including off-site facilities is approximately 18,000 (Fig. 3.48). The population distribution can be seen in Table 3.12 and Fig. 3.49. The predominant distribution is: Y-12, 7300; ORNL, 5100; and ORGDP, 2500. This current level of employment has decreased from 19,360 over the past 3 years because of the termination of the CRBRP and subsequent shutdown of the gaseous diffusion enrichment process. Employment levels have been fairly stable since World War II with significant changes occurring rarely with major programmatic changes. Very little decline is anticipated before a slow, gradual increase occurs in the foreseeable future.

No comprehensive traffic studies have been performed for the ORR. The Tennessee Department of Transportation (DOT) and DOE have made spot measurements of traffic (traffic counts) either as routine or in response to a specific need. Each of the major facilities has conducted internal traffic surveys, which are discussed in the respective SDPs. Therefore, the database for vehicular circulation is, for the most part, nonexistent. Using information from the major facilities traffic surveys,

Table 3.11. Barricades on the Oak Ridge Reservation[a]

Barricade		Road barricaded	Barricade location
No.	Type		
1-A	B	Dyllis Orchard Road East	Off Blair Road
1-B	B	Dyllis Orchard Road West	Near Raby Road
2-A	B	East Ridge Road West	Near Poplar Creek
3-A	G	East Ridge Road East	Off Highway 95—old guard house
3-B	B	East Ridge Water Tower Road	Near water tower
3-C	B	West Quarry Road	Bridge blocked up
4-A	B	Kennedy Bend Patrol Road	Off State Highway 58
4-B	B	Gallaher Ferry Road	Off Lawnville Road
5-A	B	West Water Tank Road	Off Bear Creek Road
5-B	B	South Water Tank Road	Off Bear Creek Road
5-C	EG	Water Tank No. 2 Road	Near filtration station
6-A	G	Poplar Creek Road	Intersection of Highways 95 and 58
6-B	B	Wheat Road	Off Blair Road
6-C	B	Wheat Road	Off Blair Road
6-D	B	Water Tank Road	Off Blair Road
8-A	B	Walnut Orchard Road	Bear Creek and Highway 95
9-A	G	Monitoring Station Access	Intersection of Highways 95 and 58
10-A	B	Old County Road South	Off Highway 95
10-B	B	Hot Yard Road West	Off old county road
10-C	G	Salvage Yard Road	Off Highway 95
10-D	B	Old County Road North	Off Highway 95
10-E	B	Midway Turnpike North	Off Highway 95

Table 3.11 (continued)

Barricade		Road barricaded	Barricade location
No.	Type		
11-A	B	Gum Branch Road	Near Bear Creek
11-B	B	Temporary Gum Branch Road	Powerline east of Gum Branch
11-C	G	Midway Turnpike and Gum Branch	Gate at intersection
11-D	G	Burial Ground Access Road	Road washed out
11-E	G	Burial Ground Access Road No. 3	West end of burial ground
12-A	G	Burial Ground Access Road No. 1	East end of burial ground
12-B	G	Burial Ground Access Road No. 2	Off Bear Creek
13-A	B	Clinch River Breeder Reactor Project (CRBRP) Main Entrance	West end of Bear Creek
13-B	B	Grubb Island Patrol Road	East end of CRBRP
14-A	B	New Zion Patrol Road	Off Bear Creek
14-B	B	Oak Ridge Gaseous Diffusion Plant (ORGDP) Rifle Range	Off Bear Creek
14-C	C	Lou Cagle Road	West off New Zion
15-A	B	New Zion Patrol Road East	Off Highway 95
15-B	B	Grassy Creek Road	Off Highway 95
15-C	B	Lou Cagle Road	Off Highway 95
15-D	B	Walker Road	Off Bear Creek
16-A	B	Chestnut Ridge Road	Off Bethel Valley
16-B	B	Reeves Road North	Off Bear Creek
16-C	B	Woods Access Road	Off Bear Creek Road
16-D	B	Oak Ridge National Laboratory (ORNL) Overlook	Off Bethel Valley
17-A	B	Katies Kitchen Road	Off Old Bethel Valley
17-B	B	Old Bethel Valley Road	Intersection Old Bethel Valley
17-C	B	Hawks Nest Road	Off Old Bethel Valley
17-D	B	Access Road	Off Bear Creek

Table 3.11 (continued)

Barricade		Road barricaded	Barricade location
No.	Type		
17-E	B	Jim Diggs Road	Off Bear Creek
17-F	G	Woods Access	Off Old Bethel Valley
18-A	B	Old Bear Creek Road	West end of Y-12
19-A	B	Weir Road	Off Old Bethel Valley
19-B	B	Powerline Access Road	Off Mt. Vernon Road
19-C	B	Mt. Vernon Road	Off Old Bethel Valley
19-D	B	Access to Barn D	Near large quarry
19-E	C	Access to Field D-1	Off Old Bethel Valley
19-F	C	Access to Field D-2	Off Mt. Vernon Road
19-G	C	Access to Field D-3	Off Mt. Vernon Road
19-H	B	Y-12 Landfill	Off Mt. Vernon Road
19-I	B	Y-12 Landfill	Off Mt. Vernon Road
20-A	G	Jones Island Road	Near White Oak lake
20-B	B	Jones Island Access Road	Off Highway 95
21-A	B	North Bearden Creek Road	Off Melton Valley extension
21-B	B	West Bearden Creek Road	Off Health Physics Research Reactor (HPRR) Access Road
22-A	B	Woods Access Road	On powerline off Bethel Valley
22-B	G	Experimental Gas-Cooled Reactor (EGCR) Access Road	EGCR road off Bethel
25-C	B	Bull Bluff Road	Clark Recreational Swimming Area
23-B	G	Gallaher Bend Farm Road	Off Bull Bluff Road
24-A	G	HPRR Access Gate A	Off Park City Road
24-B	G	HPRR Access Gate B	South end of Park City Road
25-A	G	Bull Bluff Road	Off Pumphouse Road
25-B	B	Freels' Bend Road	Off Bull Bluff Road
26-A	EG	Pumphouse Road	Off Bethel Valley Road
26-B	G	Solway Bend Farm Road	Off Pumphouse Road
26-C	G	Pumphouse Access	South on Pumphouse Road

Table 3.11 (continued)

Barricade		Road barricaded	Barricade location
No.	Type		
27-A	B	C-27 Farm Access Road	Off Edgemoor Road
27-B	B	Chestnut Ridge Farm Road	Off Edgemoor Road
27-C	WG	Farm Access	Access to fields
27-D	G	Waller Farm Road	Access to radio tower
27-E	G	Farm Access	Access to fields
28-A	B	Hagwood Road	Powerline access
28-B	CH	Monitoring Checking Station	Intersection of White Wing Road
A1-A	G	North Reactor Road	At White Oak Lake
A1-B	G	Tower Shielding Facility (TSF) Field Access	
A1-C	G	TSF Water Tower Access	At parking lot, Melton Hill Lock Access
A2-A	B	West Parking Lot Access	Off Lagoon Road
A2-B	B	West Parking Lot Access	Off Bethel Valley Road
A2-C	B	Tree Plantation Access	Behind Building 1503
A2-D	B		Burial Bround 3, ORNL
A2-E	G	Burial Ground No. 3 Field	Access to Field
A2-F	G	Burial Ground No. 3 Field	Access to Field
A2-G	B	Contractors Landfill Road	Off Bethel Valley Road
A2-H	G	Lagoon Road Access to West End of Plant	Off Highway 95
A2-I	G	White Oak Lake Access	Off Highway 95
A2-J	EG	Access Burial Ground No. 6	Off Lagoon Road
A2-K	B	Building Access	Off Lagoon Road
A2-L	B	Burial Ground Access	Off Lagoon Road
A2-M	B	Burial Ground No. 4	Off Lagoon Road
A2-N	G	Access to Burial Ground Offices	Off Melton Valley Drive
A2-O	EB	Access to Burial Ground No. 5	Behind Burial Ground Office Building
A2-P	G	South Access to Burial Ground No. 5	Back entrance to No. 5

Table 3.11 (continued)

Barricade No.	Barricade Type	Road barricaded	Barricade location
A2-Q	G	Powerline Access	North Reactor Road at White Oak Lake
A2-R	G	New Shell Factor Facilities	North Reactor Road
A2-S	G	Powerline Access	North Reactor Road behind 7500
A2-T	B		Off Melton Valley Drive
A2-U	B	Burial Ground No. 7	Off Melton Valley Drive
A2-V	B	Gravel Pit Access	
A2-W	G	Water Tank Field Access	Off Water Tank Road
A2-X	B	Water Tank Road	Off Melton Valley Access
A2-Y	G	North Reactor Road East End	Access to HPRR Access
A2-Z	G	Woods Access Road	At Building 5505
A2-AA	G	Burial Ground Access	Off Highway 95
A3-A	B	Rifle Range Road	Off Bethel Valley Drive
A3-B	B	Reeves Road	North parking lot, Bethel Valley
A3-C	B	Nursery Road	North parking lot, Bethel Valley
A5-A	G	Access to Field C	Off Old Bethel Valley
A5-B	G	Access to Field C	Off Old Bethel Valley
A5-C	C	Access to Barn C	Off Old Bethel Valley
A5-D	G	Access to Kerr Quarry	Off Old Bethel Valley
A5-E	C	Access to Field B	Off Old Bethel Valley
A5-F	G	Access to Field B	Off Scarboro Road
A5-G	C	Access to Field B	Off Scarboro Road
A5-H	G	Access to Barn B and Fields	Off Old Bethel Valley
A5-I	B	Access to Water Tank	Off Scarboro Road
A5-J	G	Watertank Fence Access	Access gate
A5-K	B	Access to Y-12	East gate and parking lot
A5-L	B	Woods Access	East entrance to Y-12

Table 3.11 (continued)

Barricade No.	Barricade Type	Road barricaded	Barricade location
A5-M	G	Woods Access	East entrance to Y-12
A5-N	B	Woods Access	East entrance to Y-12
A6-A	G	East End Midway Turnpike	Off Scarboro Road
A6-B	G	Midway Turnpike	Near Water Tank Road, Y-12
A7-A	G	Access to Landfill, ORGDP	Off West Perimeter Road

[a]The Forest Management Program has coordination responsibilities for keys to the barricades.

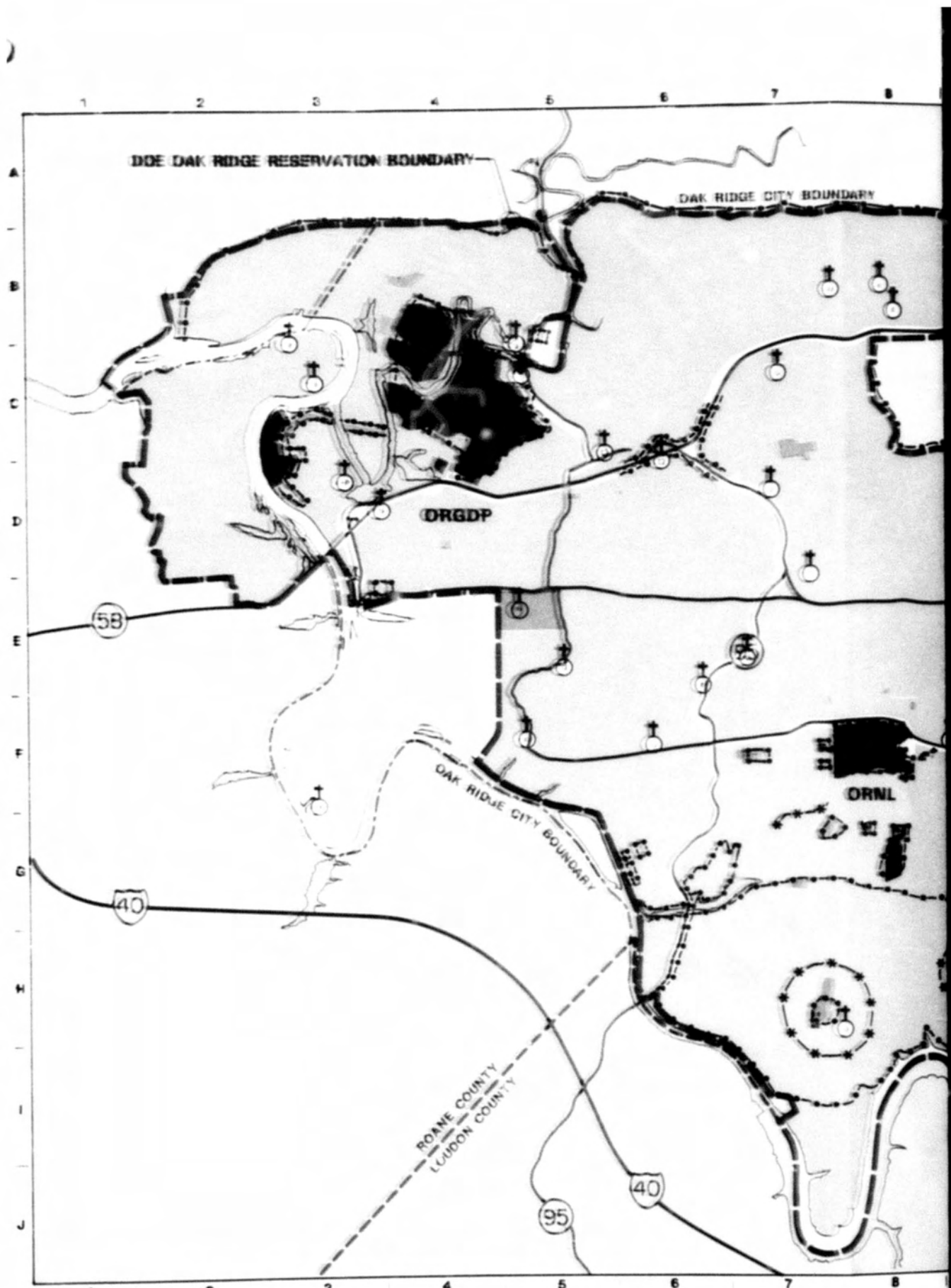
which were generated at different times, combined with the spot traffic counts obtained by DOE and DOT, a generalized traffic pattern has been fabricated to obtain a relative order of magnitude for the purposes of this document.

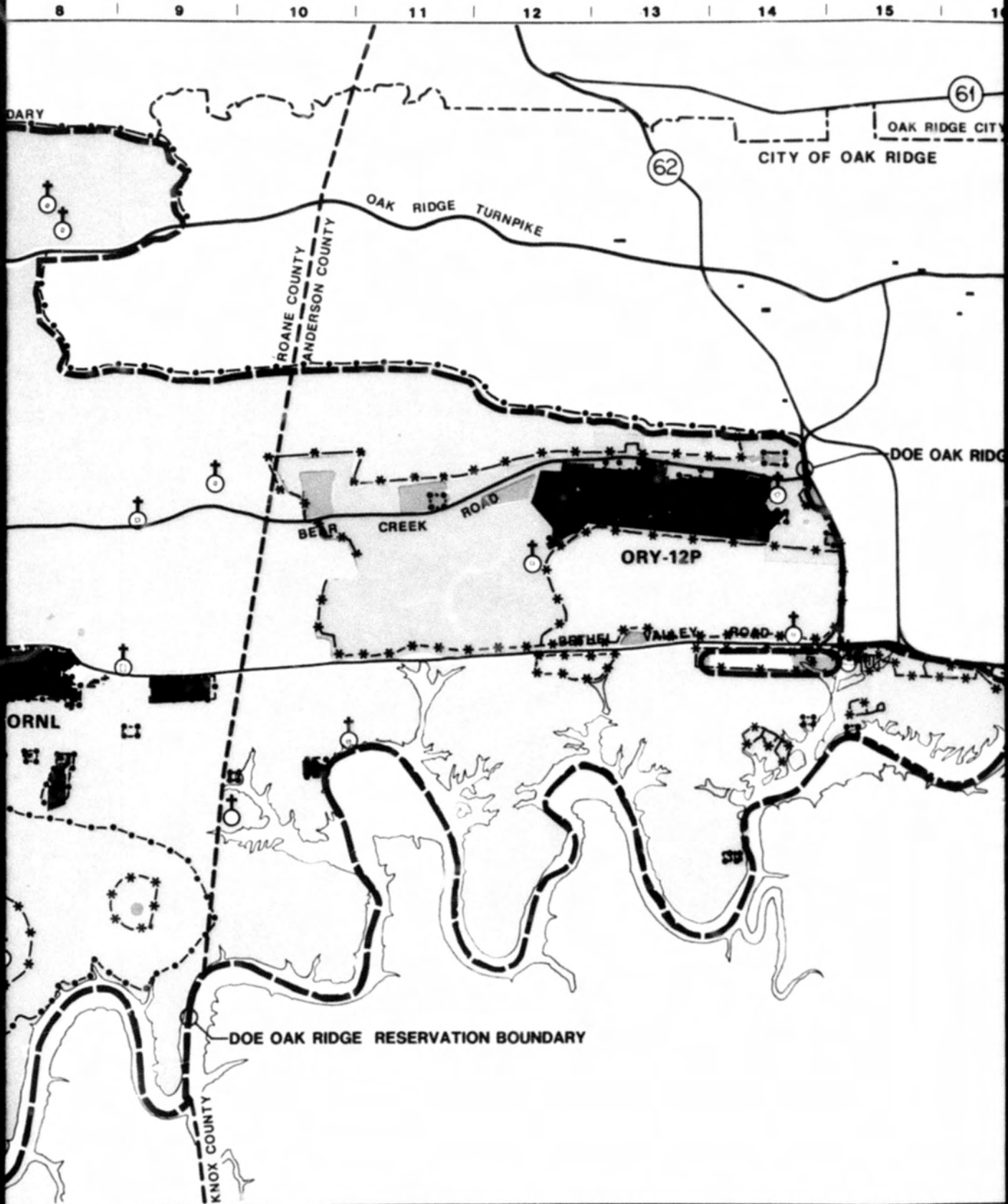
Even though many roadway improvements have been made over the years, traffic congestion is still a problem during the early morning and late afternoon hours (Fig. 3.50). Major improvements off site have had a significant positive impact on the flow of peak-hour traffic. These improvements include the Pellissippi Parkway, the Solway interchange, and State Highway 95 south of Interstate 40. On-site improvements include additional lanes on portions of Bear Creek Road, Bethel Valley Road, and the Oak Ridge Turnpike as well as the new interchange for State Highways 58 and 95. Spot improvements include some traffic signals, directional markings, and intersection improvements. No extreme congestion conditions cause undue delays except during times of construction and utility repair, which are usually of short duration.

Several factors affect circulation from a safety standpoint. These can be classified as physical and administrative factors. Physical factors include intersections and the horizontal and vertical alignments of the roadways, as well as the number and locations of points of access. Oak Ridge Turnpike and Bethel Valley Road have good alignments; however, State Highway 95 (White Wing Road), Bear Creek Road, and Blair Road have poor (marginal) alignments to support the designated allowable speeds, even without peak-hour congestion. For the speeds allowed, sight distances at the major intersections are marginal. The lack of turning lanes greatly increases the probability of vehicle collisions. The proliferation of access points affects the flow of traffic and increases the danger. The lack of traffic signals impacts both safety and flow of traffic. Administrative factors include the lack of police control, obsolete safety design standards, and lack of a designated authority to manage all aspects of the transportation systems.

3.6 RESOURCES

Currently, 24 specific resources have been identified and are represented on the ORR RMO. Some are being managed on a full-time basis while others, not program related, are quiescent by nature and thus


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
ORGDP
58
ORNL
OAK RIDGE CITY BOUNDARY
40
ROANE COUNTY
LOUDON COUNTY
95
40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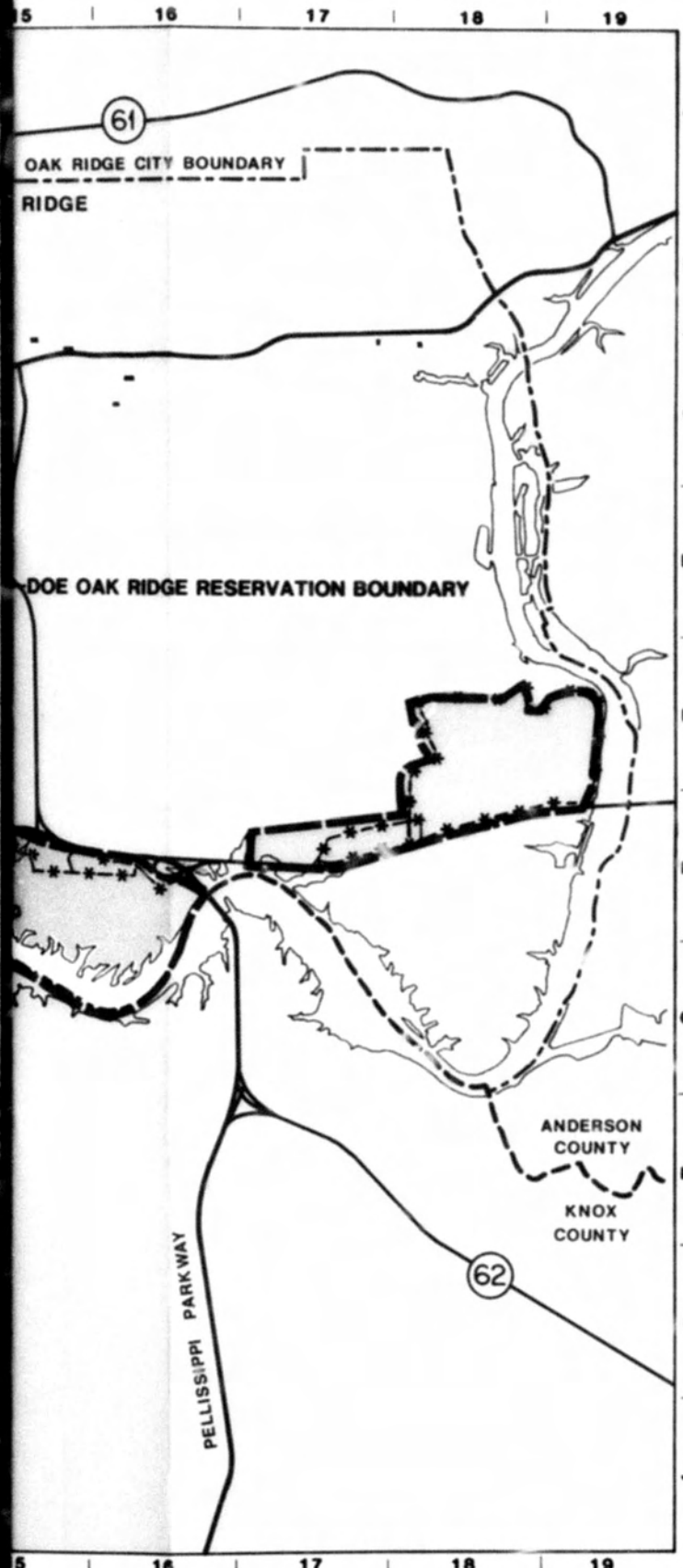
OAK RIDGE CITY
CITY OF OAK RIDGE
OAK RIDGE TURNPIKE
ROANE COUNTY
ANDERSON COUNTY
DOE OAK RIDG
BEAR CREEK ROAD
ORY-12P
BETHEL VALLEY ROAD
ORNL
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL DWG 86-14635



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- ADMINISTRATIVE CONTROLLED AREAS
- PROPERTY CONTROLLED AREAS
- SECURITY BUFFER AREAS
- ACCESS RESTRICTED AREAS
- OPEN AREAS-PUBLIC ACCESS
- CEMETERY
- CHAIN LINK FENCE
- BARBED WIRE FENCE

kilometers 0 1 2 3

0 1 2 miles

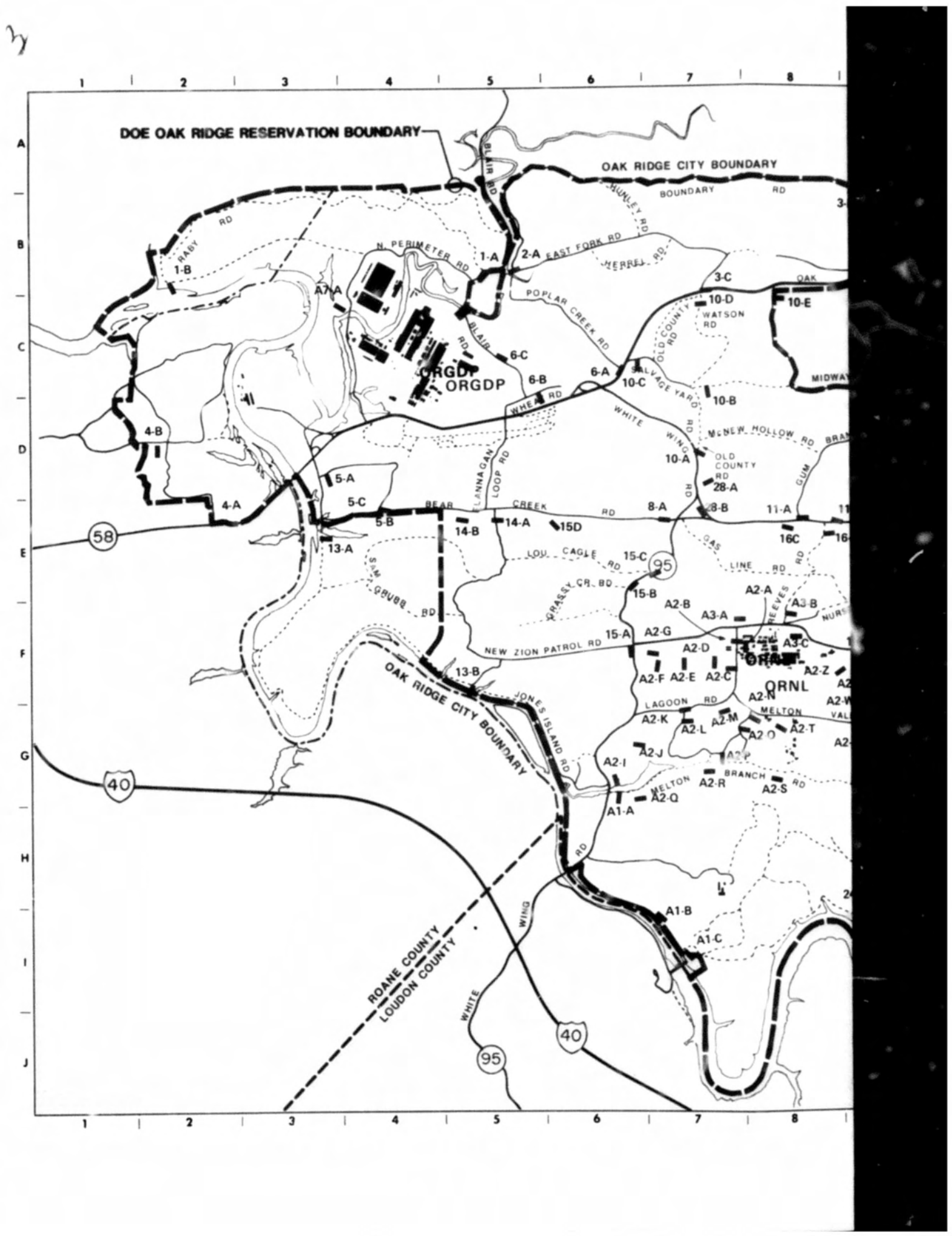
NORTH

TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.46

LEVELS OF ACCESS


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
ORGDP
ORNL
BLAIR RD
BOUNDARY RD
HUNLEY RD
RABY RD
N. PERIMETER RD
EAST FORK RD
HERREL RD
POPLAR CREEK RD
OLD COUNTY RD
WATSON RD
OAK
MIDWAY
SALVAGE YARD
WHEAT RD
WHITE WING RD
NEW HOLLOW RD
OLD COUNTY RD
GUM
BEAR CREEK RD
FLANNAGAN LOOP RD
LOU EAGLE RD
GRASSY CR. RD
SAM GRUBB RD
GAS LINE RD
REEVES
NEW ZION PATROL RD
LAGOON RD
MELTON VALLEY
MELTON BRANCH RD
JONES ISLAND RD
WING RD
WHITE
ROANE COUNTY
LOUDON COUNTY
58
95
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1-A
1-B
2-A
3-C
10-D
10-E
6-A
6-B
6-C
10-C
10-B
10-A
28-A
4-A
4-B
5-A
5-B
5-C
8-A
8-B
11-A
13-A
13-B
14-A
14-B
15D
15-A
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16C
A1-A
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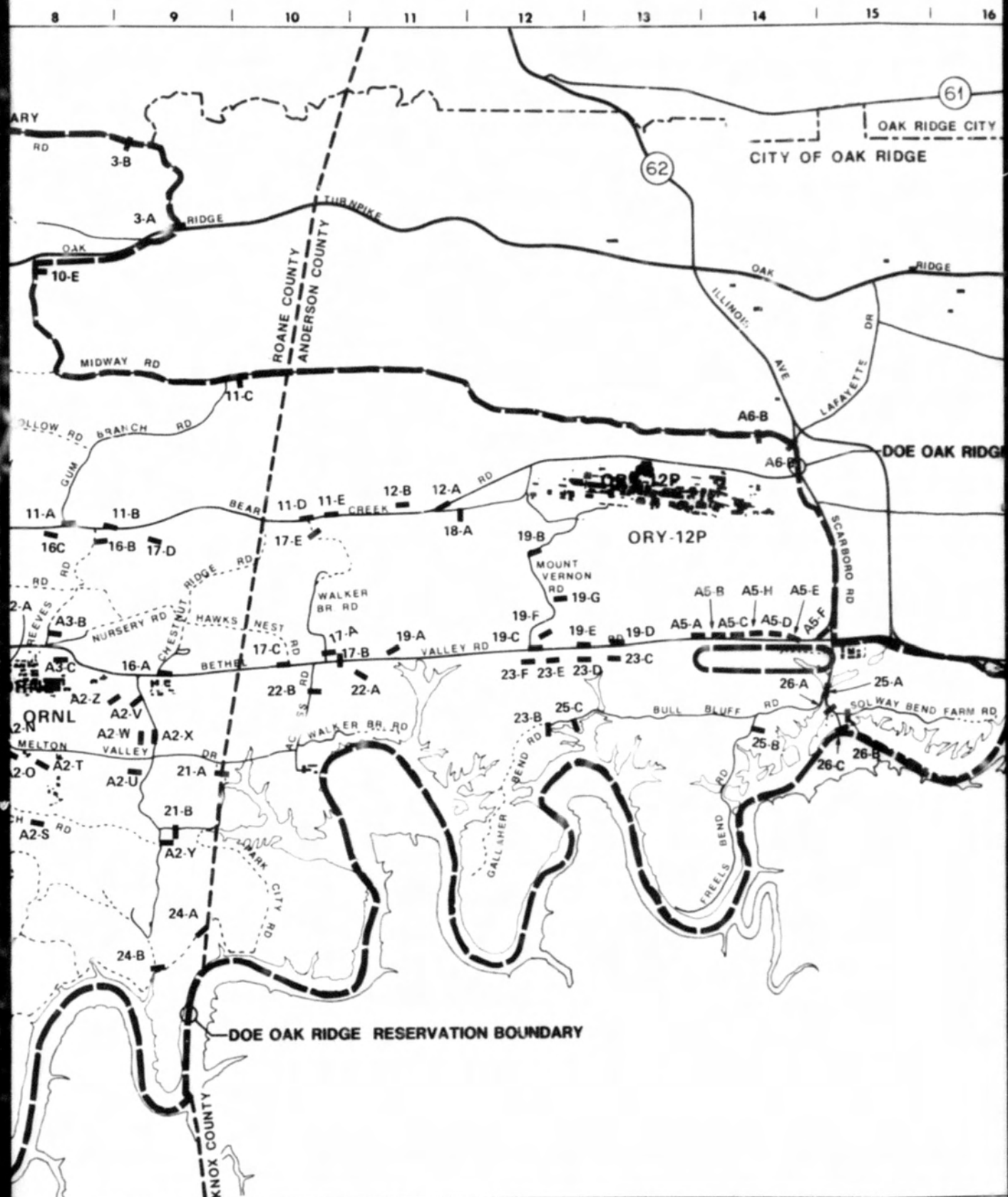
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OAK RIDGE CITY
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TURNPIKE
OAK RIDGE
ROANE COUNTY
ANDERSON COUNTY
MIDWAY RD
BEAR CREEK RD
GUM BRANCH RD
WILLOW RD
ILLINOIS AVE
LAFAYETTE DR
DOE OAK RIDGE
ORY-12P
SCARBORO RD
MOUNT VERNON RD
WALKER BR RD
CHESTNUT RIDGE RD
NURSERY RD
HAWKS NEST RD
REEVES RD
BETHEL VALLEY RD
MELTON VALLEY DR
ORNL
BULL BLUFF RD
SOLWAY BEND FARM RD
BEND RD
GALLAHER BEND RD
FREELS BEND RD
OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY
3-B
3-A
10-E
11-C
A6-B
11-A
11-B
16C
16-B
17-D
17-E
18-A
19-B
19-G
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19-E
19-D
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17-B
17-C
16-A
A3-B
A3-C
A2-A
A2-Z
A2-V
A2-W
A2-X
A2-T
A2-U
A2-S
A2-Y
21-A
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23-F
A5-A
A5-B
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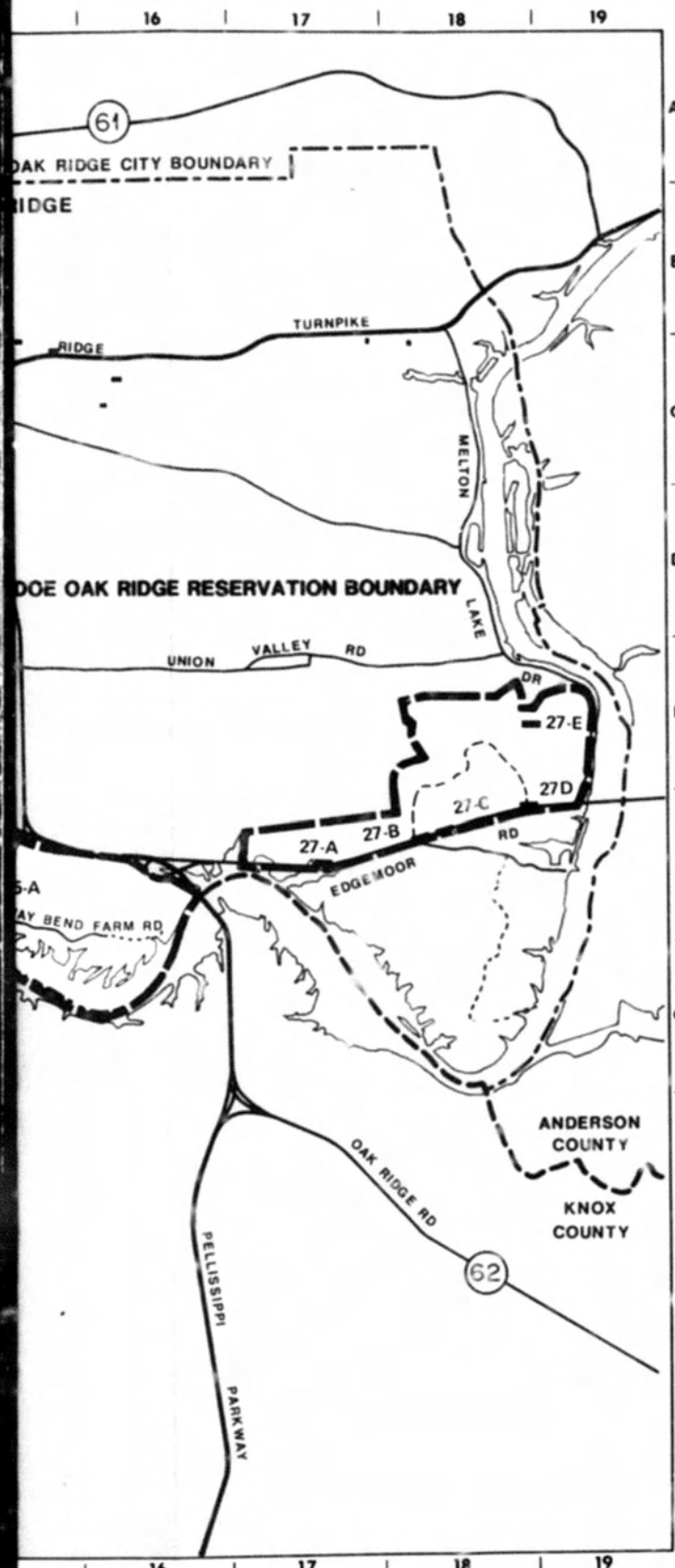
23-B

ORNL DWG 86-14867

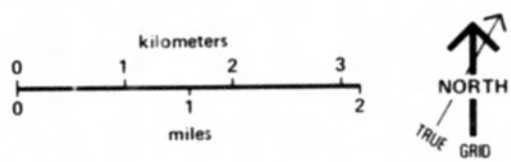


Resource Management Plan

For The:
U.S. DEPARTMENT OF ENERGY
OAK RIDGE RESERVATION
Prepared By:
MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- BARRICADES
- 27-A BARRICADE IDENTIFICATION NUMBER



Date NOV. 1986 Rev. 2

FIG. 3.47

BARRICADES

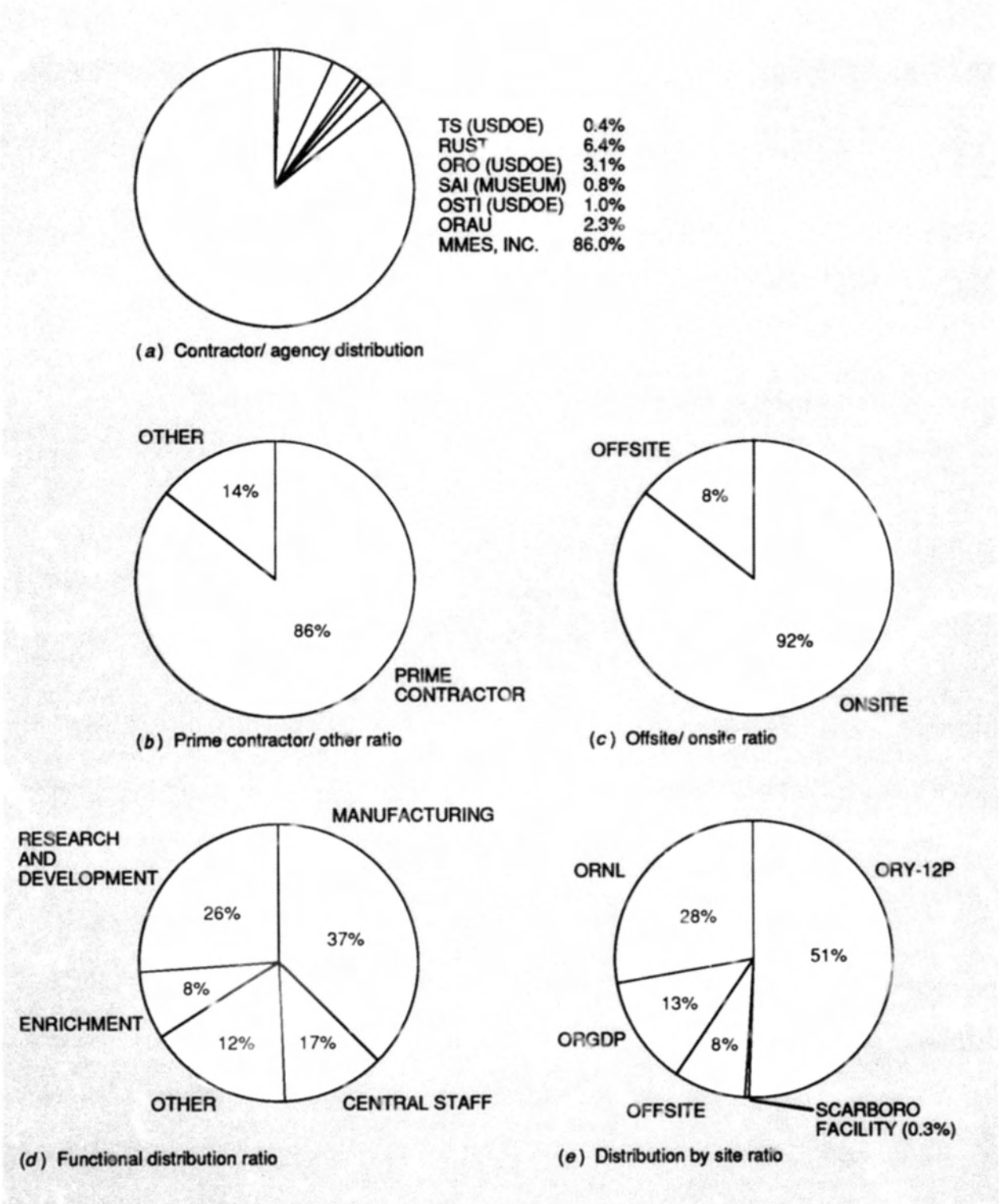


Fig. 3.48. Employment distribution.

Table 3.12. Population[a]

	1987	1988	1989	1990	1991
Oak Ridge Operations	600	600	600	600	600
Office of Scientific and Technical Information	175	175	175	175	175
Transportation Safeguards	120	120	120	120	120
Oak Ridge Associated Universities	408	414	420	425	430
Contractor for Museum of Science and Energy	145	145	145	145	145
Rust Engineering	1,135	1,035	1,035	1,035	1,035
Oak Ridge Gaseous Diffusion Plant	1,401	1,404	1,404	1,404	1,404
Oak Ridge National Laboratory	4,268	4,267	4,218	4,238	4,253
Y-12 Plant	6,714	6,730	6,750	7,100	7,000
Townsite[b]	3,004	2,979	2,973	2,973	2,973
Totals	17,970	17,869	17,840	18,215	18,135

[a]Transportation safeguards estimates were revised on Nov. 11, 1986; all other estimates are as of the end of FY 1985.

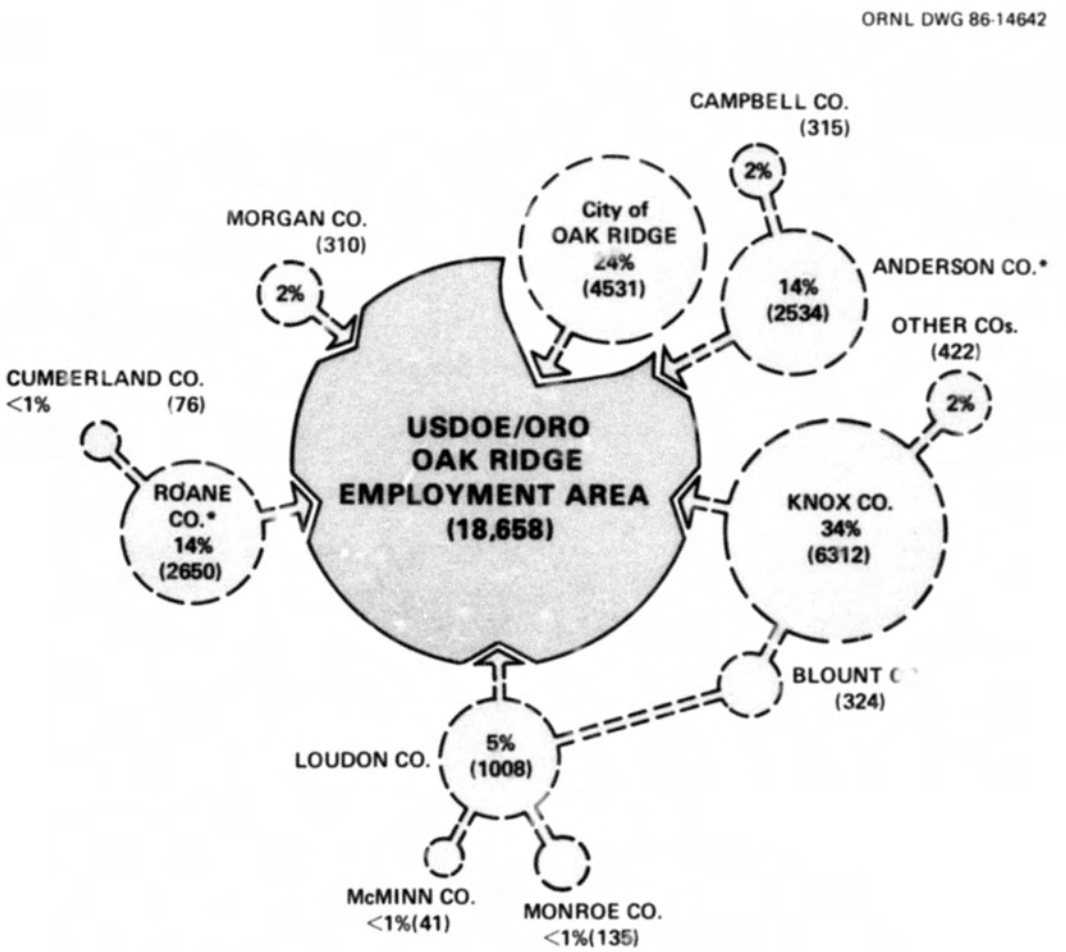
[b]Includes the central functions of the prime contractor.

Source: Planning and Budget Division, Oak Ridge Operations.

are being managed on a part-time basis. For the purposes of this document, resources are defined as assets (people, expertise, technology, property, equipment, and/or programs) that can be used to enhance or further the missions assigned. Without judging the relative merit of the current scheme for identification or subdivision of these various resources, it is important to note that some are subject to change as future needs and justifications arise. The organizational structure and line of direction and communication are well documented in Vol. 1 of the approved *Resource Management Plan for the U.S. Department of Energy, Oak Ridge Reservation* (ORNL-6026/V1).

The current organizational chart is shown in Fig. 3.51. In addition to these specific resources, the three primary facilities (ORGDP, ORNL, and Y-12), ORAU, and Rust Engineering are represented on the ORR RMO. Figure 3.52 shows the organizational line structure and information flow for addressing resource issues on the ORR. Figure 3.53 illustrates the directional flow of the ORR planning, review, and approval process.

Each specific resource is discussed in detail in terms of its real or perceived mission, policies, land needs (if programmatic), impacts, and relative land use issues. Some of the quiescent resources are discussed in detail as natural factors and others as facilities. Where possible each resource is mapped to illustrate the physical location(s) and area(s) of influence. Some determination is made as to the relative magnitude of importance, hierarchical order, or some other means



*Population outside the city of Oak Ridge.

Fig. 3.49. Population distribution.

of relating or overlaying these various land uses. A method of classification will be established to group "friendly" or compatible land uses that can coexist without artificial means of mitigating real or perceived conflicts.

The 24 resources identified are subdivided into three groups that more closely describe their various functions: (1) the Administrative Group, (2) the Functional (operational) Group, and (3) the Natural Group.

3.6.1 Administrative Group

The Administrative Group consists of nine resources that deal predominantly with planning and administrative issues. Except for FM, these resources have no staff, facilities, or land per se.

3.6.1.1 Archaeological, Cultural, and Historical Sites Management

The objective of the Archaeological, Cultural, and Historical Sites Manage-

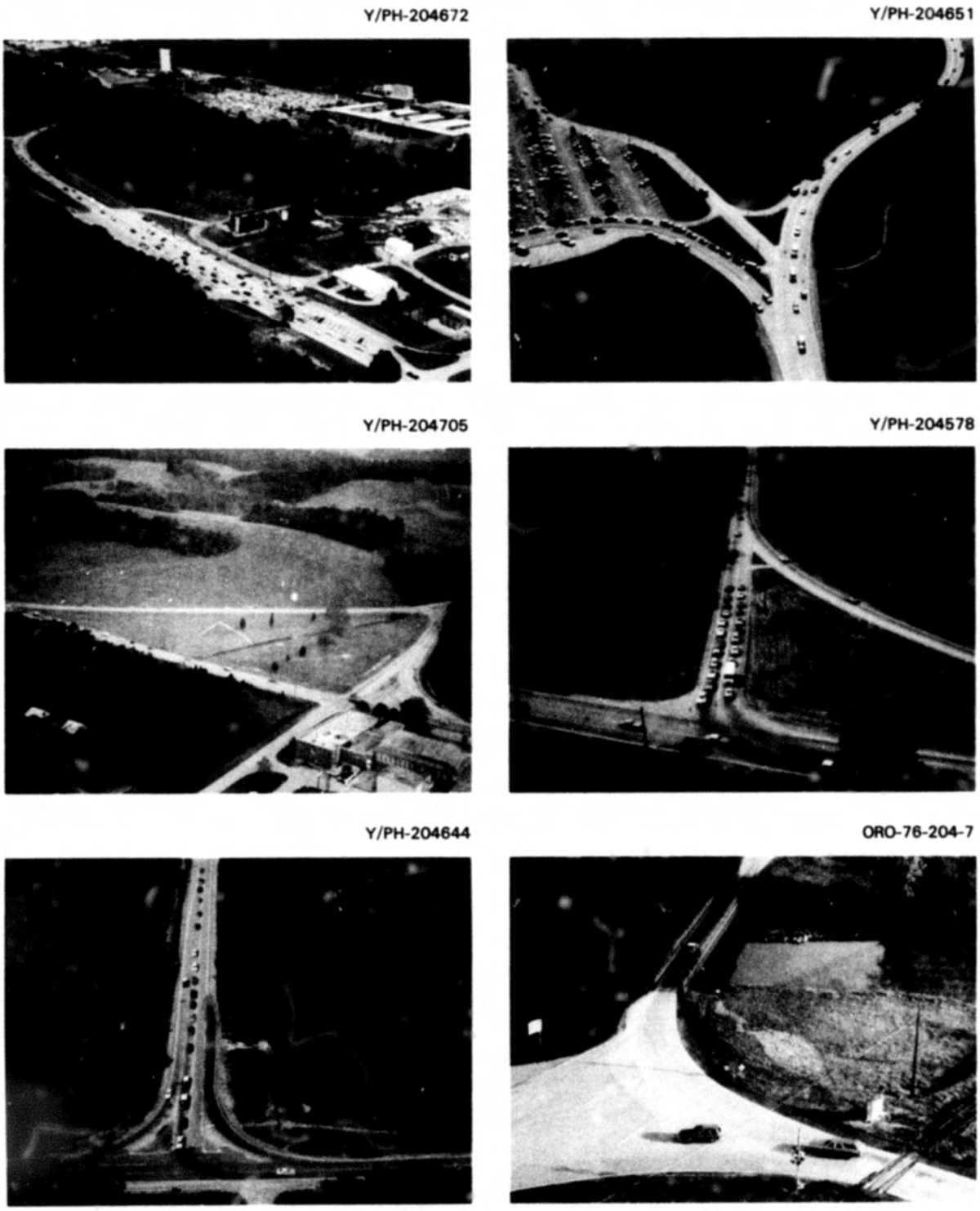


Fig. 3.50. Some areas that are subject to traffic congestion: (a) ORNL parking area along Bethel Valley Road; (b) ORNL main entrance at Bethel Valley Road (looking west); (c) interchange at Scarboro Road and Bethel Valley Road (looking northwest); (d) Illinois Avenue at Bethel Valley Road (looking north); (e) intersection of Bethel Valley Road and Highway 95 (looking east along Bethel Valley Road); and (f) one-lane bridge on Blair Road (looking north).

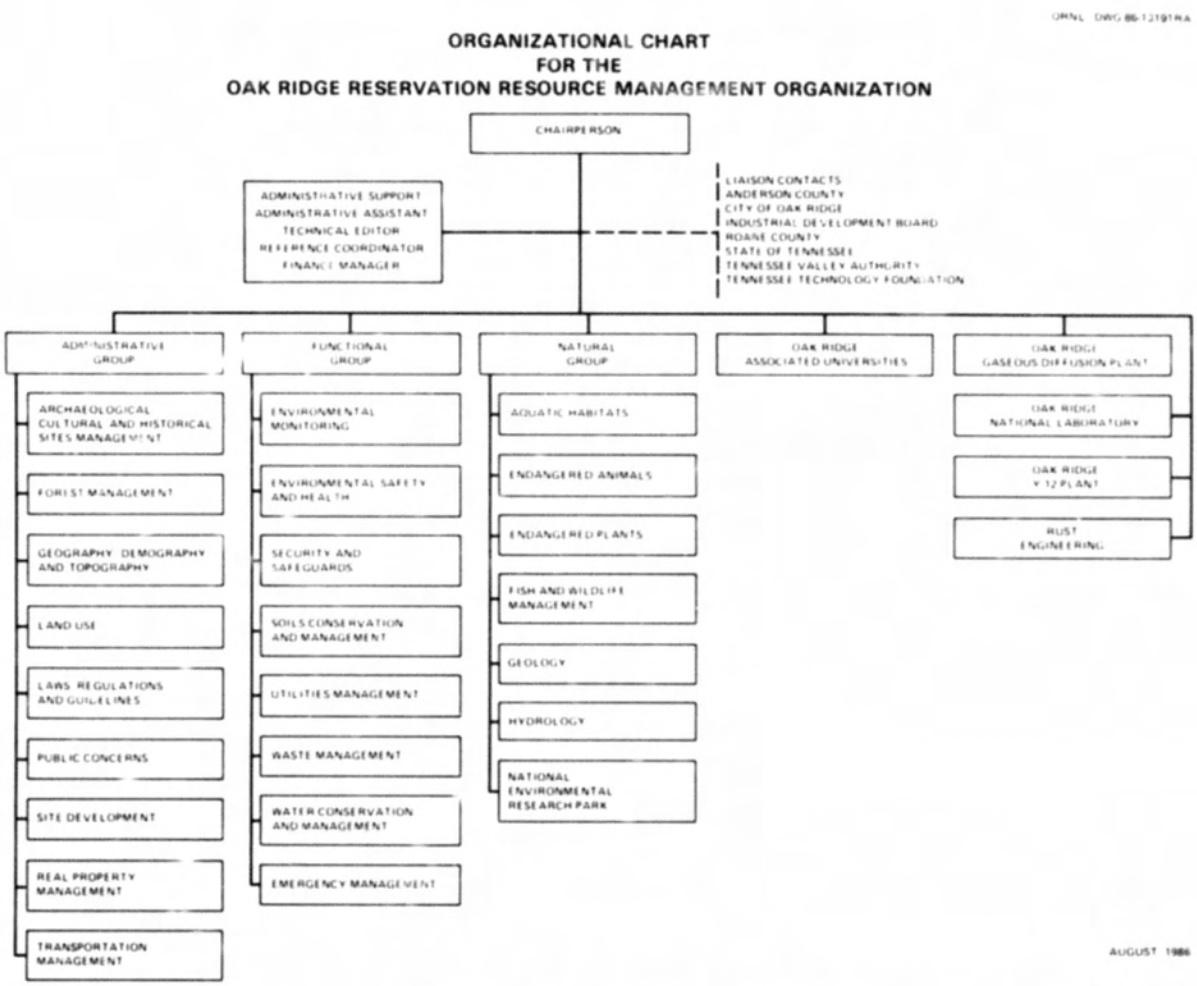


Fig. 3.51. Oak Ridge Reservation Resource Management Organization.

ment resource is to identify, locate, map, and document all of these features within the ORR and to collect and assemble all available pertinent information relating to them (inventories, reports, regulatory and preservation acts, etc.). In addition, the Resource Manager is to coordinate or interface with any parties who are conducting field investigations or related studies. No formal mission or policy statements exist aside from the federal and state legislation enacted to protect and preserve significant archaeological findings and sites, cemeteries, and historical sites.

The responsibilities and funding for this resource are such that only a limited amount of effort and funding is required for administration. A technically qualified person has been assigned this responsibility in addition to his normal duties. Any required funding is provided through the ORR RMO.

Expanded development and timbering operations are the primary sources of impact to the 30 identified archaeological sites and 28 cemeteries. The historic s s consist of the old graphite reactor (Fig. 3.54), Freels' cabin (Fig. 3.55), and two church buildings. Other cultural features

ORNL DWG 86-14869

COMMUNICATION FLOW DIAGRAM

Fig. 3.52. Organizational structure for addressing Oak Ridge Reservation resource issues.

include the American Museum of Science and Energy (Fig. 3.23), two visitors' overlooks (Figs. 3.56 and 3.57), and the Clark Center Recreational Park (Fig. 3.25). All of these require varying degrees of care and maintenance with responsibility assigned to different organizations. The primary issue, from a land use standpoint, is to understand precisely DOE's legal responsibilities (if any) for the protection and preservation of these sites.

3.6.1.2 Forest Management

The objectives of the FM program are to manage the forest on the ORR under the guidance of the principle of multiple use and to sustain the yield of quality timber products while interfacing with the other resources to ensure effective use of the forest (Fig. 3.13 and Table 4.4).

DOE's general policy statement for FM is as follows:

> When acquired land contains areas suitable for the conservation and management of forest resources, a forest management program will be established. This program will include forest administration, timber management, timber sales and harvesting, reforestation, forest protection, and all other elements related to timber production (DOE Order 4300.1B).

The many land uses and programs within the ORR are complemented by the

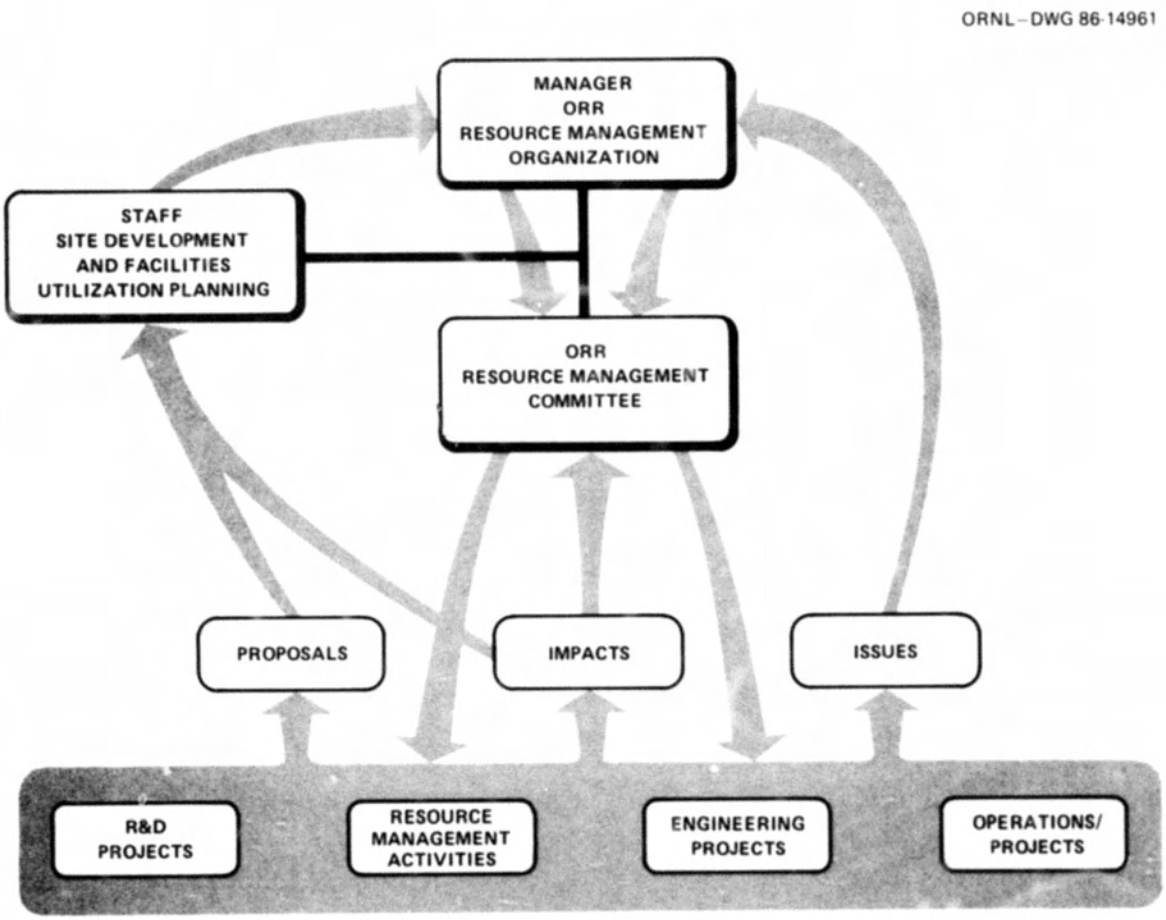


Fig. 3.53. Site planning, review, and approval process.

FM program, which interfaces directly with the functional working groups, the three plants, and ORAU. All facets of the forester's technical expertise must be used in making management decisions about treatment, protection, salvaging, harvesting, and reforestation as well as in documenting forestry-related work. One of the forester's prime responsibilities is the designation of timer stands to be harvested; others involve establishing restrictions and conditions for timber sales and establishing a conservation-type harvesting system for the Reservation's forests.

As an operational group, the FM function performs its specialty work in-house. These tasks include marking timber for sales, salvage, and protection; site preparation for reforestation; reforestation, prescribed burning; subcontractor supervision; timber inventory; mapping; fire road construction and maintenance; and similar types of work specifically requested by programs at the three major plant facilities. A staff of six full-time employees plus seasonal or part-time employees is needed to accomplish this work.

All timber sales are conducted by sealed bid, and all revenues go to the U.S. Treasury. The actual logging operations are conducted by outside vendors under contract.

Expanded and diversified uses of the ORR demand additional input and assistance from the FM program. One such use

ORNL PHOTO 5730-83

Fig. 3.54. Graphite reactor.

is the deposition of sludge on the ORR lands to improve soil quality and, hence, timber growth. This program benefits several RMC functional working groups as well as the City of Oak Ridge. For example, additional research potentials are resulting from these relatively new and diversified land uses. The FM manager is responsible for locating additional sites on the Reservation that have potential for sludge deposition, for directing the sludge deposition by the city, for coordinating these activities with research needs, for collecting sludge samples for composition analysis, and for reclaiming previously used sites with appropriate vegetation.

Because of the many activities performed by the FM program, a diversity of forestry and agricultural equipment is on hand. This equipment has been used to disk, mow, seed, plant, burn, grade, and cultivate numerous areas for a variety of program needs at the three plants.

A recent cost/benefit review of the FM program has shown the need for accounting adjustments in the system used to charge other programs for forest-related

Y/PH-193394

Fig. 3.55. Freels' cabin.

Y/PH-217636

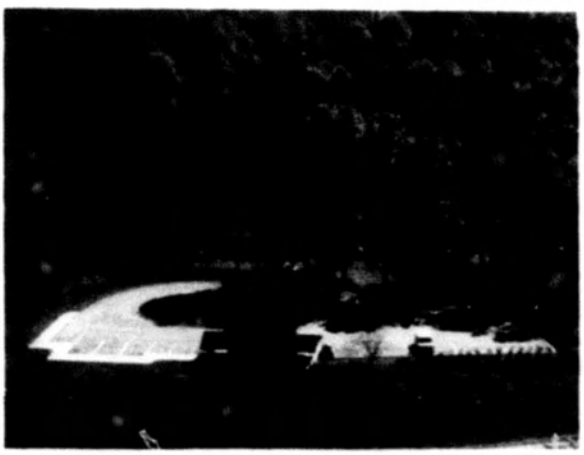


Fig. 3.56. Oak Ridge Gaseous Diffusion Plant visitors' overlook, located south of the plant and Highway 58.

Y/PH-217622

Fig. 3.57. Oak Ridge National Laboratory visitors' overlook, located north of the Laboratory and Bethel Valley Road.

work. The FM accounting system has been revised to reflect an appropriate charge for programmatic customers when their requests fall outside the normal FM activities.

3.6.1.3 Geography, Demography, and Topography

The primary objective of the Geography, Demography, and Topography resource is to provide a single, concise source of current information as to how these three topics relate to the ORR and the surrounding region. No formal mission or policy statement and no specific directives from DOE expressly address these topics. Indirectly, through DOE Order 4300.1B (under "Site Planning" in the "General Site Information" section), this information is required. Locally, through the ORR RMO, this resource is charged with this responsibility.

Even though the geography and demography of the ORR are constantly changing, little or no change of significance is occurring to the topography. This resource is considered semi-quiescent, not requiring full-time administration. Therefore, no employees are dedicated to this resource; instead, it is managed on an as-needed basis by a qualified expert who has been assigned this added responsibility.

Impacts and issues that relate specifically to this resource from a land use standpoint would evolve around the distribution and clustering of populations, their ability to migrate and evacuate, and the transportation network necessary to accommodate effective safe movement.

3.6.1.4 Land Use

The objective of the Land Use resource is to collect relevant data; organize, assess, and map the data; document various land use elements, constraints, and potential capabilities; and zone the ORR for its most effective use. This objective helps to achieve the mission of providing a mechanism for obtaining the best and most effective utilization of the land resource that can be achieved within the physical, legal, and administrative constraints with regard to the programmatic needs as they exist today and as they are perceived to be in the future.

The policy of the Land Use resource is to provide a current, studied assessment of the ORR's natural and manmade constraints and opportunities together with an understanding of programmatic needs and impacts of all resources. This understanding, combined with a commitment to safety and quality assurance, consideration for the welfare of individual employees, and stewardship of government-owned facilities and resources, is the foundation on which to plan for effective utilization of the land resource.

Administration of the land resource is an ongoing process, which is required as a part of the *Real Property and Site Development Planning* directive (DOE Order 4300.1B).

The responsibility for seeing that this function is accomplished locally rests with the DOE Engineering Manager, who looks to the prime contractor's Engineering Division to provide the technical expertise. The Engineering Division, as a service function, is primarily funded through work order requests (i.e., a requesting organization must fund the work); therefore, the source of funding is responsible for initiating and scoping the planning work to be accomplished. Since the ORR is a shared resource, funding must come from the Defense, Enrichment, and Research Programs.

Since Land Use is an administrative process, no dedicated facilities, land, or capital equipment is involved. Office space and office equipment are provided through the Engineering Division, and supplies are paid for through the various work orders.

Land as a resource and the way in which it is utilized have a direct impact on, and are impacted by, all other resources. Land use problems and issues begin with the physical, political (legal), and administrative constraints imposed on the ORR. Effective use of the land resource, mitigation of problems, and protection and preservation of essential lands from unfriendly encroachment are issues that must be addressed and resolved.

3.6.1.5 Laws, Regulations, and Guidelines

The objective of this resource is to provide a central source of documentation and interpretation of current laws and directives that regulate, constrain, permit, or require certain activities to be performed. No formal mission or policy statements exist concerning management of this resource. The RMO relies on a representative from the legal department of the prime contractor's central organization to serve in this capacity.

This resource has no other dedicated personnel, formal organization, or budget.

There are no physical impacts; however, many ORR activities must operate under special regulatory guidelines. Some activities are required as a result of other activities. The issues concerning this resource, from a land use standpoint, focus on the need to know which requirements are imposed and how they affect land use. Most of these laws, regulations, and guidelines deal with environmental, health, and safety concerns.

3.6.1.6 Public Concerns

The objective of the Public Concerns resource is to reflect the "pulse" of the RMO concerning sensitive issues such as information accessibility; environment, health, and safety; quality of life; and aesthetics. No formal mission or policy statements exist through the RMO. Each

major plant facility and the prime contractor's central organization have public relations representatives who operate within formal policy guidelines.

Management of this resource requires little time or funding and is performed by a qualified public relations officer who is available on a full-time basis but who serves on an as-needed basis.

The impacts on this resource, from a land use standpoint, are public image, credibility, and stability. Issues range from the environment to public health and safety. The focus on any issue not easily resolved must be handled with decorum while the issue is being aired, resolved, and/or mitigated.

One area that involves issues of public concern is recreation. For example, the Clark Center Recreational Area was recently opened to public access. Other attractions on the ORR that are open to the public include the visitor overlooks and the Museum. Public access entails such issues as transportation, safety, security, and levels of access.

3.6.1.7 Site Development

The objective of the Site Development resource is to provide a management tool to ensure the orderly growth and development of sites. Orderly planning gives managers the ability to correctly identify shortfalls and take advantage of opportunities in a timely fashion. The SDP increases the credibility of decisions and budget requests by allowing development in accordance with principles that have been approved in advance. When an approved SDP exists, inevitable changes to missions can be quickly and effectively analyzed, and their impact on facilities requirements can be calculated and verified. The SDP allows management to channel growth toward an efficient and effective long-term result. It reduces the need to react to crises and helps to avoid mistakes that could hamper future use.

An approved SDP serves a secondary purpose as the base document for all special studies involving facilities at the site; it is the feeder document for reports and plans required by DOE Orders that involve facilities.

DOE's official general policy on site development is as follows:

> A Site Development Plan will be locally prepared and managed for all major DOE sites . . . . Site Development Plans should be fully coordinated with all Departmental elements who have an interest in the site either from a programmatic, policy or regulatory viewpoint . . . . After full consideration of all viewpoints, Site Development Plans shall be approved . . . . Once approved, Site Development Plans will be continuously maintained and kept current through the process of revisions and changes . . . . All acquisitions, development, and permanent facility usage will be in accordance with the approved Site Development Plan and any revisions and changes to it. If a plan change cannot be prepared, then deviations from the agreed upon plan precepts require a written waiver approved by the Field Organization Manager (DOE Order 4300.1B).

Land use is a normal part of the site development planning process and is

included in the SDP. The organization, personnel, budgeting, and facilities are the same as for the Land Use resource (Sect. 3.6.1.4). The impacts, problems, and issues are also the same as for Land Use.

3.6.1.8 Property Management

The primary objective of the Property Management resource is to provide a single point of focus for information, issues, and questions involving real property on the ORR.

Facility management functions are delineated in DOE Order 4300.1B. A real property coordinator appointed at each ORR facility serves in varying part-time capacities to meet the requirements of this order. Through the RMO, issues affecting real property are channelled to facility coordinators. Management duties are performed on an as-needed basis by an individual who has been given this added responsibility.

3.6.1.9 Transportation Management

The primary objective of the Transportation Management resource is to provide a single point of contact for information, issues, and questions involving transportation systems within the ORR. This resource will not require full-time management but will require someone who is knowledgeable of transportation standards and traffic safety and familiar with the facilities' needs. This responsibility is not currently being fulfilled.

3.6.2 Functional Group

The Functional Group contains eight resources that deal predominantly with operational issues. Five of these are programmatic functions that are staffed and have ongoing budgets to operate and maintain their resource as well as to implement their programs. The three exceptions are the Soils Conservation and Management, Water Conservation and Management, and Emergency Management resources.

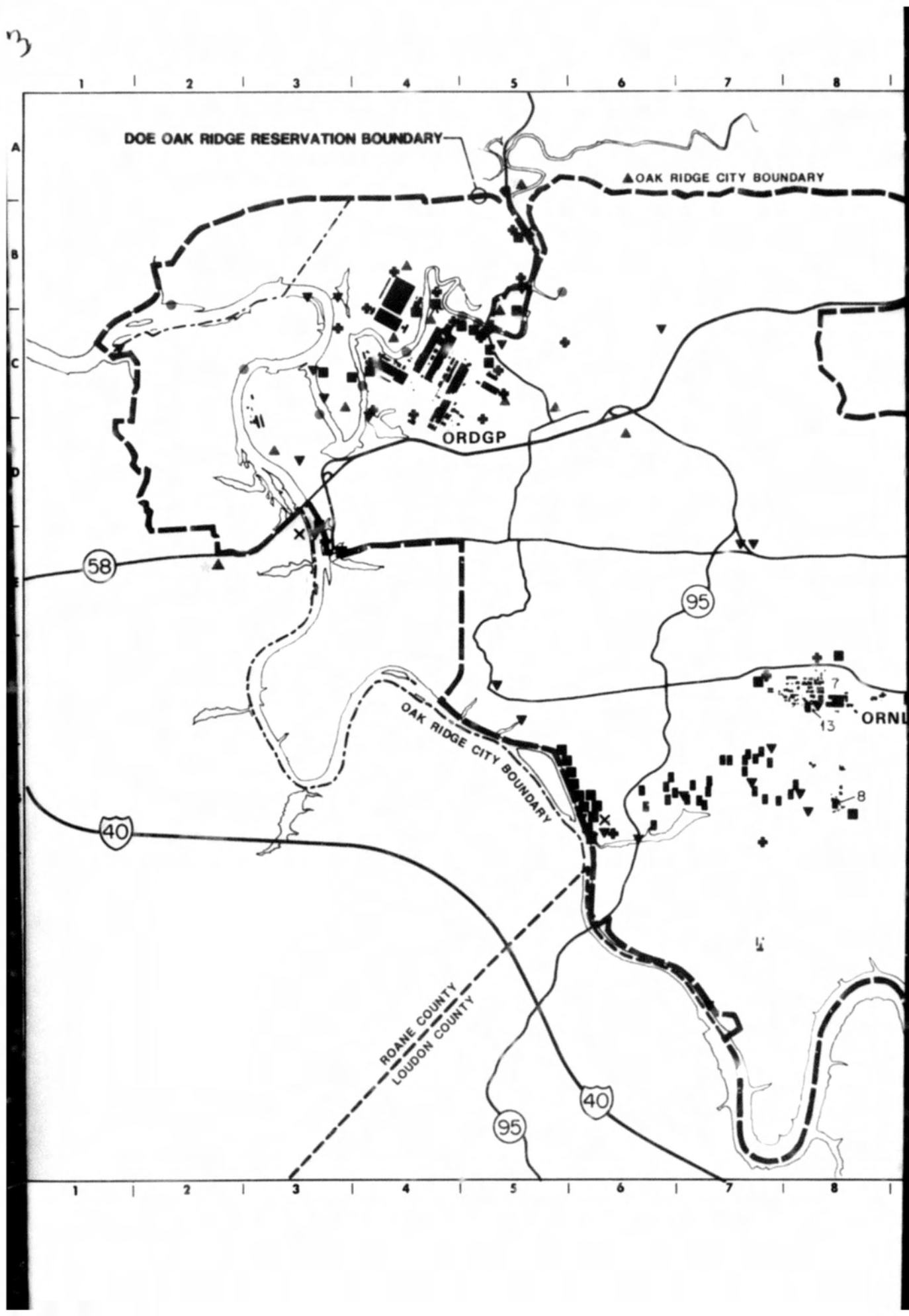
3.6.2.1 Environmental Monitoring

Routine monitoring and sampling for radiation, radioactive materials, and chemical substances on and off the ORR are used to document compliance with appropriate standards, identify trends, provide information for the public, and contribute to general environmental knowledge. The surveillance program assists in fulfilling the DOE policy of protecting the public, employees, and environment from harm that could be caused by its activities and reducing negative environmental impacts to the greatest degree practicable. Environmental monitoring information complements data on specific releases, trends, and summaries. For more information, see ORNL-6271, *Environmental Surveillance of the Oak Ridge Reservation and Surrounding Environs During 1985.*

Various types of measurements (Figs. 3.58 and 3.59) are taken at the following monitoring and sampling locations:

1. regional stations located at distances up to about 140 km (87 miles) from the ORR to provide a basis for determining conditions beyond the range of potential influence of these installations;

2. stations located within the ORR and in some residential and community areas to document conditions in areas occupied and visited by the public and potentially affected by these installations;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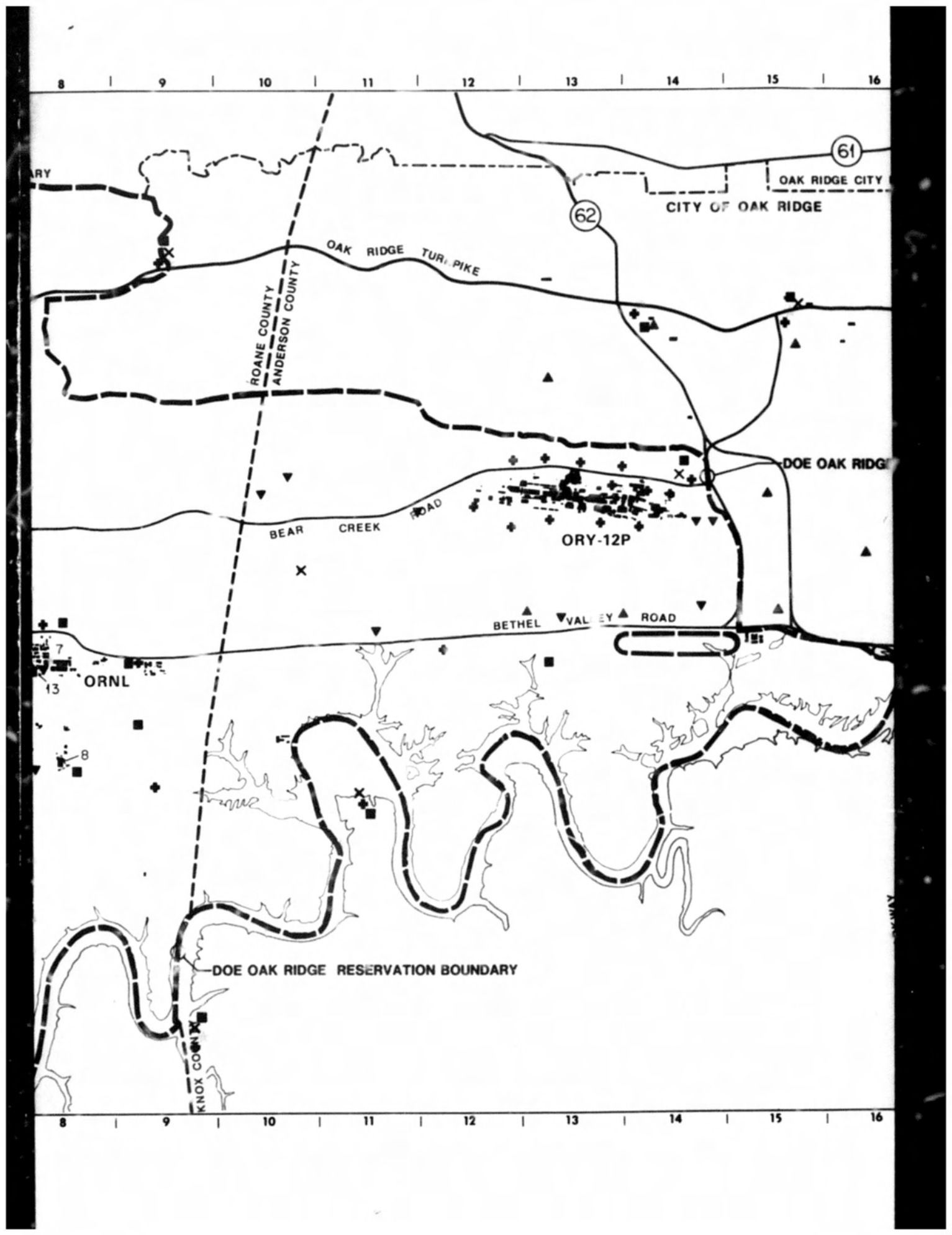
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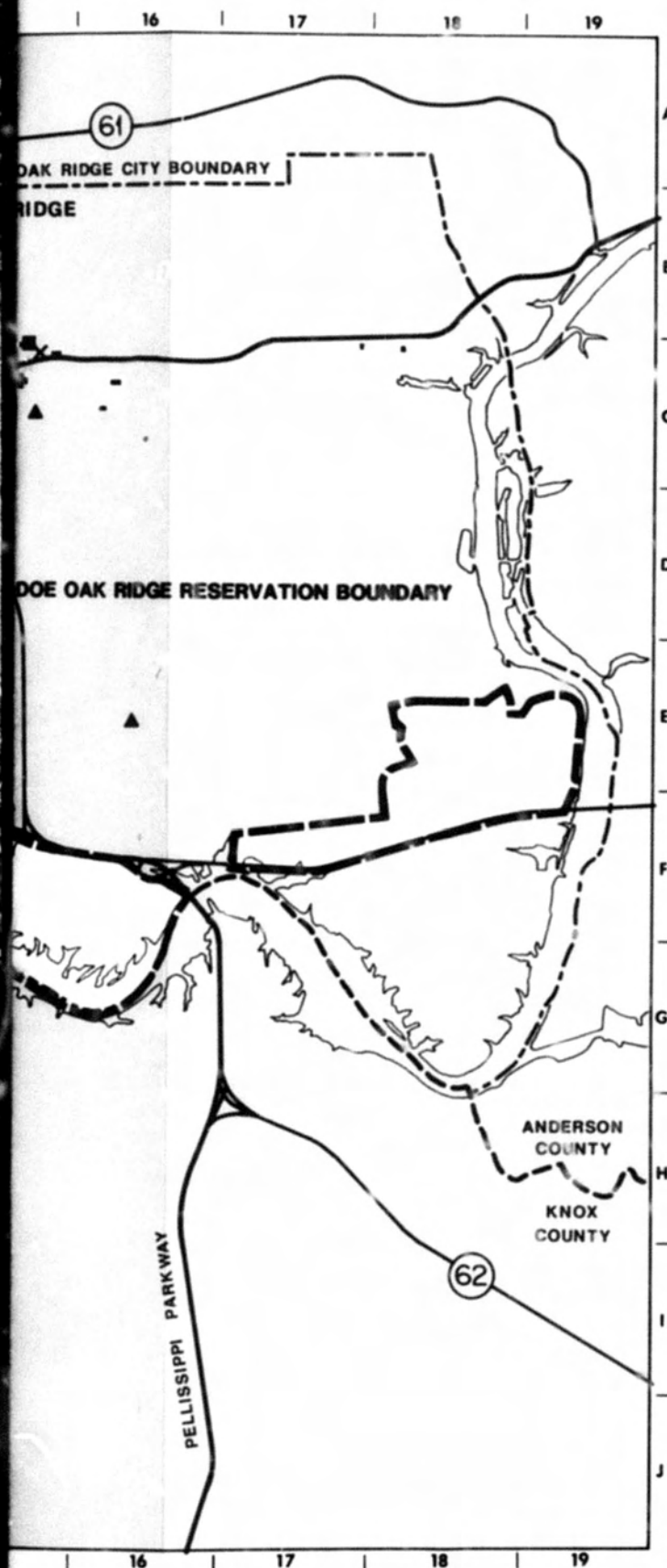

Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- TLDs
- RCRA WELLS
- VEGETATION
- SEDIMENT
- WATER
- RAIN
- SOIL
- AIR

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Date NOV. 1986 Rev.

FIG. 3.58

ENVIRONMENTAL MONITORING STATIONS

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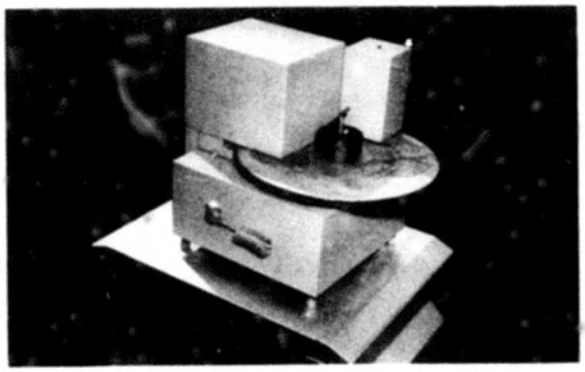

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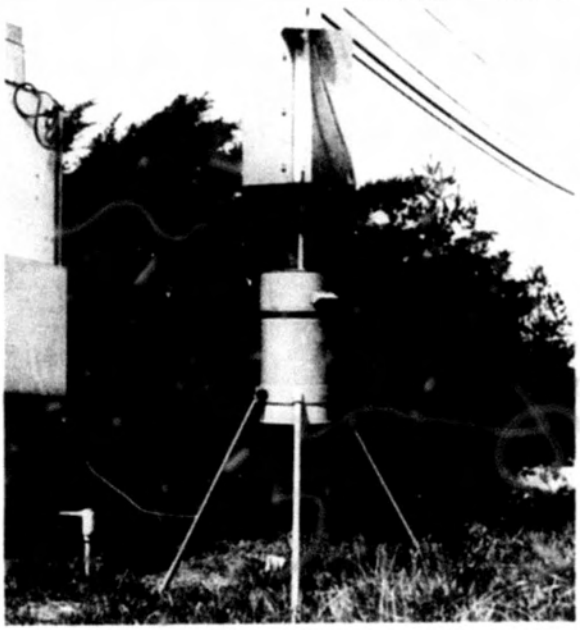

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ORNL PHOTO 2019-80

ORNL PHOTO 1484-82

ORNL PHOTO 2029-80

Fig. 3.59. Environmental monitoring activities.

3. perimeter stations located on the boundaries of ORGDP, ORNL, and Y-12 to document conditions in areas on their boundaries; and
4. on-site stations located on ORGDP, ORNL, and Y-12 site areas accessible only to employees or authorized visitors.

Several types of monitoring data are collected: (1) air, (2) external gamma radiation, (3) water (surface water and groundwater), (4) biological (fish, deer, and milk), (5) vegetation, and (6) soil and sediment.

Air monitoring. Historically, there have been five systems for monitoring air at DOE's Oak Ridge facilities: (1) stations around the perimeter of the Y-12 Plant, (2) stations around the perimeter of ORGDP, (3) stations around the ORR formerly identified as perimeter air monitors (PAMs), (4) stations inside the ORNL plant boundary, formerly identified as ORNL local air monitors (LAMs), and (5) stations outside the ORR at distances of 19 to 121 km (12 to 75 miles), designated as remote air monitors. Recently, in an effort to better describe impacts at each of the plant's boundaries, ORNL regrouped its LAM and PAM stations into (1) ORNL perimeter stations and (2) ORR stations.

The ORR air monitoring system consists of 10 stations that are, with one exception, outside the ORNL, Y-12, and ORGDP plant boundaries but inside the ORR boundary. These provide data for evaluating releases from Oak Ridge facilities to the immediate environment. The remote air monitoring system consists of seven stations that are outside the ORR at distances of 19 to 121 km (12 to 75 miles). This system provides background data to aid in evaluating local conditions and fallout data.

External gamma radiation. These measurements are made to confirm that routine radioactive effluents from the Oak Ridge facilities are not significantly increasing external levels above normal background. Measurements are also made in the few relatively small areas accessible to the public where current or past operations could cause radiation levels to be elevated. The monitoring network can also be used to assess the impact of unusual occurrences.

Surface water. Several institutions routinely monitor water quality in the Clinch River; these include TVA, the U.S. Geological Survey, and the Tennessee Department of Public Health. Water quality measurements are also made at a number of stations operated by Energy Systems for DOE.

Groundwater. ORNL has a groundwater network consisting of 22 monitoring wells located adjacent to three surface impoundment areas. In 1985, Y-12 installed and developed additional wells to further investigate and characterize regional groundwater conditions and to provide additional monitoring capabilities. The original 21 groundwater monitoring wells at ORGDP are of questionable reliability, and the data collected from them have not been sufficiently consistent to indicate trends or to identify the direction of contaminant migration.

Biological monitoring. Fish are routinely collected from the Clinch River for tissue analyses of radionuclides, mercury, and polychlorinated biphenyls. Three species (bass, bluegill, and carp) serve as representative organisms for determining impacts of plant operations.

Two primary sources of deer for monitoring have been deer harvests (including

scheduled deer hunts) and vehicle-deer collisions. In fact, the public hunts were prompted in part by the continued personal property losses and the increasing potential for human injury resulting from the increased deer population. Radioiodine has been found in the thyroid glands of both vehicle-killed and harvested deer.

Raw milk is monitored for ^{131}I and ^{90}Sr through analysis of samples from nine locations within an 80-km (50-mile) radius of Oak Ridge. Samples are collected from five stations near Oak Ridge about once a week. The four more-remote stations are sampled about once a month.

Vegetation. Grass samples and pine needles have been collected and analyzed for uranium, fluoride, and a variety of radionuclides.

Soil and sediment. Soil sampling is performed to allow examination of atmospheric deposition of radionuclides. Only the top 2 cm (0.8 in.) of the soil sample were analyzed [except for locations around ORGDP, where the sample depth was 1 cm (0.4 in.)].

Sediments play a dominant role in aquatic ecology by serving as a repository for radioactive or chemical substances that pass by way of bottom-feeding biota to the higher trophic levels. Thus, a sediment sampling program was initiated near ORGDP in 1975 to determine concentrations of various metals in the sediment of Poplar Creek and the Clinch River.

3.6.2.2 Environmental Safety and Health

The use of buffer zones (Fig. 3.60) around the perimeter of nuclear facilities is standard. The size of the zone should be consistent with the "as low as reasonably achievable" concept with regard to exposure of personnel to radioactive or toxic materials. For a maximum hypothetical accident, regulations have established 300 rem to the thyroid and 25 rem to the whole body for 2 h as the maximum radiation doses permitted at the edge of an exclusion boundary (buffer zone).

Buffer zones are generally regarded as controlled areas that are not permanently occupied, such that evacuation would be prompt and easy following an accident that could have serious "off-site" health impacts. A buffer zone is permitted to have occasional occupancy and may be dual-use property (i.e., it may be shared for such uses as agriculture, FM, research, and even off-site permanent residences). In any case, emergency plans and capabilities must ensure rapid evacuation on short notice.

The size (radius) of a buffer zone varies with the relative hazard of the particular facility. For example, a very-low-hazard nuclear facility may require no buffer zone, while a minimally contained reactor may require 16 km (10 miles) or more.

The following buffer zone needs for the ORR facilities were discussed in the *Oak Ridge Reservation Land-Use Plan*, DOE/ORO-748, Rev. 1 (March 1980).

1. *ORGDP*. Although ORGDP's enrichment facilities have been shut down, they are officially in a standby mode, ready for restart in the early 1990s. This status implies the same imposition of environmental, safety, and health requirements that would be imposed if the facilities were in full operation. Inherent in the uranium enrichment process are certain designs, process variables, and quality assurance provisions that also effect a high degree of containment for uranium. These provisions, in conjunction with the fact that only

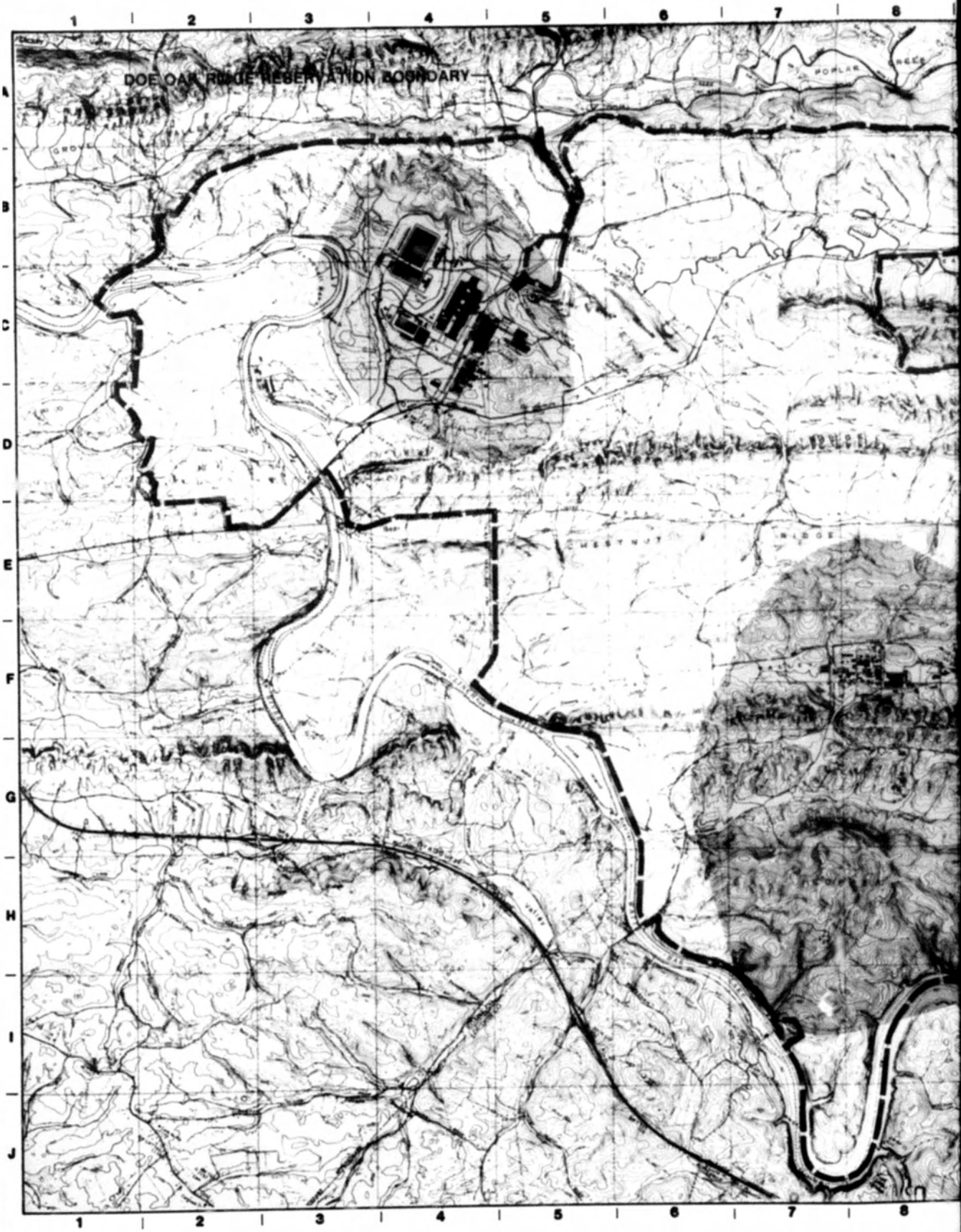
low-^{235}U-assay UF_6 is handled at ORGDP, indicate that an extremely large buffer zone is not needed. However, hazard analysis is based on a philosophy of assuming the failure of certain lines of containment. For ORGDP, the potential for large releases of uranium involves ancillary feed, withdrawal, and sampling operations in which UF_6 is heated in large-capacity (up to 14 tons) cylinders. Thus, considerations involving routine environmental releases and maximum postulated accidental releases support a 1-km minimum buffer zone radius for ORGDP. Doses from postulated accidents should not exceed 1 rem (whole-body) in this zone.

2. *ORNL.* Buffer zones or exclusion areas are reasonably well-defined for ORNL, particularly for the reactor facilities, where extensive documentation is required. For HFIR and the Oak Ridge Research Reactor, the buffer zone radius is controlled by whole-body radiation exposure. Thyroid exposure is not a factor because iodine filtration systems are incorporated into these reactors. The buffer zone for HFIR [100 MW(t)] is 2.8 km (1.75 miles); the Research Reactor has a 1.6-km (1-mile) buffer area. The TSF and the HPRR require fairly large buffer areas because they are operated in an unshielded condition. Fences, which serve as the edge of the buffers for these unshielded reactors, control personnel access. The radius of the TSF's irregularly shaped buffer ranges from 1.2 to 2 km (0.75 to 1.25 miles). The buffer zone radius for the HPRR ranges from 0.8 to 1.6 km (0.5 to 1 mile). The total buffer for ORNL consists of the buffer areas for these facilities and the 1.6-km (1-mile) zone for plutonium and waste treatment facilities.

3. *Y-12.* Operations at Y-12 include enriched uranium fabrication, uranium recovery, and plutonium handling. Also included are a variety of R&D programs that involve the use of toxic or hazardous substances. Rigid controls exist to minimize plant impact on the environment through design, monitoring, and procedures. Still, a nominal 1-km buffer zone is considered necessary. This should ensure that whole-body doses from criticality accidents (worst accident) do not exceed about 0.1 rem. The need for a buffer zone is further supported by the fact that Y-12 operations are flexible and subject to decisions made by outside design groups involved in defense programs.

4. *Scarboro Facility.* The buffer zone for this facility is a fenced area that encloses an array of radiation sources used to irradiate large animals; when in use, the sources are unshielded. Severe operating controls are imposed because the size of the buffer zone is limited by the proximity of the lake reservoir. An expanded buffer zone may be required if future research programs include the use of significant quantities of transuranics.

5. *Radioactive and chemical waste burial.* With the exception of the radioactive waste burial area northwest of Y-12 along Bear Creek, all major radioactive and chemical waste treatment and burial areas are included in existing buffer zones. Buffer zone cri-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Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

HEALTH AND SAFETY BUFFERS

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Date NOV. 1986 Rev.

FIG. 3.60

HEALTH AND SAFETY BUFFERS

teria and requirements for commercial radioactive waste burial operations are not defined; however, depending on certain factors (the geology of the area, the type of materials buried, etc.), an appropriately fenced exclusion area of reasonable size is considered adequate. This area is needed to effect any required monitoring, access, and expansion of operations. The fenced perimeter around the Y-12 Bear Creek waste burial operations thus constitutes an acceptable exclusion area for current operations. Future expansions could require an enlarged perimeter.

3.6.2.3 Security and Safeguards

The functions of this group are to safeguard special nuclear material and classified information and material in accordance with applicable laws, Executive Orders, and DOE regulations and to protect government property from theft, damage, or destruction. This requires the establishment and maintenance of systems for the control, physical protection, measurement, accountability, storage, document handling, and personnel security programs that effectively detect and deter adversary actions.

Government materials and property include the installation itself and essentially all materials, equipment, supplies, and items that are not directly owned by the government but that are integrated into the installation's operations in the interest of the government.

Many laws are applicable to theft, damage, or misuse of government materials and property, including the following.

1. *Section 641, U.S. Criminal Code, Title 18,* makes it unlawful to embezzle, steal, purloin, or knowingly convert to one's own use or another's use any thing of value that belongs to the United States or its departments or is being made for the government under contract. It is also illegal for someone to receive, conceal, or convert to his own use any government property known to have been embezzled, stolen, purloined, or converted.

   When the value of the property does not exceed $100, the guilty person may be fined not more than $1,000, imprisoned not more than one year, or both. If the value is greater than $100, the guilty person may be fined up to $10,000, imprisoned up to ten years, or both.

2. *Section 1361, U.S. Criminal Code, Title 18,* makes it unlawful to willfully injure or commit any depredation against any property of the U.S. government, its departments, or any property being manufactured or constructed for the United States. If the damage does not exceed $100, the guilty person may be fined up to $1,000, imprisoned up to one year, or both. If the damage is greater than $100, the guilty person may be fined up to $10,000, imprisoned up to ten years, or both.

3. *Section 229, Atomic Energy Act of 1954, as amended,* authorizes DOE to issue regulations restricting unauthorized entry into or upon any facility or real property subject to DOE jurisdiction and to prohibit bringing into or upon such facility or real property any dangerous weapon, explosive, or other dangerous instrument without proper authority. Willful violation where there is no barrier is punishable by a

fine of not more than $1,000. Unauthorized entry where there is a fence, wall, floor, roof, or other structural barrier is punishable by a fine of not more than $5,000, imprisonment for not more than one year, or both. Such facilities and areas must be posted conspicuously with specially worded signs.

4. *Section 161k, Atomic Energy Act of 1954, as amended,* authorizes the arming of protective force personnel and sets forth the conditions under which the use of deadly force is authorized.

DOE orders set forth standards and procedures to be followed to prevent theft, damage, or destruction of government property, including special nuclear materials, and to protect against unauthorized access to or theft of classified information.

To carry out the security and safeguards mission, each installation maintains a staff of security specialists and a uniformed, armed protective force supplemented by special weapons, alarms, detection systems, vehicles, physical barriers, access control systems, gates, fences, and other physical security measures implemented according to established procedures and policy. Overall operations are coordinated through the Manager of the Security and Safeguards Resource, who has matrix responsibilities.

3.6.2.4 Soils Conservation and Management

This resource (like the geology, topography, and hydrology resources) is a natural resource and is relatively static or quiescent. Thus, it does not require full-time management. The primary objective of this resource is to provide a single point of contact for information, issues, and questions involving soils within the ORR. This function is served on a part-time, as-needed basis by an Environmental Sciences Division (ESD) soil expert, who is knowledgeable of the day-to-day functions and programs involved in work that impacts soils.

3.6.2.5 Utilities Management

The objective of this resource is to ensure the continuation of utilities services, including electrical power, raw and treated water, natural gas, and telecommunications, to all DOE-related facilities on the ORR. The Utilities Management Coordinator is responsible for reviewing all proposed major changes to utility right-of-ways and proposed service additions or deletions that involve facilities outside plant boundaries to assess impacts on the overall resource. The coordinator is also responsible for involving appropriate parties in the review of these changes.

Funding and staffing for this resource are provided by the annual operating budgets for the utilities functions at ORGDP, ORNL, and Y-12. A representative from one of these organizations is available to coordinate activities with the ORR RMO. This individual carries out these responsibilities in addition to normal job duties.

The primary sources of impact to the Utilities resource come from severe weather, natural disasters, new construction, or demolition on the ORR. The only management tasks involved with the impacts resulting from weather or natural disasters are the timely restoration of services to affected facilities. The management of impacts resulting from construction or demolition is more preventive

in nature and can be handled appropriately through proper review of such proposed activities by the ORR RMO.

3.6.2.6 Waste Management

The primary objective of the Waste Management resource is to provide a single, concise source of current information about past, current, and planned waste management programs and activities on the ORR. Waste management strategy plans currently being developed will identify land resource requirements, programs, and plans for the coordinated management of wastes generated on the ORR. This coordinated approach will help to ensure that waste management policies and procedures are consistently implemented, that the limited number of acceptable sites for waste management on the ORR are utilized most efficiently, and that the use of available resources is maximized to solve ORR waste management problems.

The Waste Management resource includes radioactive low-level waste (LLW) and transuranic waste, Resource Conservation and Recovery Act hazardous wastes, mixed radioactive and hazardous wastes, and sanitary/industrial wastes (including those generated as part of routine and nonroutine operations and site remedial actions).

Wastes generated on the ORR are currently managed through a strategy involving waste minimization, interim storage, disposal in existing burial grounds (using improved operational methods and technologies where feasible), and demonstrations of waste management technologies. Technology demonstration programs for LLW, mixed, and hazardous wastes are being developed and implemented. In addition, a new LLW management facility and an industrial landfill are being sited on the ORR.

Waste management activities are governed by a variety of federal and state laws and regulations and DOE orders. The most important of these are the Resource Conservation and Recovery Act and its implementing regulations, the State of Tennessee's Hazardous Waste Management Act and Solid Waste Disposal Act and their implementing regulations, and DOE Orders 5480.2, "Hazardous and Radioactive Mixed Waste Management" and 5820.2, "Radioactive Waste Management."

Programs are in place to manage wastes generated on the ORR; the direct implementation of these programs is the responsibility of the ORNL, Y-12, and ORGDP waste management organizations. Coordination and oversight of waste management policies, strategies, plans, and activities are the responsibility of the Energy Systems Central Waste Management Office. Waste management activities are funded by the Defense, Enrichment, and Research programs.

Several other facilities for sanitary/industrial wastes disposal, mixed and hazardous waste treatment and storage, and LLW treatment will be required over the next several years. However, the exact designs and locations of these facilities are not finalized. Clearly, the demand for acceptable sites that meet federal and state siting requirements for waste management will compete with other land uses in the near term as waste management facilities are upgraded and remedial actions are taken to ensure that facilities are in compliance with environmental protection and waste management requirements. In addition to direct competition for available land, waste management activities will impact the other

functional and resource groups through buffer zones, potential contaminant releases, security requirements, radiation shielding requirements, and utility and transportation requirements.

Figure 3.61 shows active, inactive, and planned waste disposal areas. Figure 3.62 shows various scenes of waste management on the ORR.

3.6.2.7 Water Conservation and Management

This function is intended to ensure that maximum benefit is derived from water resources and that they are protected. A recently published *Water Conservation Plan* (ORNL/ESH-1/V21) summarizes the water balance for the ORR and includes plans for optimizing water usage and protecting water quality.

Water usage at the ORR facilities includes makeup water for cooling purposes (cooling tower and once-through cooling water), water for process systems, sanitary water, and water for boiler feed and ash sluice at the steam plants. Cooling water accounts for over 50% of the water used at each plant. The water withdrawn from the Clinch River is consumed by these processes, lost to the atmosphere as evaporation, or eventually discharged back to the Clinch, either directly through tributary streams or indirectly by groundwater flow. Energy Systems facilities discharge 49.84 million L (13.14 million gal) to the Clinch River system each day.

Potential options for minimizing water usage at the ORR facilities include controlling water line leakages, recycling effluents, reducing once-through cooling, and installing flow meters for accurate accountability of water use.

Water quality can be affected by discharges from the three plants and by groundwater transport of pollutants from burial grounds and landfills. Few streams on the ORR do not receive waste in some form, as direct discharge, surface runoff, or groundwater discharge.

Programs are in place to preserve and protect water quality within the ORR. These include the National Pollutant Discharge Elimination System (NPDES) permits, best management practice plans, and remedial action plans. The intent is to improve water quality through adequate characterization of effluents and waste so that appropriate treatment, storage, disposal, or remedial action programs can be implemented. Monitoring wells provide information on groundwater quality so that an assessment can be made of the effectiveness of pollution control measures.

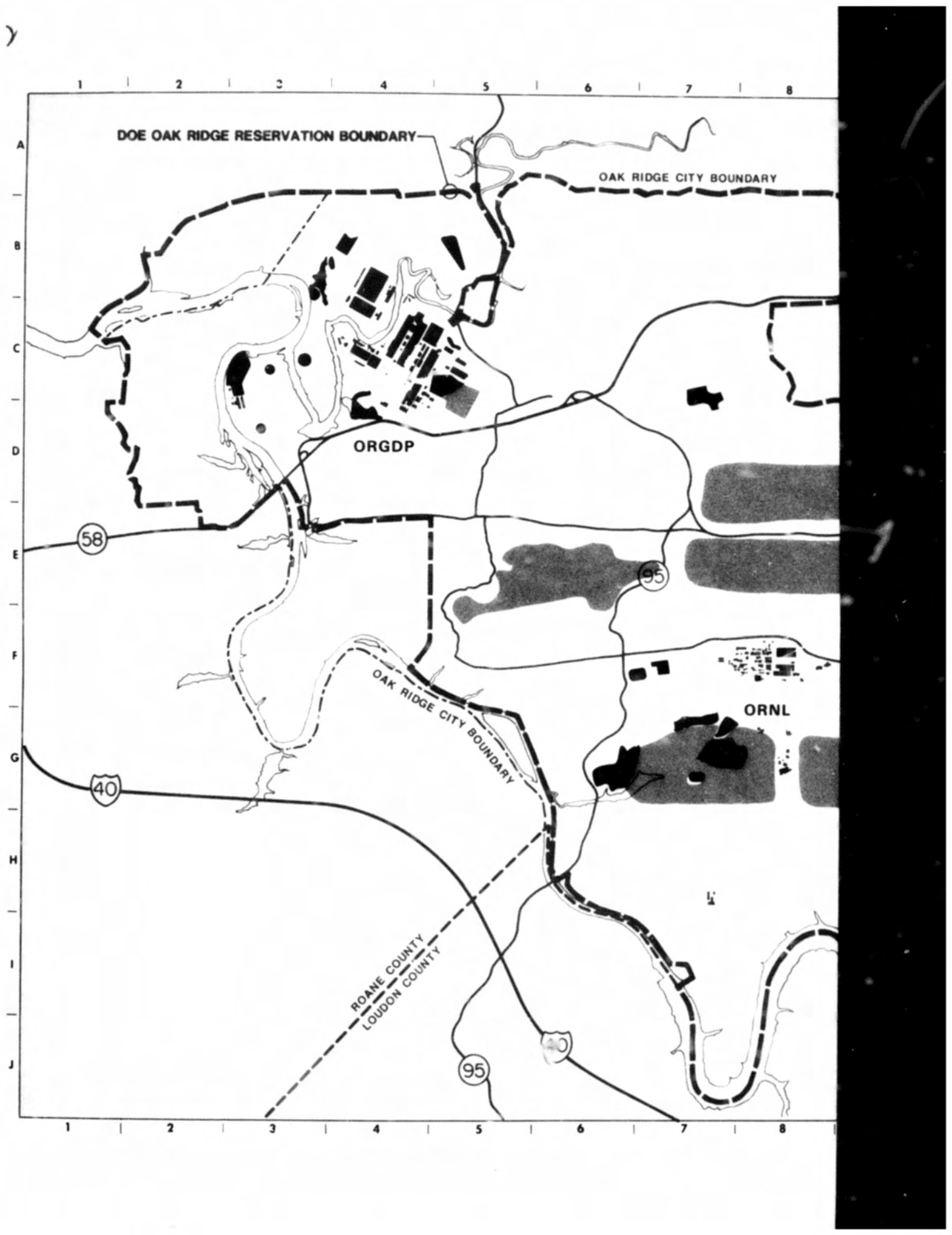
For more information about the hydrology of the ORR, see Sect. 3.3.5.

3.6.2.8 Emergency Management

The three Energy Systems facilities in Oak Ridge have extensive emergency preparedness programs. Each facility has plans, equipment, and trained personnel to deal with any credible emergency on an around-the-clock basis.

Each facility has a well-equipped fire department that is trained to handle any possible fire situation. The three facilities and the City of Oak Ridge have mutual aid agreements to assist in fighting fires that are beyond the capability of any one fire company. Each facility is responsible for fighting fires on the Reservation land outside its perimeter fence.

In addition to the fire departments, a well-trained Emergency Squad is available to assist as auxiliary fire-fighters. The squads are also trained in dealing with vehicle accidents, hazardous and/or toxic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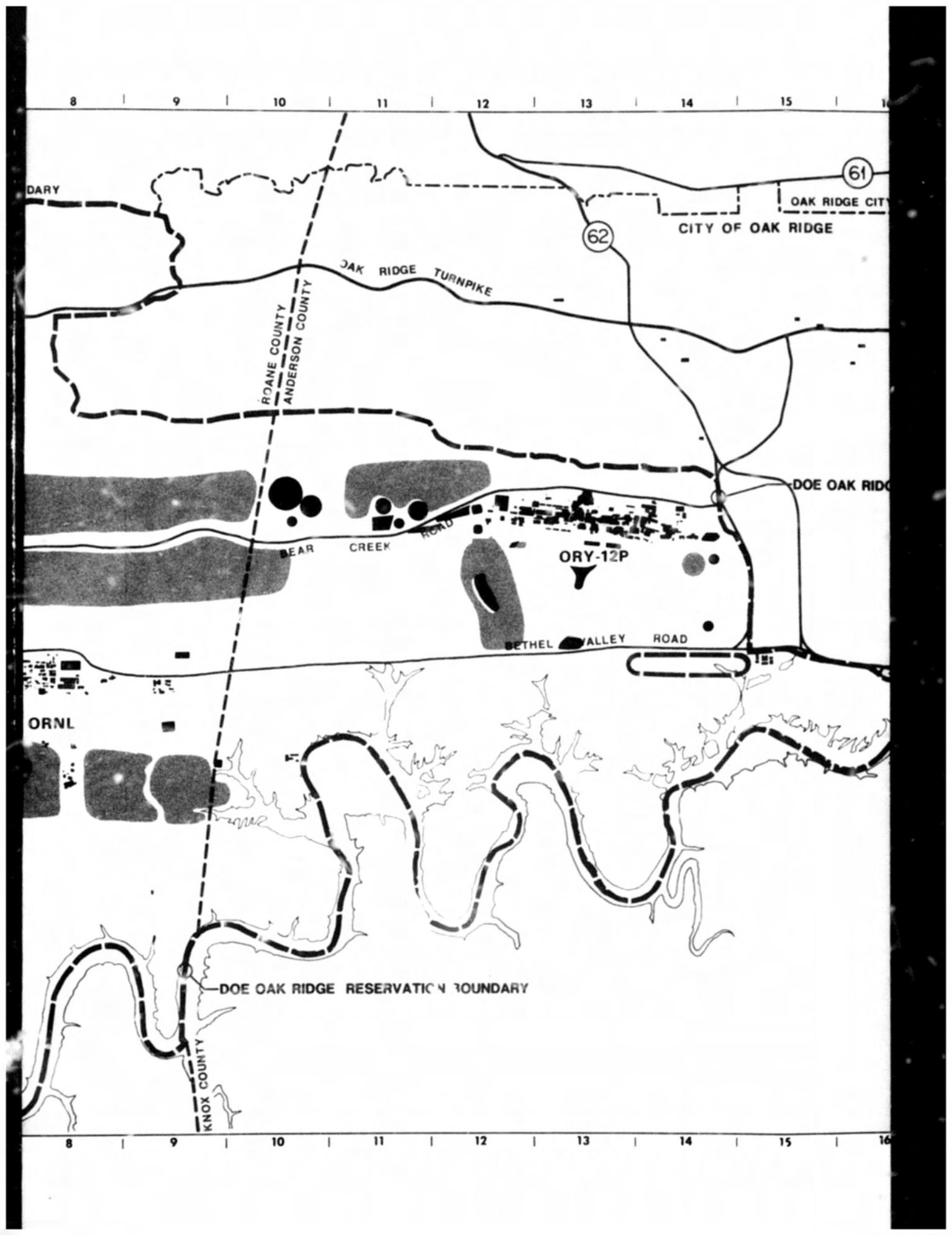
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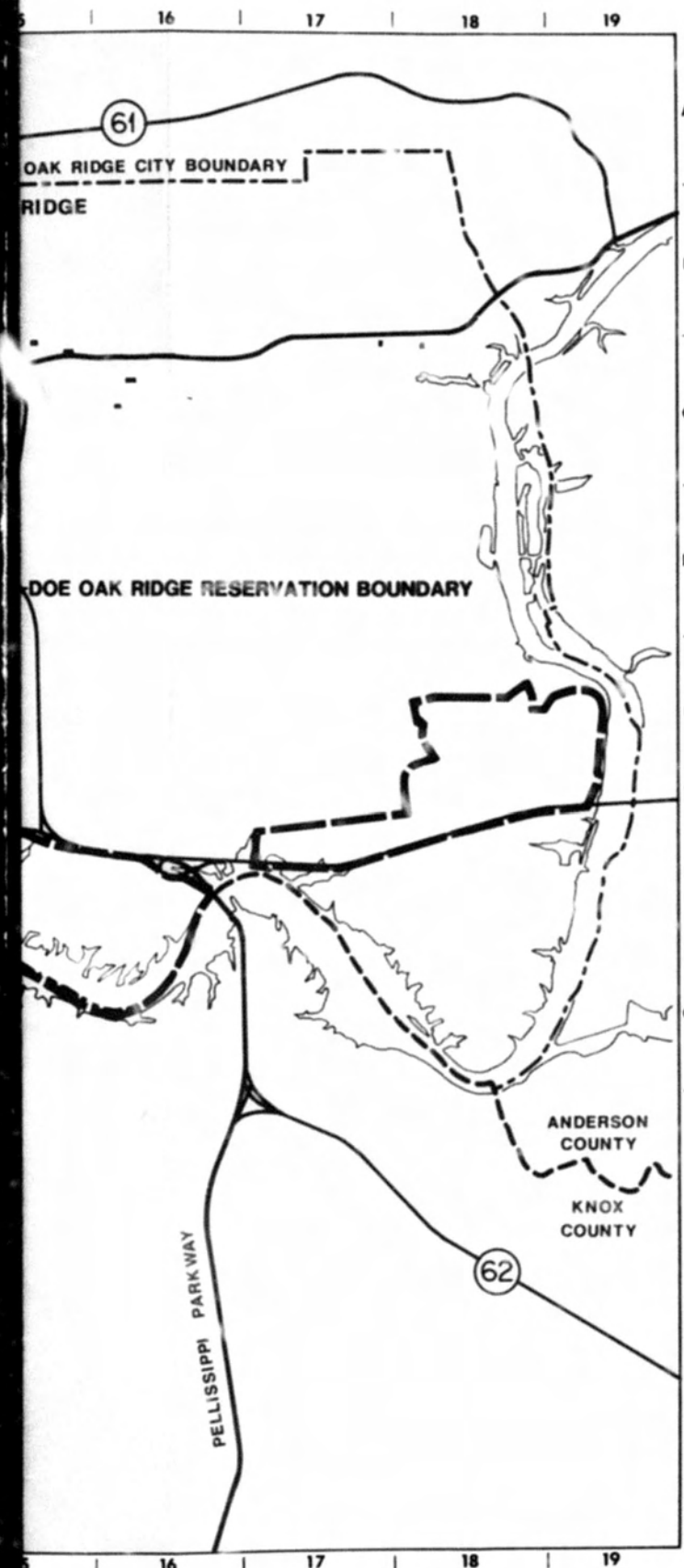


Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- ACTIVE DISPOSAL AREA
- INACTIVE DISPOSAL AREA
- PLANNED DISPOSAL SITE

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.61

WASTE DISPOSAL

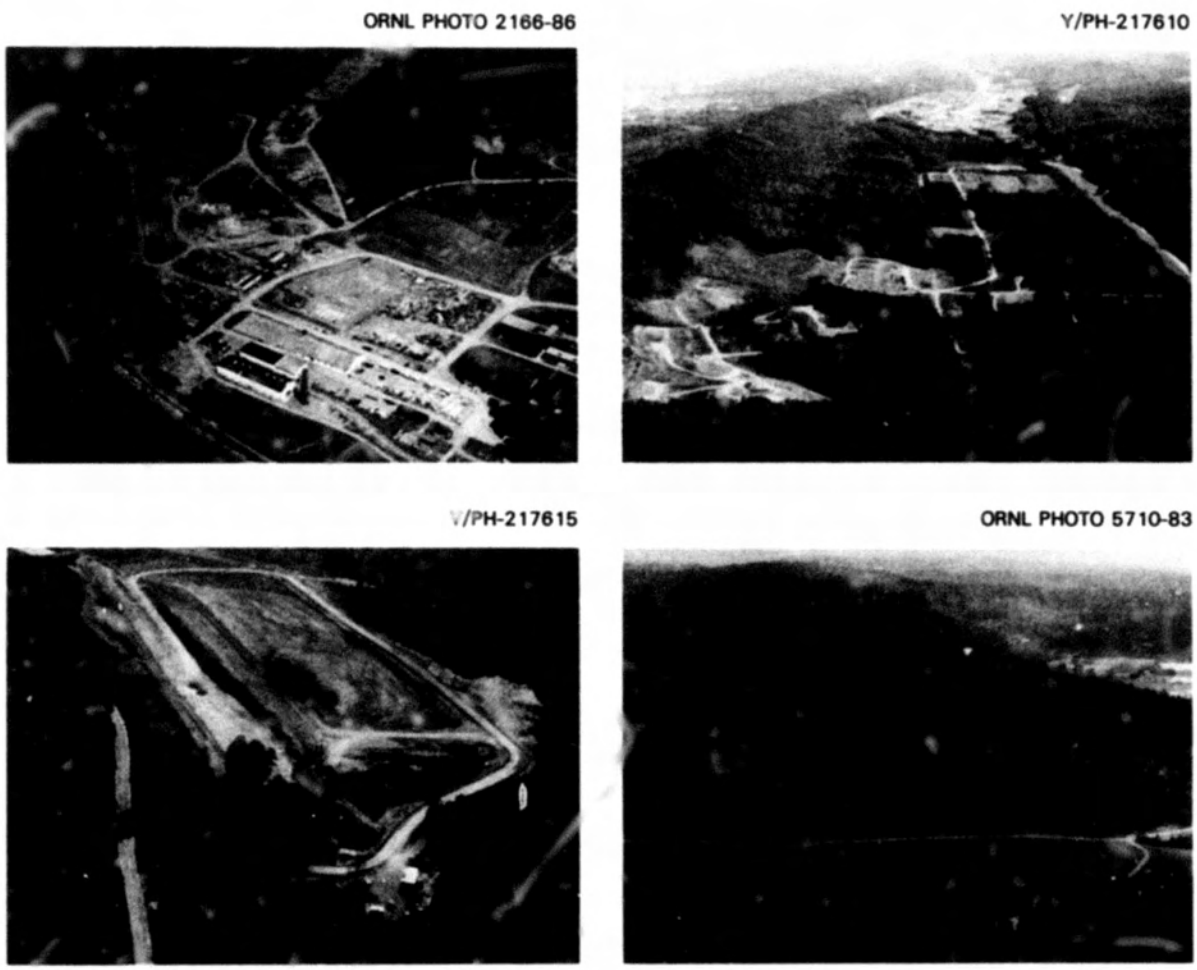


Fig. 3.62. Waste management areas.

material releases to the atmosphere, flammable and toxic liquid spills, radiation hazards, natural phenomena events, and other emergencies that are unique to each facility.

Each facility also has a variety of emergency response vehicles, light and heavy equipment, and state-approved ambulances that are available to respond in an emergency. On-site medical facilities are staffed with trained medical personnel for prompt treatment of injuries.

Each site maintains an Emergency Control Center for direction of responses to major emergencies. Effective communications can be maintained by the use of plant telephones as well as fixed, mobile, and radio equipment operating on a number of frequencies.

Personnel from the Energy Systems emergency preparedness programs meet with city, county, and state emergency planning and response personnel to discuss mutual concerns and to conduct drills that test these organizations' abilities to work together in an emergency.

3.6.3 Natural Group

This group consists of seven resources that deal primarily with natural issues.

Two are actively managed, staffed, and funded: Fish and Wildlife Management and the NERP.

3.6.3.1 Aquatic Habitats

The purpose of this Resource is to provide a management plan that will ensure survival of threatened or endangered species and provide suitable experimental and reference sites to meet present ecological research and biomonitoring needs. No formal mission or policy concerning management of this resource exists.

Long-term biological monitoring of several streams on the ORR is performed to determine compliance with both state and federal regulations. For example, results obtained from these biomonitoring studies will be used to determine if the effluent limitations established in the NPDES permits for Y-12, ORNL, and ORGDP protect and maintain the classified uses of these streams (e.g., growth and propagation of fish and aquatic life). Consequently, efforts should be made to minimize any additional disturbances to these streams. Additionally, several undisturbed reference sites located on and adjacent to the ORR are being used for research and as controls for the biomonitoring studies; the integrity of these sites should be maintained.

3.6.3.2 Endangered and Threatened Animals

The mission of this resource is to implement a Threatened and Endangered Species Management Program that protects and enhances those wildlife species and the habitats critical to their survival. Table 3.13 lists the status of such species on the ORR.

In managing the ORR, DOE's policy is to be consistent with the Endangered Species Act of 1973 and with the Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974. These acts require federal agencies to ensure that any actions they authorize, fund, or carry out do not jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitats.

Ongoing inventories of threatened and endangered species on the ORR and consultation with appropriate agencies are central to compliance with state and federal legislation. Appropriate agencies include the U.S. Fish and Wildlife Service, the Tennessee Wildlife Resources Agency (TWRA), and the Tennessee Heritage Program of the Tennessee Department of Conservation.

Official documents and statutes that apply to this resource are:

1. Endangered Species Act of 1973 (16 U.S.C. 1531-1543; 50 CFR Pt. 17);
2. National Environmental Policy Act (PL 91-190, U.S.C. 4321-4347, January 1, 1970, as amended by PL 94-52, July 3, 1975, and PL 94-83, August 9, 1975; 40 CFR Pts. 1500-1508);
3. Bald and Golden Eagles Protection Act (16 U.S.C. 668-668d);
4. Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974 [Tennessee Code Annotated (TCA) 70-8-101];
5. DOE Order 4300.1B, *Real Estate Management*, Chap. VIII;
6. DOE Order 5440.1C, *National Environmental Policy Act;*
7. DOE, *Compliance with the National Environmental Policy Act*, 10 CFR Pts. 208, 711, and 1021;
8. DOE/EP-0132, *Environmental Compliance Guide*, DOE Office of Environmental Protection, 1981;

Table 3.13. Status of threatened and endangered species on the Oak Ridge Reservation (ORR)[a]

Species	Legal status		ORR status
	Federal	State	
Invertebrates			
Alabama lamp pearly mussel (*Lampsilis virescens*)	E		County
Crass River snail (*Athernia crassa*)	T		County
Dromedary mussel (*Dromus dromas*)	E	E	County
Fine-rayed pigtoe pearly mussel (*Fuscoraia cuneolus*)	E	E	County
Orange-footed pearly mussel (*Plethobasus cooperianus*)	E	E	County
Pink mucket pearly mussel (*Lampsilis orbiculata*)	E	E	County
Rough pigtoe pearly mussel (*Pleurobema plenum*)	E	E	County
Shiny pigtoe pearly mussel (*Fusconaia edgariana*)	E	T	County
Spiney River snail (*Io fluvialis*)	E		County
White warty-back pearly mussel (*Plethobascus cicatricosus*)	E	E	County
Yellow-blossom pearly mussel (*Epiblasma florentina*)	E	E	County
Fish			
Blue sucker (*Cycleptus elongatus*)		T	County
Spotfin chub (*Hybopsis monacha*)	T	E	County
Yellowfin madtom (*Noturus flavipinnis*)	T	E	County
Amphibians			
Tennessee cave salamander (*Gyrinophilus palleucus*)		T	County
Reptiles			
Northern pine snake (*Pituophis melanoleucus*)		T	Range
Birds			
Bachman's sparrow (*Aimophila aestivalis*)		E	SR, R
Bewick's wren (*Thryomanes bewickii*)		T	Range
Black-crowned night heron (*Nycticorax nycticorax*)		T	V, U
Cooper's hawk (*Accipiter cooperii*)		T	PR, U
Grasshopper sparrow (Ammodramus *savannarum*)		T	SR, U
Marsh hawk (*Circus cyaneus*)		T	WV, R
Osprey (*Pandion haliaetus*)		E	WV, U
Peregrine falcon (*Falco peregrinus*)	E	E	County
Red-cockaded woodpecker (*Picoides borealis*)	E	E	Range

Table 3.13 (continued)

Species	Legal status		ORR status
	Federal	State	
Sharp-shinned hawk (*Accipiter striatus*)		T	County
Southern bald eagle (*Haliaeetus leucocephalus*)	E	E	V, R
Mammals			
Eastern cougar (*Felis concolor*)	E	E	V, R
Gray bat (*Myotis grisescens*)	E	E	County
Indiana bat (*Myotis sodalis*)	E	E	Range
River otter (*Lutra canadensis*)		T	Range

[a]Legend for this table:

County—The species has occurred in Anderson or Roane County according to records of the Tennessee Heritage Program.

Range—The ORR lies within the geographic range of the species, but occurrence records on the ORR and in Anderson and Roane counties are lacking.

E—Endangered
PR—Permanent (year-round) resident
R—Rare
SR—Summer resident (does not occur in winter)
T—Threatened
U—Uncommon (slightly more common than "rare")
V—Visitor (occurs sporadically or occasionally)
WV—Winter visitor (does not occur in summer)

Data were compiled from (1) D. C. Eagar and R. M. Hatcher (eds.), 1980, *Tennessee's Rare Wildlife, Vol. 1, The Vertebrates*, Tennessee Wildlife Resources Agency, Nashville, Tenn.; (2) J. T. Kitchings and J. D. Story, 1984, *Resource Management Plan for the U.S. Department of Energy Oak Ridge Reservation, Vol. 16, Appendix Q, Wildlife Management*, ORNL-6026/V16; and (3) original observations of ORNL staff.

9. DOE/EP-0058, *Guidance Manual for Compliance with the Endangered Species Act*, DOE, Washington, D.C., 1982;
10. 50 CFR Pt. 17.11, *Endangered and Threatened Wildlife*, U.S. Fish and Wildlife Service, 1984; and
11. Tennessee Proclamation 75-15, *Tennessee Threatened and Endangered Wildlife Species*.

No formal organization has been established for management of endangered animals on the ORR. Their status has recently been reviewed by J. W. Boyle et al. (*Environmental Analysis of the Operation of Oak Ridge National Laboratory, X-10 Site*, ORNL-5870) and by J. T. Kitchings and J. D. Story (*Resource Management Plan for the U.S. Department of Energy, Oak Ridge Reservation, Vol. 16, Appendix Q: Wildlife Management*, ORNL-6026/V16). Figure 3.63 shows the relationship of the TWRA officer to the ORR wildlife specialist.

Future reviews and fields surveys will be performed annually by the Endangered Animals representative under the direction of the chairperson of the Natural

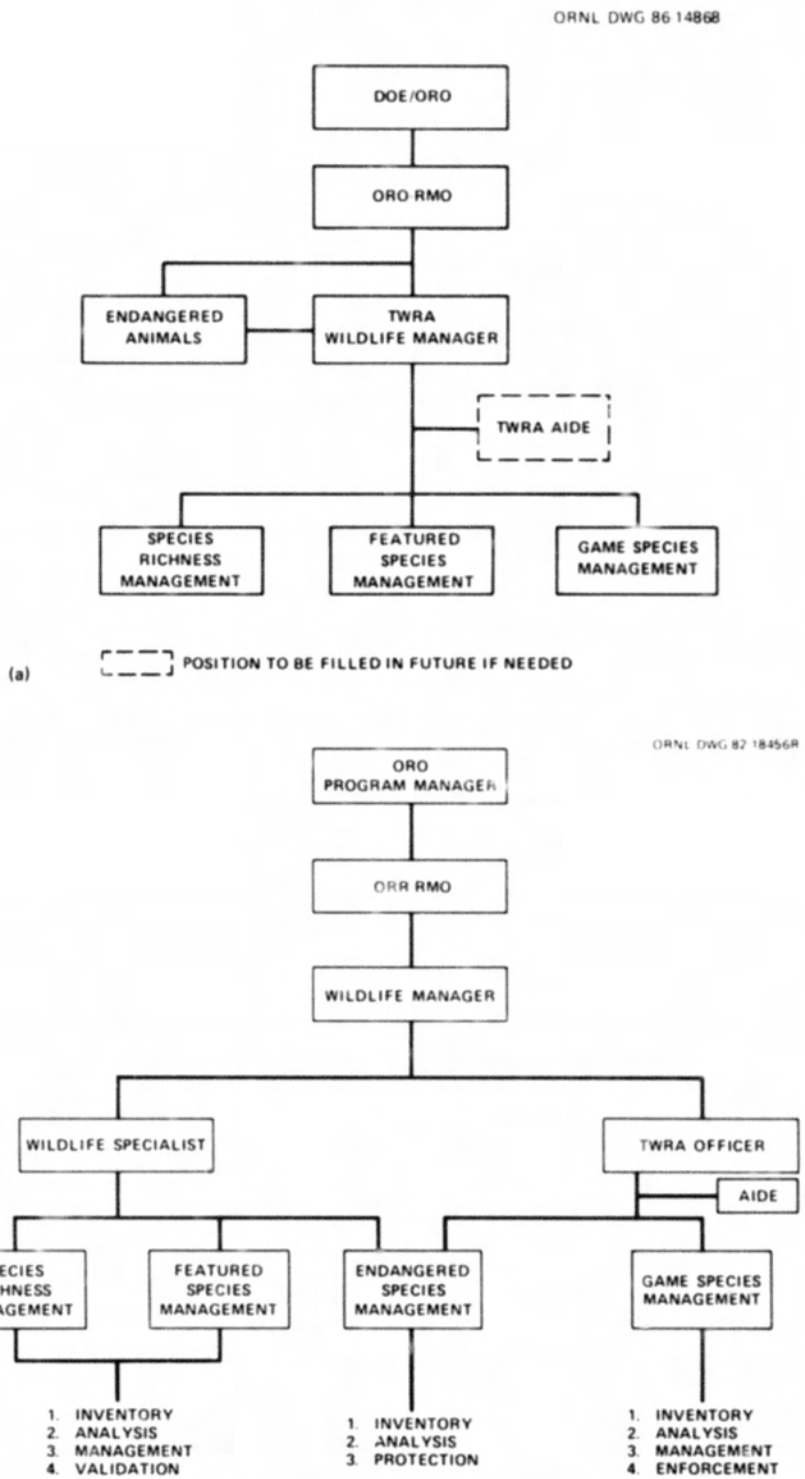


Fig. 3.63. Organizational structures for wildlife management on the Oak Ridge Reservation: (a) existing and (b) proposed.

Resources Group of the RMO. Possible management activities will be considered when necessary to coordinate land use activities with the welfare of endangered animals.

Currently, no land use activities on the ORR are known to be affecting any federal- or state-listed endangered or threatened animal species or their habitats. Any loss of wildlife habitat to industrial, commercial, or residential development would have adverse impacts on threatened or endangered fauna. To pinpoint populations of various species, surveys and mapping efforts are needed.

3.6.3.3 Endangered and Threatened Plants

The objective of this resource is to provide an Endangered and Threatened Plant Species Program that protects and enhances populations of designated species and the habitats critical to their survival. The government land acquisition in 1942 for the Manhattan Project afforded protection and actually enhanced population growth in some species by removing large tracts of land from production. An example is ginseng, a species collected extensively during the first half of the century for its purported medicinal properties. Before the government land acquisition, this species had been practically extirpated from the area that later became the ORR. Since government acquisition, the species has increased in numbers and distribution.

Since the inception of ORNL's ESD (or its precursor), individual scientists have exhibited interests in rare plant species. Even so, it was not until promulgation of the National Environmental Policy Act (PL91-190, U.S.C. 4321-4347, January 1, 1970) and the Endangered Species Act of 1973 (16 U.S.C. 1531-1543; 50 CFR 17) that much attention was given to determining if such species existed on the ORR. Identification of threatened or endangered plants was usually ancillary to some other field activity. An example was the 1966 discovery on the ORR of an orchid (*Spiranthes ovalis*) that previously had not been known to occur in Tennessee (Taylor 1967).

In 1979, Parr and Taylor compiled a list of plants designated as rare, threatened, endangered, or of special concern. Since that time, an official list of Tennessee Rare Plants has been issued (Tennessee Department of Conservation 1982). By abstracting recent inventory data, a newer list (Mann and Patrick 1983) for the ORR has been assembled (Parr 1984). A total of 14 plant species designated by the State of Tennessee (Tennessee Department of Conservation 1983) and the federal government (U.S. Department of Interior 1980) as endangered or threatened have been identified as being present on the ORR (Table 3.14).

It has been recommended that the preservation of critical habitats be adopted as a major management practice to ensure the survival of endangered and threatened plant species. So far, 16 sites on the NERP have been established as Natural Areas for nonmanipulative ecological research (see Sect. 3.6.3.7). These areas also provide protection for state and federally listed rare plant species. Because these species are distributed among the various Natural Areas (Fig. 3.67), a map depicting specific locations is not necessary in the Resource Management Plan. Information of location is available on a need-to-know basis from the NERP or the Endangered Plants Resource managers.

Table 3.14. Rare plant species on the Oak Ridge Reservation

Genus, species, and authority	Family	Common name	List status	
			Federal[a]	State[b]
Aureolaria patula (*Chapm*) Pennell	Scrophulariaceae	False foxglove	1	T
Climicifuga rubifolia Kearney	Ranunculaceae	Bugbane	2	T
Delphinium exaltatum Ait.	Ranunculaceae	Tall larkspur		E
Diervilla lonicera Mill.	Caprifoliaceae	Bush-honeysuckle	2	T
Fothergilla major (Sims) Lodd	Hamamelidaceae	Witch alder		T
Hydrastis canadensis L.	Ranunculaceae	Goldenseal		T
Liatris cylindracea Michx.	Asteraceae	Blazing star		E
Lilium canadense L.	Liliaceae	Canada lily		T
Panax quinquefolius L.	Araliaceae	Ginseng		T
Plantanthera flava (L.) Lindley	Orchidaceae	Southern rein-orchid		S
Saxifraga careyana Gray	Saxifragaceae	Carey's saxifrage	2	S
Solidago ptarmicoides (Nees) Boivin	Asteraceae	Goldenrod		T
Spiranthes ovalis Lindley	Orchidaceae	Lesser ladies' tresses		S
Tomanthera auriculata (Michx) Raf.	Scrophulariaceae	Auricled gerardia		E

[a]Taxa currently under review for inclusion on federal list (U.S. Department of the Interior 1980): Category 1—Taxa for which the U.S. Fish and Wildlife Service (USFWS) currently has sufficient information on hand to support the biological appropriateness of their being listed as Endangered or Threatened species. Category 2—Taxa for which information now in the possession of the USFWS indicates the probable appropriateness of listing as Endangered or Threatened, but for which sufficient information is not presently available to biologically support a proposed rule.

[b]Status as listed on the Official List of Tennessee's Rare Plants (Tennessee Department of Conservation 1982):

E—Endangered
T—Threatened
S—Special concern

Indiscriminant modification or destruction of habitat could not only cause a reduction of the population but also result in a restriction of the population's expansion and recovery. Many species, however, are rare because they occupy unusual, often temporary, habitats and may be dependent on some types of interference.

Specific recommendations for effective protection of endangered and threatened plant species occurring on the ORR include four major actions: (1) increased reconnaissance to verify species that have been seen at one time but are not supported by voucher specimens and increased efforts to locate species whose habitat requirements suggest a high probability that they occur on the Reservation; (2) species evaluations through a review of information to define variables

essential for individual and population survival; (3) habitat preservation through establishment of natural areas; and (4) determination of habitat maintenance requirements. These actions would not only provide protection and information necessary for species and habitat preservation but would also lead to assessment guidelines important for interaction with various land use practices. Continuous monitoring of known populations of threatened and endangered species on the ORR and interactions with appropriate experts (NERP Resource Manager) and agencies are essential to comply with state and federal legislation.

3.6.3.4 Fish and Wildlife Management

As part of its mission, this resource is responsible for

1. coordinating implementation of the November 30, 1984, cooperative agreement between DOE and the TWRA, which established the ORR as a State of Tennessee Wildlife Management Area (WMA);
2. assisting in the development of the ORR WMA for the enhancement of wildlife species through the application of scientific wildlife management programs with an emphasis on multiple uses of the wildlife resource (i.e., recreation, research, education, aesthetic values, etc.);
3. assisting in the implementation and updating of Appendix Q (*Wildlife Management*), including the following highlights: (a) a species richness program to maintain habitat diversity to ensure that all wildlife species currently found on the ORR WMA continue to exist in viable numbers, (b) a feature species program to produce selected species in designated areas, (c) a game species management program to maintain wildlife game species for recreation, education, and research, (d) an endangered and threatened species management program to protect and enhance both the wildlife species and the habitats critical to their survival, and (e) technical assistance in the management of wildlife problems;
4. conducting and coordinating hunts on the ORR WMA as part of a game management program;
5. enforcing applicable state and federal wildlife laws on the ORR WMA; and
6. coordinating these missions through the ORR RMO.

The Fish and Wildlife Management Resource is governed by several policy statements contained in DOE Order 4300.1B, in a cooperative agreement between DOE and the TWRA, in the Federal Endangered and Threatened Species Act, and in the Tennessee Nongame and Endangered or Threatened Wildlife Act of 1974 (TCA 70-8-101).

DOE Order 4300.1B, Chapter VIII, Sect. 3, states:

> *FISH AND WILDLIFE MANAGEMENT.* All installations having suitable land and water areas will have programs for the harvesting of fish and wildlife by the public. Hunting, fishing, and trapping will be in accordance with the fish and game laws of the State. Appropriate State licenses are required. Provisions will be made for controlled public access to DOE property for hunting, fishing, and trapping, provided it does not interfere with missions. Fish and wildlife

management will be integrated with other natural resources activities. Cooperation with State and Federal fish and conservation agencies is required, pursuant to 16 U.S.C. 661, 470, 1536, 703, 1431, and 668; 42 U.S.C. 4331; 7 U.S.C. 136; and 33 U.S.C. 1401. A management program that complies with accepted scientific practices will be established.

The TWRA/DOE agreement of November 30, 1984, is for a minimum term of five years. During the initial five-year period, this agreement may be terminated for cause only; thereafter, it may be cancelled by either party giving 90 days' written notice. According to the agreement, DOE has permitted the TWRA to establish a WMA on the ORR and has granted the TWRA complete control of wildlife harvesting (consistent with the Resource Management Plan). Goals of the program are, where consistent with DOE programmatic use of lands, to develop the area for wildlife species and to carry out other wildlife-oriented projects.

The Endangered and Threatened Species Act requires all federal agencies to conserve such species and to cooperate with state and local agencies in resolving related issues.

The state legislation (TCA 70-8-101) also requires protection of species or subspecies listed in the Tennessee Wildlife Resources Commission Proclamation 75-15 and in the U.S. List of Endangered Native and Foreign Fish and Wildlife (50 CFR Pt. 17).

The Fish and Wildlife Management Resource is coordinated through the Natural Group subcommittee of the ORR RMO. Currently, one TWRA wildlife manager is assigned to the ORR WMA. A TWRA/DOE agreement calls for an aide to the wildlife manager, but the position has not been filled at this time. If the full scope of the Wildlife Management Plan is to be realized, additional personnel may be needed.

Others who are closely involved with this resource are the NERP Director, the forest manager, and safeguards and security personnel.

Wildlife resources occupy all areas of the ORR WMA. Therefore, as for land use, all lands not occupied by physical facilities are suitable for wildlife management purposes (except for areas to which access is limited for programmatic, health, safety, or national security reasons). In 1985 and 1986, some lands were opened to hunting, as shown in Fig. 3.64.

Potential positive impacts of the resource include

1. control of wildlife problems,
2. increased wildlife management research potential,
3. increased recreational use of the ORR WMA (e.g., deer hunts, wildlife observation, etc.),
4. implementation and updating of the wildlife management plan,
5. positive public relations (resulting from the hunts, etc.),
6. on-site enforcement of applicable wildlife laws,
7. re-introduction of once-indigenous wildlife species (e.g., wild turkeys), and
8. increased communication and cooperation between resource functions.

Potential negative impacts include

1. potential for problems resulting from recreational use of the ORR WMA,
   a. increased security and safeguards problems,
   b. damage to equipment and properties,

c. increased litter, and
d. negative public relations; and
2. potential for conflicts between resource functions.

Current issues include lack of communication and interaction among resource managers. Efforts should be made to maintain habitat diversity and thus wildlife diversity.

3.6.3.5 Geology

The objective of this resource is to provide a central source of documentation and data about geology on the ORR. No formal mission or policy statements exist concerning management of this resource. The RMO relies on a representative of the prime contractor to serve in this capacity. This resource has no other dedicated personnel, formal organization, or budget.

For more information about geology on the ORR, see Sect. 3.3.2 of this document.

3.6.3.6 Hydrology

The objective of this resource is to provide a central source of documentation and data about hydrology on the ORR. No formal mission or policy statements exist concerning management of this resource. The RMO relies on a representative of the prime contractor to serve in this capacity. This resource has no other dedicated personnel, formal organization, or budget.

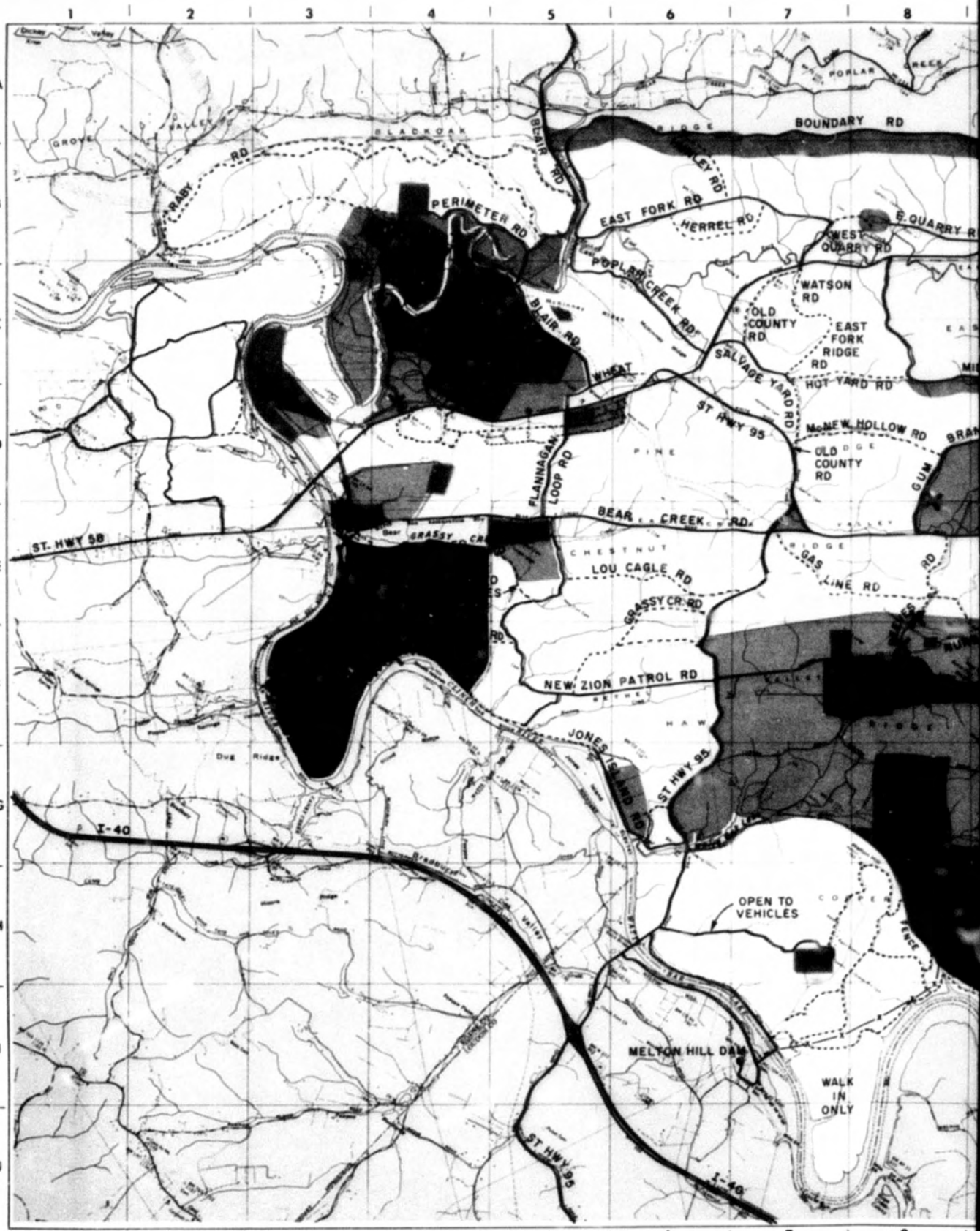
For more information about hydrology on the ORR, see Sect. 3.3.4 of this document.

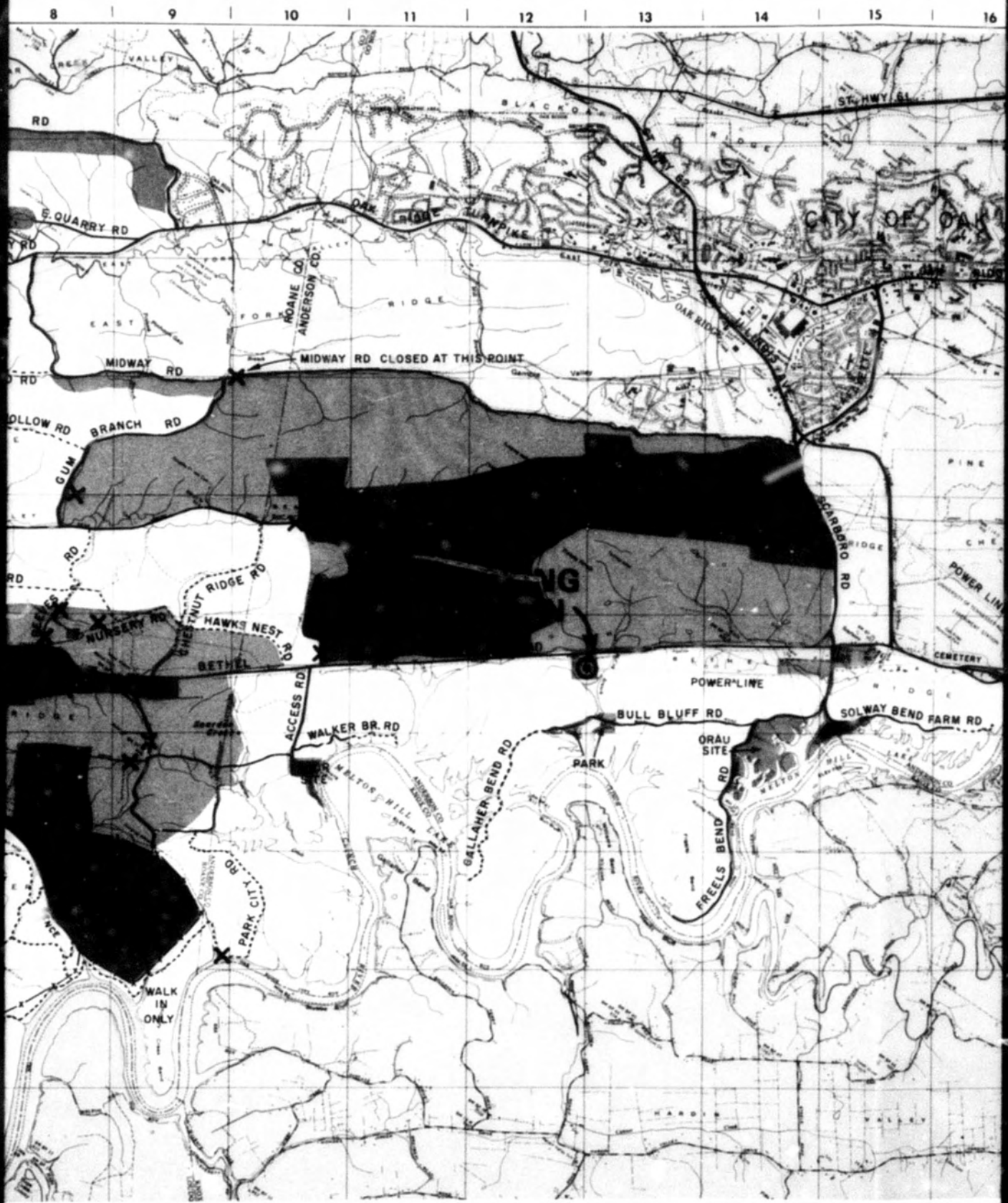
3.6.3.7 National Environmental Research Park

The Oak Ridge NERP, established in 1980, consists of 5,500 ha (13,590 acres) on the ORR. As one of five DOE NERPs, its purpose is to provide protected land areas for research and education in the environmental sciences and to demonstrate the environmental compatibility of energy technology development. Figures 3.65 (see Table 3.15) and 3.66 show locations of research areas.

Programmatic goals of the NERP include:

1. Research—basic and applied research projects that include assessment, monitoring, prediction, and demonstration. The NERP coordinates all ESD work on the ORR with the RMO.
2. Preservation—protection of genetic diversity through DOE NERP Natural Areas and Reference Areas (shown in Fig. 3.67 and Table 3.16). Currently, 18 locations on the ORR are known to contain federally listed species (or species under status review for federal listing), and these locations have been designated as DOE NERP Natural Areas. Areas on the ORR that are representative of the vegetational communities of the southern Appalachian region or that possess unique biotic features have been designated as DOE NERP Reference Areas. These areas (shown in Fig. 3.67) are important as sites for nonmanipulative ecological research and to provide baseline information for long-term observations. In an agreement between ORO and the Tennessee Department of Conservation, eight ORR areas were registered in 1986 as State Natural Areas.
3. Education—providing opportunities for learning in the environmental sciences through various programs for high school and college students as well as faculty. These programs include the NERP Ecological Study Center, NERP Post-Doc Fellowship, and interaction with University of Tennessee, ORNL, and ORAU university programs.


BOUNDARY RD
PERIMETER RD
EAST FORK RD
HERREL RD
WEST QUARRY RD
POPLAR CREEK RD
WATSON RD
OLD COUNTY RD
EAST FORK RIDGE RD
SALVAGE YARD RD
HOT YARD RD
ST HWY 95
NEW HOLLOW RD
PLANNAGAN LOOP RD
BEAR CREEK RD
ST. HWY 58
LOU CAGLE RD
GAS LINE RD
GRASSY CR RD
NEW ZION PATROL RD
JONES ISLAND RD
I-40
OPEN TO VEHICLES
MELTON HILL DAM
WALK IN ONLY
BLAIR RD
RABY RD
WHEAT
GUM
FENCE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RD
S. QUARRY RD
MIDWAY RD
MIDWAY RD CLOSED AT THIS POINT
GUM BRANCH RD
CHESTNUT RIDGE RD
HAWKS NEST RD
NURSERY RD
BETHEL
ACCESS RD
WALKER BR. RD
BULL BLUFF RD
SOLWAY BEND FARM RD
POWER LINE
CEMETERY
SCARBORO RD
GALLAHER BEND RD
FREELS BEND RD
PARK
ORAU SITE
PARK CITY RD
WALK IN ONLY
ROANE CO.
ANDERSON CO.
OAK RIDGE
CITY OF OAK
ST. HWY 61
PINE RIDGE
WELTON MILL LAKE
CREEK

ORNL DWG 86-14644

Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

DOE/TWRA WILDLIFE MANAGEMENT AREA

LEGEND:

- OPEN/ARCHERY HUNTING (OCT. 11, 12, 18, 19) AND OPEN/GUN HUNTING (NOV. 15, 16 AND DEC. 13, 14, 20, 21)
- OPEN/ARCHERY HUNTING (OCT. 11, 12, 18, 19)
- TVA LAND (OPEN TO QUOTA PERMIT HOLDERS ON SPECIFIED HUNT DATES)
- NONWILDLIFE MANAGEMENT AREA (NO HUNTING)
- SAFETY ZONE (NO HUNTING)
- PLANT SITE/SECURITY ZONE (NO HUNTING) *
- OAK RIDGE CITY LAND (OPEN TO QUOTA PERMIT HOLDERS ON SPECIFIED HUNT DATES)
- —— MAIN ROADS – OPEN TO HUNTERS IN HUNTING AREAS
- ------ GRAVEL ROADS – OPEN TO HUNTERS IN HUNTING AREAS
- X ROAD CLOSED – NO VEHICLES BEYOND THIS POINT

kilometers 0 1 2 3

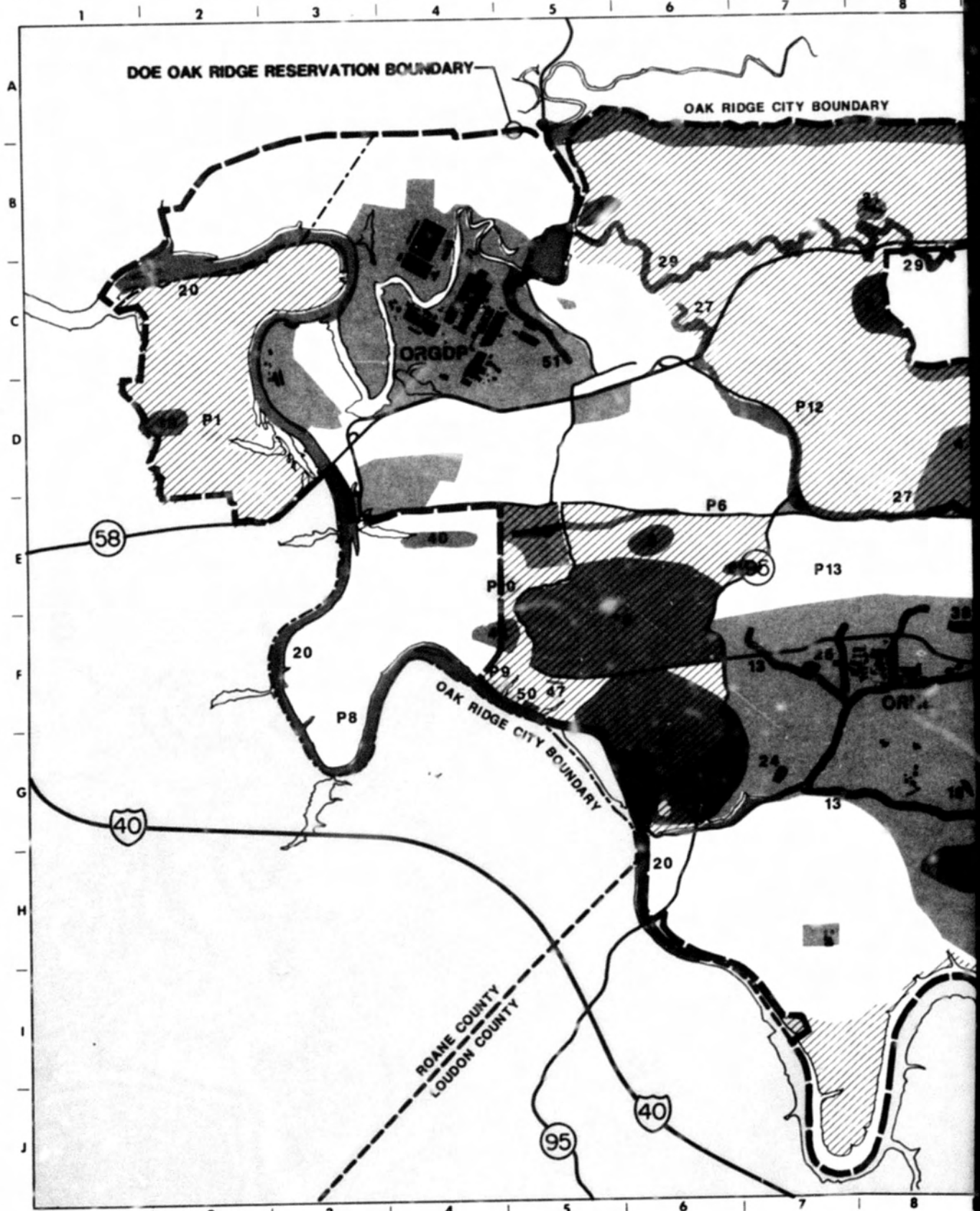
0 1 2 miles

NORTH TRUE / GRID

Date **SEPT. 1986** Rev. **2**

FIG. 3.64

1986 OAK RIDGE WILDLIFE MANAGEMENT AREA HUNTING MAP


DOE OAK RIDGE RESERVATION BOUNDARY
OAK RIDGE CITY BOUNDARY
ORGDP
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P8
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P12
P13
OAK RIDGE CITY BOUNDARY
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LOUDON COUNTY
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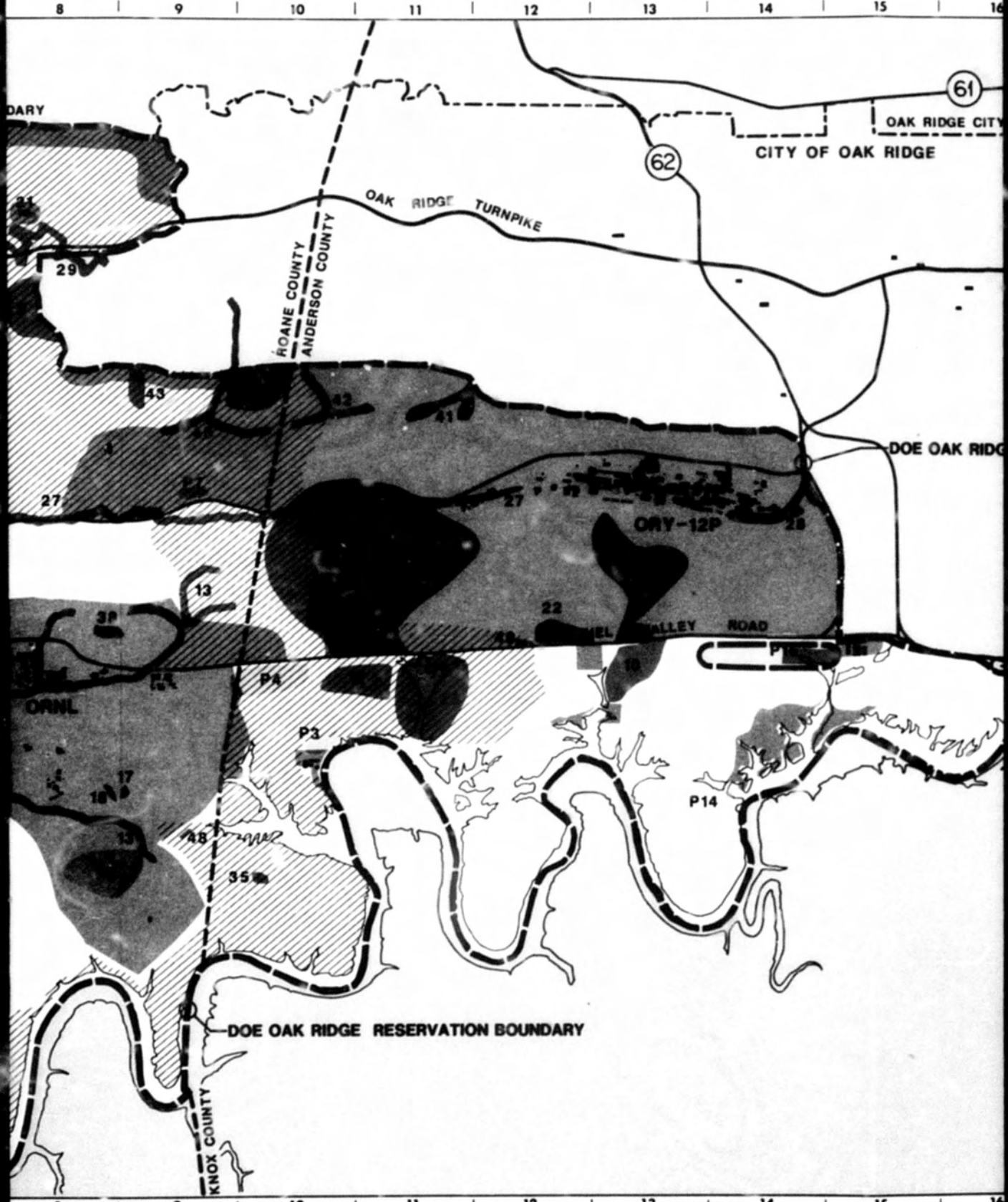
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OAK RIDGE CITY
CITY OF OAK RIDGE
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ROANE COUNTY
ANDERSON COUNTY
DOE OAK RIDG
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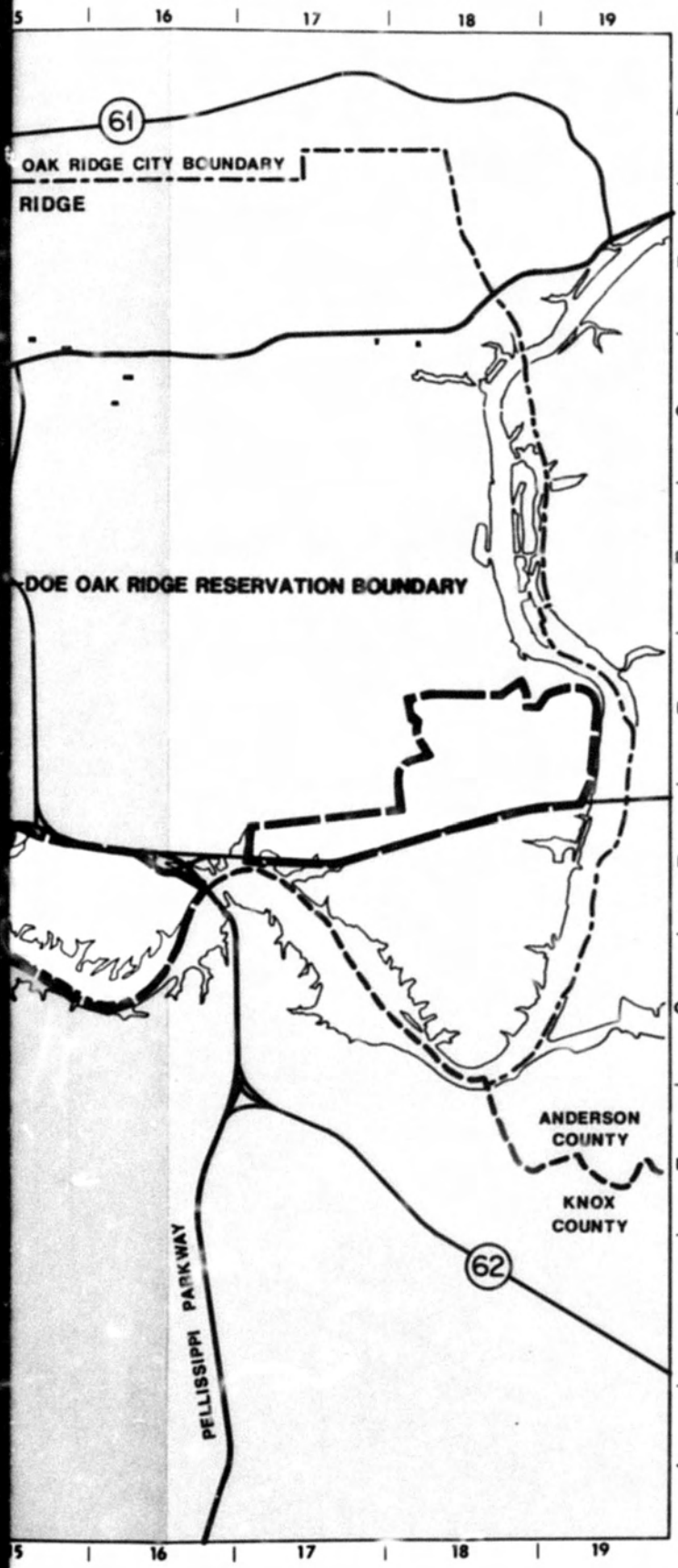
DOE OAK RIDGE RESERVATION BOUNDARY
KNOX COUNTY

ORNL–DWG 86-14638



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

CURRENT RESEARCH SITE

PAST RESEARCH SITE (P)

NATIONAL ENVIRONMENTAL RESEARCH PARK BOUNDARY

kilometers 0 1 2 3

0 1 2 miles

NORTH TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 3.65

Environmental Sciences Division

RESEARCH AREAS

Table 3.15. Legend for the Research Areas map

Map No.	Approximate size of area		Environmental Sciences Division research sites on the Oak Ridge Reservation	Contact
	ha	(acres)		
			Current research	
1	6	(14)	Plant Population Monitoring	L. K. Mann
2	52	(129)	Coal Ash Study and Roger's Quarry	R. R. Turner
3	17	(43)	Plant Population Monitoring	L. K. Mann
4	9	(22)	Plant Population Monitoring	L. K. Mann
5	17	(43)	Fertilizer Study Plots	D. W. Johnson and S. G. McLaughlin
6	6	(14)	Pine Harvesting Plots	D. W. Johnson
7	259	(639)	Walker Branch Watershed	Atmospheric Turbulence and Diffusion Laboratory (ATDL), D. W. Johnson, and W. Van Winkle
8	15	(36)	Whole Tree Harvesting	D. C. West
9	186	(459)	Field Fumigation Facility Area	ATDL and G. E. Taylor
10	23	(57)	Plant Population Monitoring	P. D. Parr
11	23	(57)	Plant Population Monitoring	L. K. Mann
12	6	(14)	Radionuclide Research	C. T. Garten
13	12	(29)	White Oak Creek Biological Monitoring and Abatement Program	J. M. Loar
14	1	(3)	Radionuclide Research	C. T. Garten
15	1	(3)	Radionuclide Research	C. T. Garten
16			Not assigned	
17	1	(3)	Hydrologic Transport	R. J. Luxmoore
18	1	(3)	Clearcut Studies	R. B. Clapp
19	6	(14)	White Oak Creek Biological Monitoring and Abatement Program	J. M. Loar
20	189	(466)	White Oak Creek Monitoring	J. M. Loar
21	3	(7)	Lambert Quarry Research	B. L. Kimmel and R. R. Turner
22	6	(14)	Sludge Field Stabilization	D. W. Johnson
23	58	(144)	Melton Branch Embayment	S. M. Adams and B. L. Kimmel
24	6	(14)	Radionuclide Research	C. T. Garten
25	3	(7)	CO_2 Monitoring	R. J. Luxmoore
26	209	(517)	Chestnut Ridge Hydrology	R. B. Clapp
27	102	(251)	Bear Creek Characterization and Monitoring	J. M. Loar
28	12	(29)	East Fork Poplar Creek	J. M. Loar
29	3	(7)	East Fork Poplar Creek	J. M. Loar
30	8	(20)	Rare Plant Monitoring	P. D. Parr
31	38	(93)	White Oak Creek Monitoring	J. M. Loar
32	23	(57)	White Oak Creek Monitoring	J. M. Loar
33	17	(43)	White Oak Creek Monitoring	J. M. Loar

Table 3.15 (continued)

Map No.	Approximate size of area		Environmental Sciences Division research sites on the Oak Ridge Reservation	Contact
	ha	(acres)		
34	12	(29)	White Oak Creek Monitoring	J. M. Loar
35	3	(7)	Rare Plant Monitoring	P. D. Parr
36			Not assigned	
37	1	(3)	Biomass Demonstration Plots	J. W. Ranney
38	6	(14)	Trapsite	P. D. Parr
39	9	(22)	Bear Creek Monitoring	J. M. Loar
40	12[a]	(29[a])	Bear Creek Montoring	J. M. Loar and R. R. Turner
41	15	(36)	East Fork Poplar Creek	J. M. Loar and R. R. Turner
42	15	(36)	East Fork Poplar Creek	J. M. Loar and R. R. Turner
43	9	(22)	East Fork Poplar Creek	J. M. Loar
44	12[b]	(29[b])	Biomass Fertilizer Study	J. W. Ranney
45	4	(11)	East Fork Poplar Creek	J. M. Loar
46			Not assigned	
47	1	(3)	Population Genetics	P. D. Parr
48	1	(3)	Population Genetics	P. D. Parr
49	3	(7)	Population Genetics	P. D. Parr
50	1	(3)	Population Genetics	P. D. Parr
51	12	(29)	K-1700 Stream Monitoring	J. M. Loar
52	6	(14)	East Fork Poplar Creek	J. M. Loar
53	6	(14)	East Fork Poplar Creek	J. M. Loar
	1,442	(3,562)		
			Past research	
P1	3[c]	(7[c])	Tree Phenotype Repository	G. E. Taylor
P2	29	(72)	Cesium Forest	N. T. Edwards
P3	12	(29)	Tree Ring Studies	C. F. Baes
P4	17	(43)	Carbon Allocation	S. G. McLaughlin
P5	3	(7)	Cesium-137 Research Field	G. E. Taylor
P6	9	(22)	Sulfur Addition	B. A. Kelly
P7	3	(7)	Burn Research	D. W. Johnson
P8	12[a]	(29[a])	Lichen Reference	L. L. Sigal
P9	9	(22)	Lichen Reference	L. L. Sigal
P10	17[b]	(43[b])	Lichen Reference	L. L. Sigal
P11	6	(14)	Cesium-137 Studies	G. E. Taylor
P12	3	(7)	McNew Hollow Study	G. E. Taylor
P13	3	(7)	Radioecological Study	G. E. Taylor
P14	3	(7)	Irradiated Seed Plantings	G. E. Taylor
P15	3	(7)	Irradiated Chestnut Tree Plantings	G. E. Taylor
	132	(323)		

[a]Located entirely on Tennessee Valley Authority (TVA) property.

[b]Approximately half is located on TVA property.

[c]Located within Segment "O," which is currently being excessed and disposed.

ORNL PHOTO 5320-85

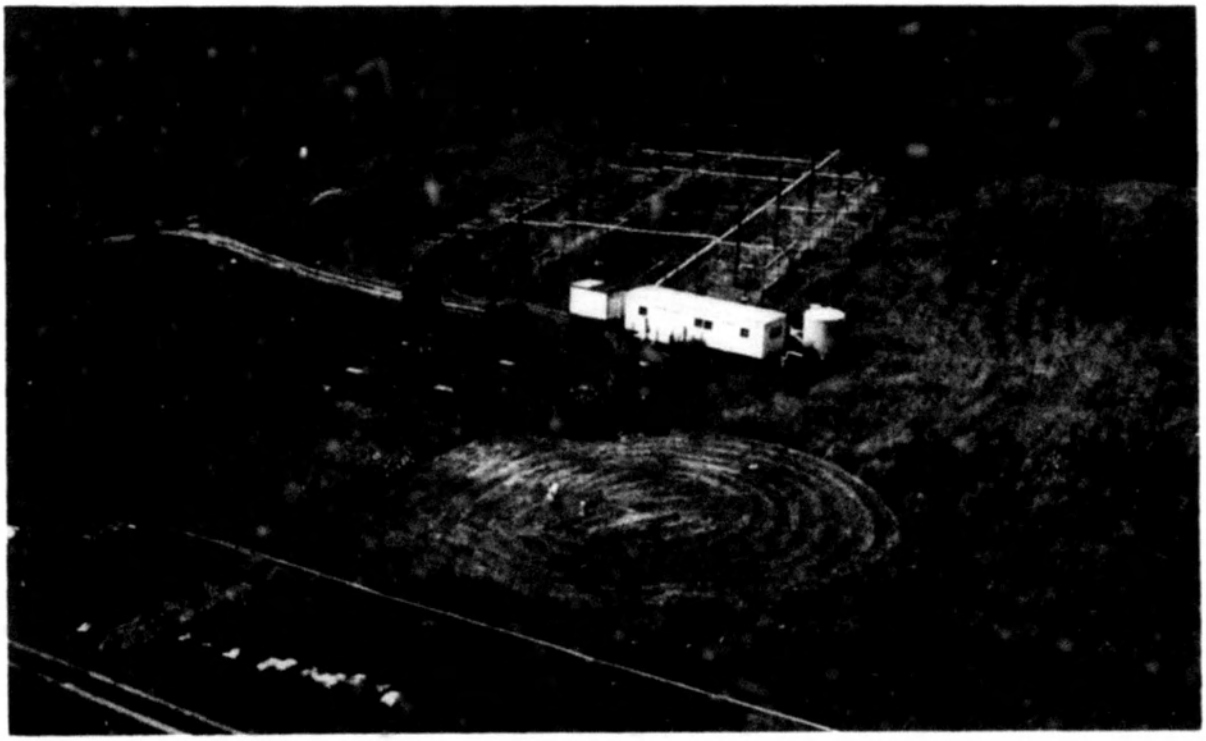


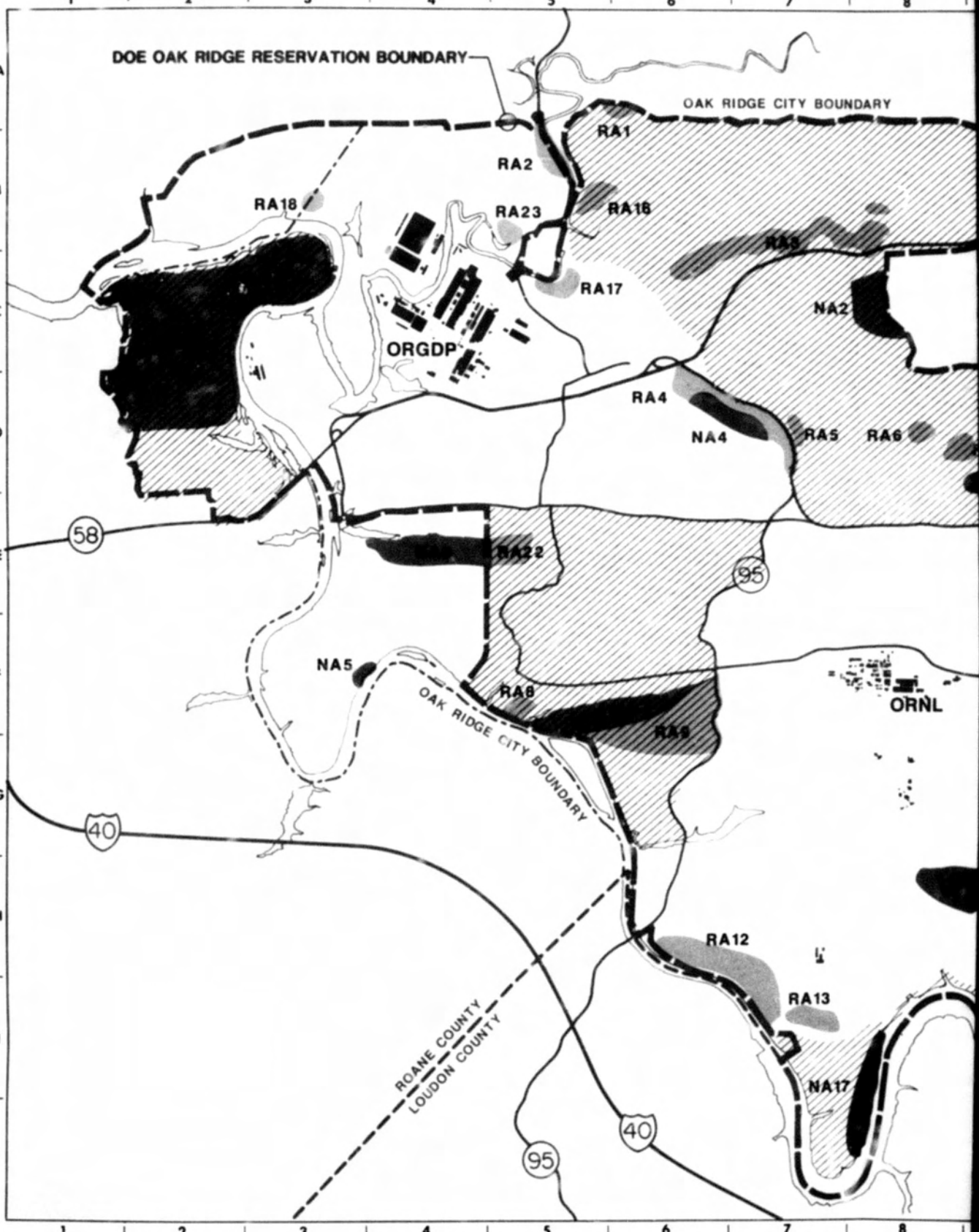
Fig. 3.66. Biomass research area. (This photo shows a portion of area number 9 on Fig. 3.65.)

Documents that guide the NERP program include

1. the NERP Charter and a letter from James L. Liverman, Assistant Administrator for Environment and Safety, August 31, 1976;
2. Program Directives for NERP Programs, from Liverman;
3. Oak Ridge Proposal for NERP, letter from R. F. Hibbs, President, Union Carbide Corporation Nuclear Division, February 18, 1980;
4. Management Plan for Oak Ridge NERP and a letter from R. J. Hart, Manager, ORO, January 29, 1981;
5. DOE Order 4300.1B, Chapter VIII;
6. Natural Areas Agreement letter from P. T. Marquess, Assistant Manager for Administration, DOE-ORO, October 3, 1985; and
7. Memorandum from A. W. Trivelpiece, Director, Office of Energy Research, DOE, to J. La Grone, Manager, ORO, August 12, 1985.

The NERP Project Manager is responsible for day-to-day operation of the NERP and coordination of various activities (e.g., ensuring compatibility and/or noninterference of NERP projects with DOE program assignments and coordinating support for approved outside research). Other personnel include a senior staff member, subcontract personnel, consultants, and student researchers.

About 60 researchers used NERP facilities in FY 1985. (This does not include the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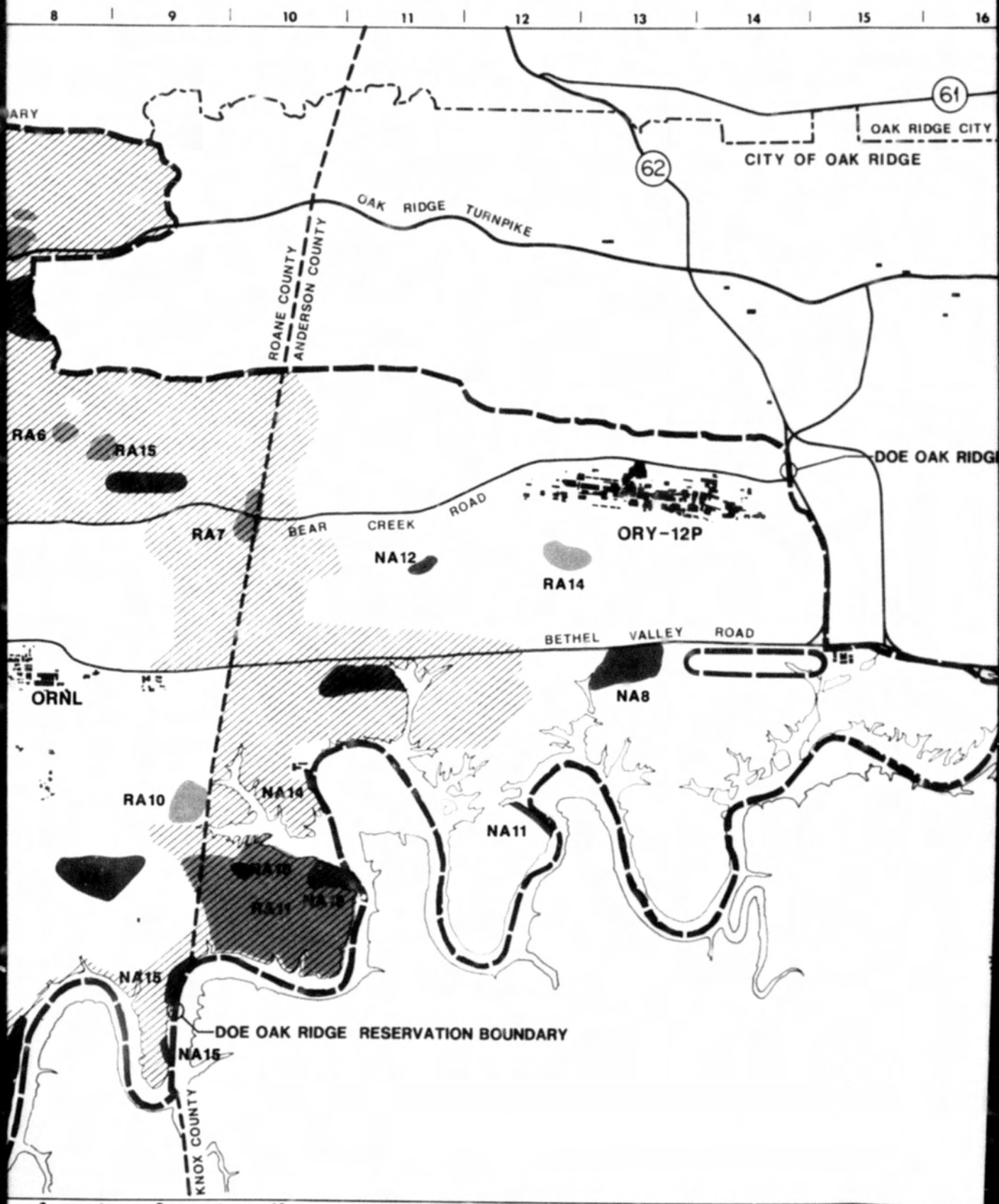
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ANDERSON COUNTY
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BEAR CREEK ROAD
ORY-12P
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BETHEL VALLEY ROAD
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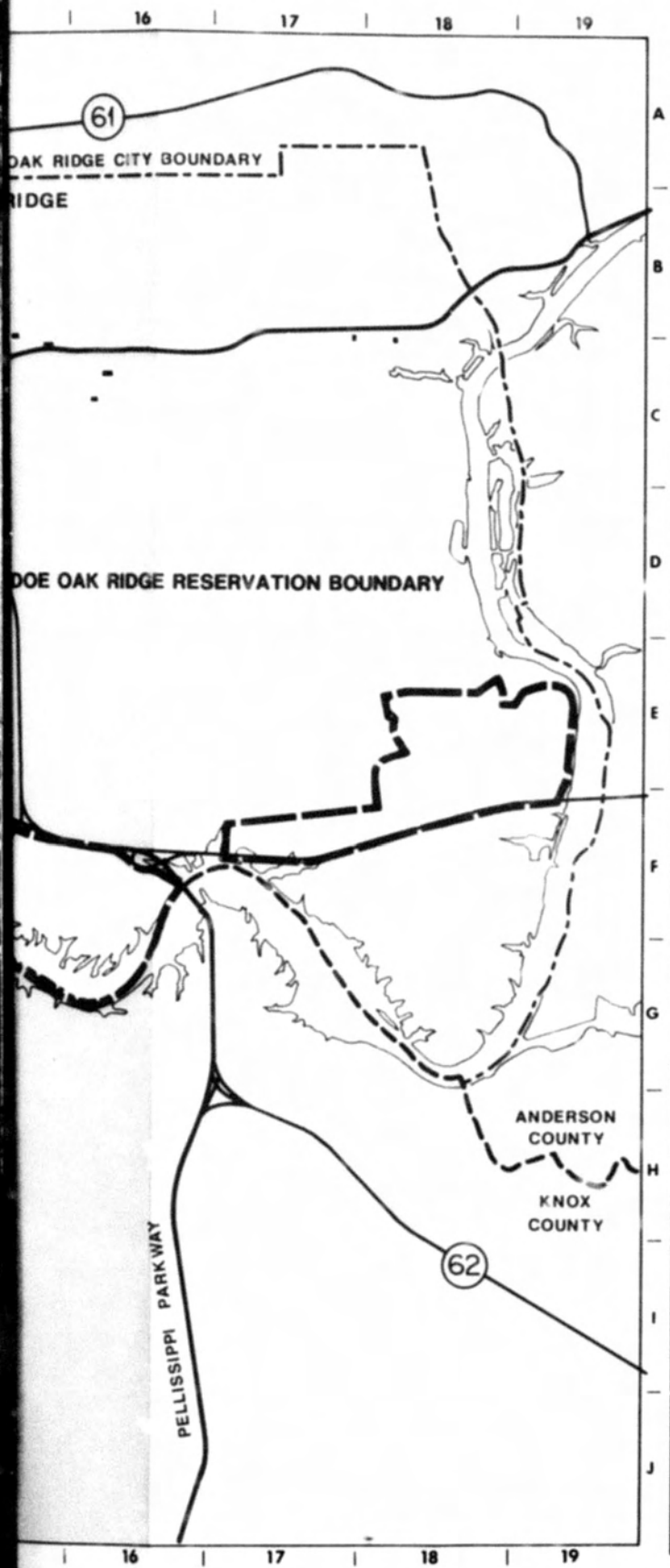

Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- NATURAL AREA (NA)
- REFERENCE AREA (RA)
- NATIONAL ENVIRONMENTAL RESEARCH PARK BOUNDARY

kilometers 0 1 2 3

0 1 2 miles

NORTH

TRUE GRID

Date NOV. 1986 Rev.

FIG. 3.67

DOE NERP

REFERENCE AND NATURAL AREAS

Table 3.16. Legend for the Reference and Natural Areas Map

Map No.	Approximate size of area		National Environmental Research Park Reference Areas on the Oak Ridge Reservation	Map No.	Approximate size of area		National Environmental Research Park Natural Areas on the Oak Ridge Reservation
	ha	(acres)			ha	(acres)	
RA1	6	(15)	Blackoak Ridge Hemlock Bluffs	NA1	251[a]	(620[a])	Crowder Cemetery Barrens and River Bluffs
RA2	15	(36)	Leatherwood Bluffs	NA2	21	(51)	East Fork Ridge Mesic Forest
RA3	59	(146)	East Fork Floodplain	NA3	36[b]	(88[b])	Grassy Creek Mesic Slopes
RA4	32	(80)	Bear Creek Wetlands	NA4	15	(36)	Rein Orchard Swamp
RA5	3	(7)	McNew Hollow Marsh	NA5	9[b]	(22[b])	Breeder Bluffs
RA6	9	(22)	Pink Lady Slipper Community	NA6	38	(95)	Raccoon Creek Goldenseal Area
RA7	15	(36)	Bear Creek Mesic Forest	NA7	23	(58)	Walker Branch Embayment "Barren"
RA8	12	(29)	Raccoon Creek Barren	NA8	27	(66)	McCoy Branch Embayment "Barren"
RA9	62	(153)	Haw Ridge Upland Hardwoods	NA9	30	(73)	Cesium Forest Orchid
RA10	12	(29)	Moss and Lichen Pine Community	NA10	6	(15)	Lazy Beaver Forest
RA11	162	(401)	Copper Ridge Area	NA11	12	(29)	Bull Bluff
RA12	38	(95)	Dry River Bluffs	NA12	3	(7)	Walker Branch Watershed
RA13	9	(22)	White Pine Forest	NA13	21	(51)	Pine Ridge Lily Area
RA14	15	(36)	Fanny Knob White Oak Area	NA14	9	(22)	White Cedar Area
RA15	9	(22)	Beech/Mountain Laurel Community	NA15	9	(22)	Hickory Creek Bend Bluffs
RA16	12	(29)	Poplar Creek Cliffs	NA16	6	(15)	Hickory Creek Bend Bluffs
RA17	15	(36)	McKinney Ridge Hemlocks	NA17	21	(51)	
RA18	9	(22)	Blackoak Ridge White Pines	NA18	18	(44)	
RA19			Unassigned				
RA20			Unassigned		555	(1,365)	
RA21			Unassigned				
RA22	18	(44)	Grassy Creek Security Site				
RA23	6	(15)	Poplar Creek Rookery				
	518	(1,275)					

[a]Located within Segment "O," which is currently being excessed and disposed.
[b]Entirely on TVA property.

800 students and teachers who participated in the Ecological Study Center.)

The NERP program's annual budget has ranged from $140,000 in FY 1980 to $93,000 in FY 1986. Most research on the NERP is through ORNL's ESD, whose budget for FY 1986 is about $31 million.

No buildings are devoted exclusively to the NERP. However, several ESD facilities are used for NERP purposes. In addition, NERP/ESD Research Areas contain various structures and experimental equipment (e.g., meteorological towers and sampling equipment for water, soil, and air).

Although the NERP has remained the same size as when it was established, it cannot be classified as "stable." NERP land is constantly being considered for non-NERP-related uses, the most prominent being the transfer of land to the City of Oak Ridge.

The Oak Ridge NERP is by far the smallest of the five NERPs. Since its establishment in 1980, the greatest issue facing the NERP has been the possibility that its land will be turned over to other uses. At various times, discussions have involved the possible transfer of land to be used for a synfuels plant [486 ha (1200 acres)], for a waste disposal facility [162 ha (400 acres)], and for residential development [about 330 ha (815 acres)]. More recently, NERP lands have been considered for the construction of an Oak Ridge airport. Any reductions in the ORR land base affect not only current research but also the development of future research.

The NERP's positive impacts on the ORR include

1. preservation of unique habitats and rare plant species;
2. enhancement of FM through encouraging (a) preservation and planting of species native to the area and (b) maintaining species diversity;
3. protection of wildlife through research and protection of habitats;
4. opportunities for positive public relations (including enhanced communication with various state and federal agencies);
5. increased participation of area school systems through the Ecological Study Center; and
6. increased database of available information about the ORR.

As for negative impacts, the NERP philosophy has not always been compatible with FM goals of using the land for timber production. In addition, site development planning may be affected by NERP boundaries. The execution of DOE's programmatic missions must be ensured; however, ongoing environmental projects and protected and natural areas must be given careful consideration in any site use decisions.

Because of its large land area, the NERP influences many resources, even if it does not directly impact them. Areas of influence include environmental monitoring, safety and health, security, soil conservation and management, utilities management, waste management, water conservation and management, aquatic habitats, geology, hydrology, archaeological and historical sites, geography, and topography.

Issues that need to be addressed include

1. clarification of policies for excessing or transfer of NERP land for non-programmatic functions,
2. integration of FM objectives with NERP objectives,
3. development of formal communications from the forest manager concerning plans for any cutting on the ORR,

4. membership of the NERP Program Manager on the ORO Land Use Committee,
5. clarification of policies for excessing any ORR land, and
6. improved communication among resources through monthly meetings of the RMO.

4. DATA COLLECTION AND COMPILATION

The data in this document consist mainly of (1) information used in previous planning efforts for each of the major plants and the ORR, (2) the *Resource Management Plan for the U.S. Department of Energy, Oak Ridge Reservation* (ORNL-6026), and (3) the *Oak Ridge Reservation Land-Use Plan* (DOE/ORO-748). Whenever possible, the data have been updated and supplemented to address land use issues specifically. Other input has been contributed through the review process.

Data compilation has followed a specific outline to present a sequential flow of information supporting any conclusions and recommendations. Some of the information was reformatted, rewritten, and supplemented to address planning issues.

For the most part, planning issues (see Sect. 2.2) are being addressed on a day-to-day basis by the ORR RMO. Some have been identified in local news media accounts. Still others are more elusive, latent issues that are difficult to identify and even more difficult to express in terms of planning applications (e.g., conflicting management philosophies, resistance to change, lack of relevant policies, etc.).

4.1 SITE ANALYSIS AND MAPPING PROCESS

The data analysis and mapping processes are designed to focus or isolate the various features, natural or man-made, that influence planning. These specific "closeup" analyses are then measured or quantified to give an order of magnitude, degree of influence, or relative impact on the usability of the land resource. It is important to have a measured and calculated understanding of the physical features and how these features, separately and when combined, impact land use decisions.

Data layering is a technique used in mapping. Specific pieces of information (data) are separately mapped using a common scale for the purpose of overlaying or combining them with other data that have been mapped to build a composite. Once the data are combined, certain conclusions can be drawn and an order of magnitude can be applied. This is a very reliable technique used in making land use and siting recommendations and decisions. It is used to develop a map that identifies the various constraints that impede development and certain types of land use.

4.2 SLOPES

The entire Reservation is characterized by a rolling topography of subtle to exaggerated slopes with little or no expanse of flat land. The slopes constitute real constraints to development. To measure this aspect of the topography, a slope map (Fig. 4.1) has been prepared that illus-

trates the degree of constraint and order of magnitude these various slopes have on the land. The slopes are categorized into three ranges of relative constraint (Table 4.1). The gentlest slopes, 0% to 15%, offer the easiest and most flexible opportunities for development. Slopes of 15% to 25% require great care and sensitivity in siting utilities and structures and pose moderate constraints to development. Although erosion potential exists, these sites offer the opportunity for architectural innovation. Steep slopes of more than 25% are the most difficult to develop: erosion potential is greatest, disturbance is most visible, revegetation is most difficult, and construction costs are highest.

Although a vast amount of the ORR appears to fall within the mild slope classification [62%, or more than 8,900 ha (22,000 acres)] where development could possibly occur, other factors significantly reduce development potential [from more than 8,900 ha (22,000 acres) to approximately 4,450 ha (10,000 acres)]. However, land that is otherwise constrained for development may still be suitable for other vital uses such as research, FM, health and safety buffers, and more.

4.3 ASPECT

Automation of ORR topographic data will enhance analysis of the land's suitability for different uses. Instead of checking manually mapped slope data for engineering suitability for construction, analysts will be able to "call up" automated slope and aspect data (Fig. 4.2). For instance, there is now no convenient way to display all south-facing land areas of 0.4 ha (1 acre) or larger with slopes of less than 10% within 610 km (2,000 ft) of a paved road within 3,050 km (10,000 ft) of an existing plant. Permutations of these types of analysis will be possible when topographic data at a finer resolution than currently available are entered into the automated geographic information system for the ORR. The system was initiated in January 1983; until it is fully available, resource planning will be confined to the limitations of the coarser resolution of the existing automated topographic database (which may be quite suitable for FM purposes where larger-scale land units are employed) or to the manually portrayed slope categories portrayed in this document.

4.4 SOILS

Various soil properties and characteristics must be considered in the assessment of sites for different land uses. The chemical properties of soils are important for situations involving engineering applications, processes of soil formation, plant (vegetation) growth, and waste disposal

Table 4.1. Land areas for various slopes within the Oak Ridge Reservation

Slope classification	Area		Percent of total
	ha	(acres)	
Mild slope (0–15%)	9,235	(22,810)	62
Moderate slope (15–25%)	3,198	(7,900)	22
Steep slope (>25%)	2,393	(5,910)	16
Total	14,826	(36,620)	100


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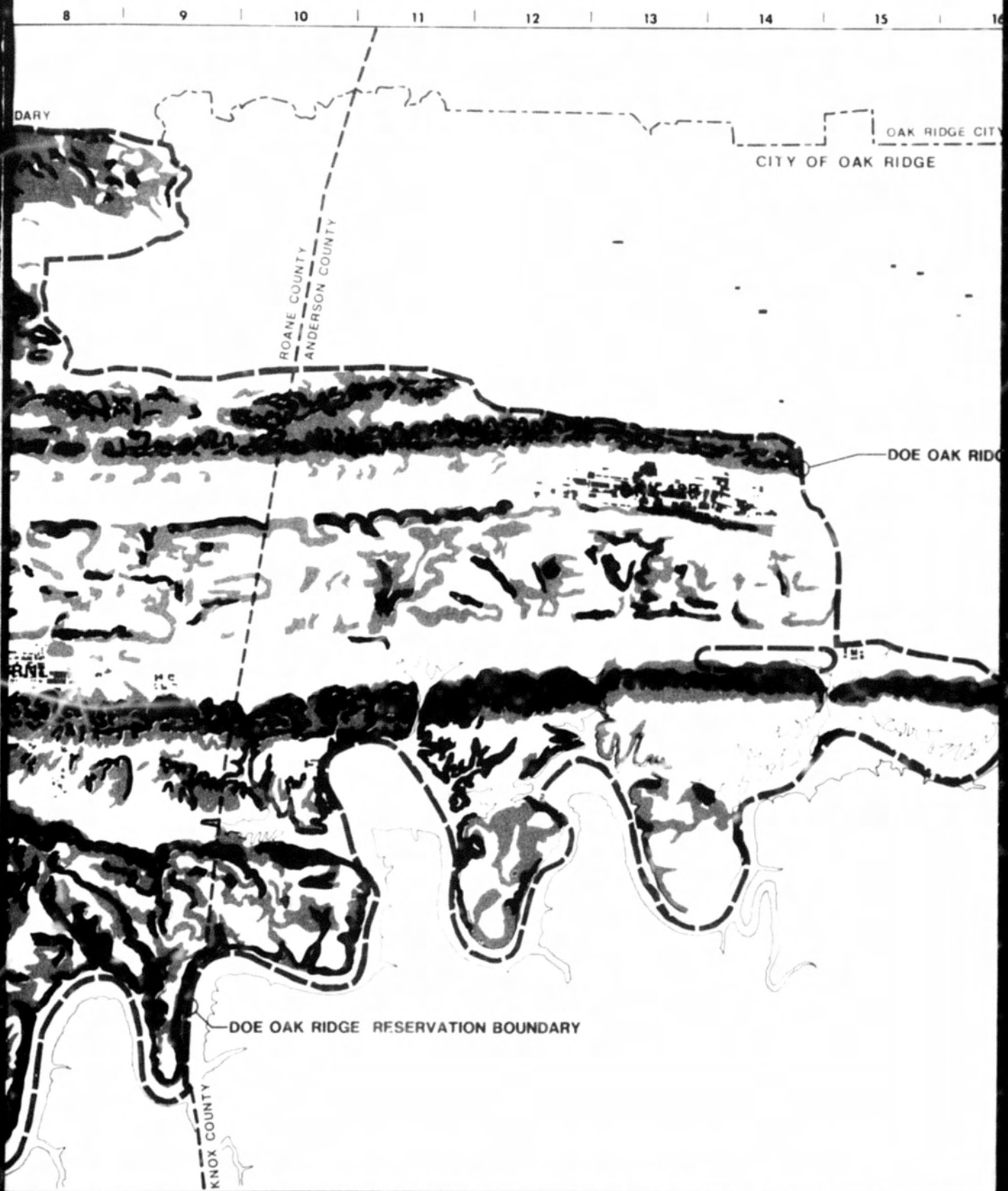
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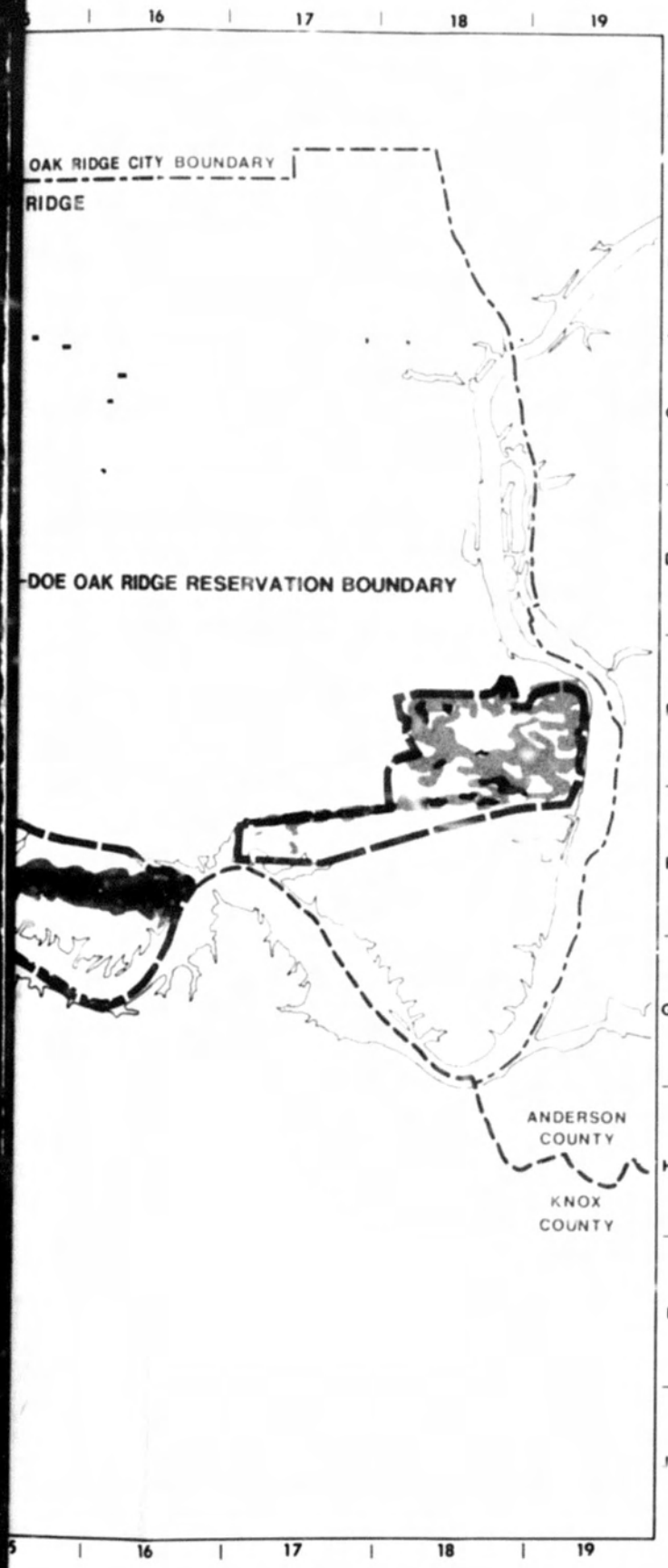

Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

	0–15%	MILD
	15%–25%	MODERATE
	> 25%	STEEP

kilometers
0 1 2 3
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Date **NOV. 1986** Rev. **1**

FIG. 4.1

SLOPE

(Table 4.2). Several physical properties of soils are important in planning and management (Table 4.3). Soil qualities and characteristics are important for FM (Table 4.4), for wildlife management (Table 4.5), and for various site development needs (Table 4.6). For planning purposes, soil series are placed into soil groups (Table 4.7), and prime and fragile lands are mapped (Fig. 4.3).

The various soil groups, as they relate to land use planning and management, fall into two categories: soil groups from the residuum (Rome, Conasauga, Knox, and Chickamauga) and soil groups from the colluvium and alluvium.

4.4.1 Rome Soils

Most Rome soils are on steep slopes and have a very high erosion hazard if vegetation is removed and the surface is left bare. Disturbed areas should be replanted to prevent erosion.

The geologic dip of the strata is very steep on south-facing slopes and approximately parallel to the slope gradient. As a consequence, whenever the lower slope is cut, the landform above tends to become unstable. Mass earthflows or mudflows are very common on these steep-dip slopes. Water also flows downward and laterally along dip planes and may come

Table 4.2. Soil chemical properties[a]

Soil group	Corrosivity		pH range	Estimated cation exchange capacity[b]		
	Steel	Concrete		Surface	Subsoil	Saprolite
		Residuum				
Rome	Low	Moderate-high	4.5–6.0	5–15	10–20	NA[c]
Conasauga	Moderate	Moderate	4.5–6.0	10–15	15–20	NA
Knox	High	Moderate-high	4.5–5.5	5–10	8–20	NA
Chickamauga						
Gladeville	High	Low	6.6–8.2	20–40	40–80	NA
Colledgedale	High	Moderate-high	4.5–5.5	10–15	20–40	NA
		Colluvium				
Rome/Conasauga	Low-moderate	Moderate-high	4.5–6.0	5–10	5–10	NA
Knox	Moderate	Moderate	4.5–5.5	5–10	5–10	NA
		Alluvium				
Holocene/ Modern	Moderate-high	Low-moderate	4.5–7.8	5–10	5–10	NA
Pleistocene	Moderate	Moderate	4.5–5.5	5–10	5–10	NA

[a]Data from U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey Investigations*, Report No. 15, Washington, D.C., 1967.

[b]Millequivalents per 100 g of soil [centimoles (+) kg^{-1} soil].

[c]NA = data not available.

Table 4.3. Soil physical and engineering properties[a]

Group	Surface					Subsoil				
	Shrink-swell	LL[b] (%)	PI[c] (%)	Unified class	K factor	Shrink-swell	LL (%)	PI (%)	Unified class	K factor
					Residuum					
Rome	Low	20–30	NP[d]–8	ML, CL	0.24	Low	15–40	NP–13	GM, SM	0.28
Conasauga	Low	20–40	5–15	ML, CL	0.32	Moderate	45–75	17–40	MH, ML, CL, CH	0.37
Knox	Low	15–30	3–15	ML, CL	0.28	Moderate	40–70	20–40	MH, ML	0.24
Chickamauga										
Gladeville	Moderate	30–60	20–35	GC, CL, CH	0.17	High	35–70	35–70	CH, MH, CL	0.17
Colledgedale	Low	20–40	5–16	ML, CL	0.37	Moderate	40–80	20–50	MH, CH	0.24
					Colluvium					
Rome/ Conasauga	Low	20–35	2–10	SM, SC	0.28	Low	20–35	2–10	GM, SM, ML	0.28
Knox	Low	20–30	NP–10	ML, CL	0.34	Low	20–30	5–15	CL, GC	0.28
					Alluvium					
Holocene/Modern	Low	<30	NP–10	ML, CL	0.32	Low	20–40	4–20	ML, CL	0.43
Pleistocene	Low	20–30	3–10	ML, CL	0.37	Low	40–70	10–25	CL, ML	0.32

[a]Adapted from the following U.S. Department of Agriculture, Soil Conservation Service documents: *Anderson County, Tennessee, Soil Survey*, Supr. Doc., Washington, D.C., 1981; *Soil Survey Investigations*, Report No. 15, Washington, D.C., 1967; and *National Soils Handbook*, Washington, D.C., 1983.

[b]LL = liquid limit.

[c]PI = plastic index.

[d]Nonplastic.


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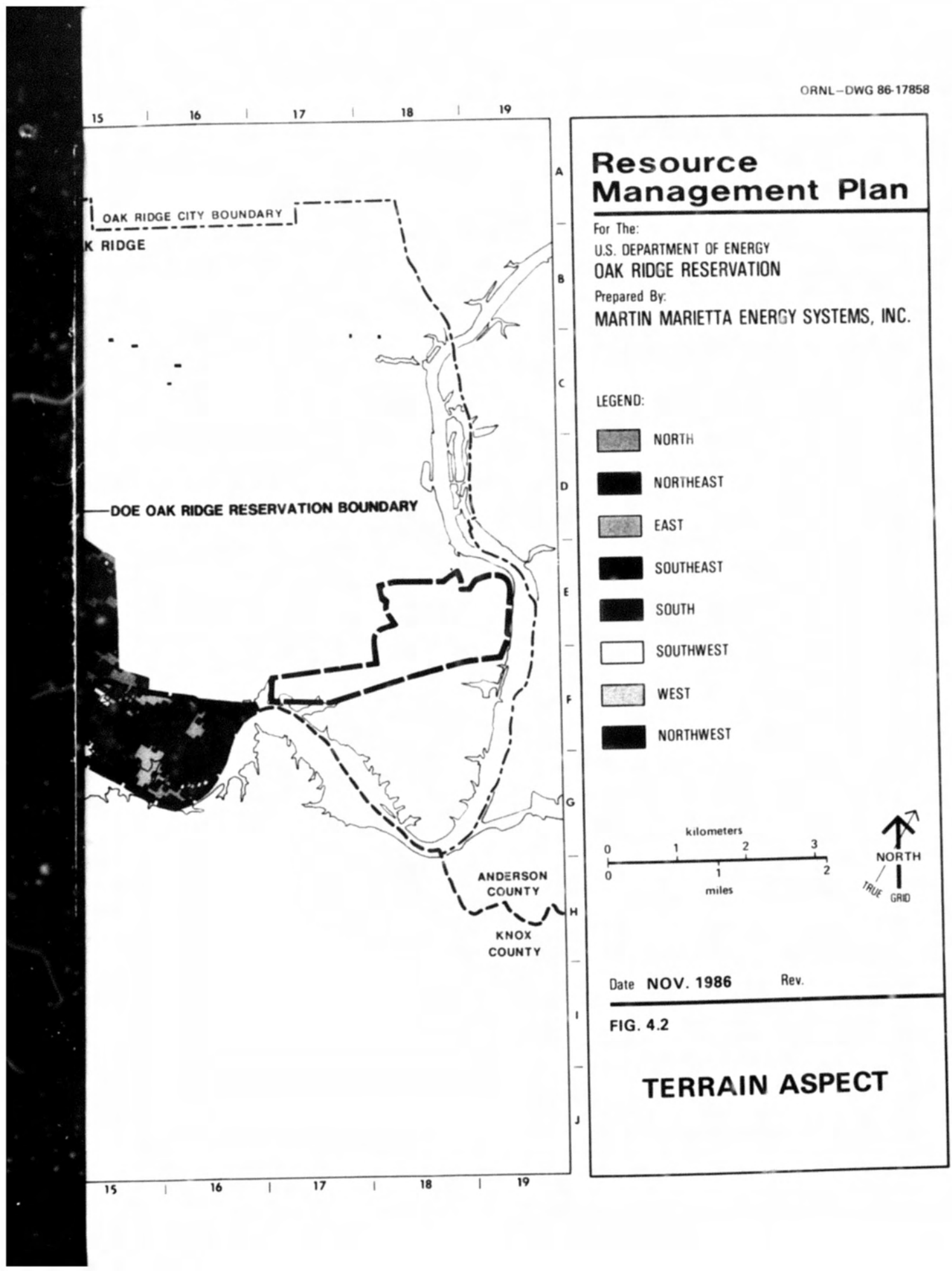


Table 4.4. Woodland management[a]

Soil group	Erosion hazard	Seedling mortality	Windthrow hazard	Trees to plant	Rating[b]	Trees to manage
			Residuum			
Rome	Slight-moderate	Slight-moderate	Slight-severe	White pine	50–60	Oaks Hickories
Conasauga	Moderate	Moderate	Slight	Loblolly pine	50–65	Yellow poplar Oaks Hickories Virginia pine
Knox	Slight-moderate	Slight	Slight	Loblolly pine White pine Yellow poplar	70–80	Oaks Hickories Yellow poplar
Chickamauga						
Gladeville	Moderate	Severe	Severe	Red cedar	10–30	Red cedar
Colledgedale	Moderate	Slight	Slight	Yellow poplar Loblolly pine	75–85	Yellow poplar Oaks Hickories
			Colluvium			
Rome/Conasauga	Moderate	Slight	Slight	Loblolly pine	85–95	All species
Knox	Slight	Slight	Slight	Yellow poplar Black walnut Loblolly pine	75–85	All species
			Alluvium			
Holocene/Modern	Slight	Slight	Moderate-slight	Sweet gum Loblolly pine Sycamore White pine Yellow poplar	100	All species
Pleistocene	Slight-moderate	Slight	Slight	Yellow poplar Black walnut Loblolly pine	95–100	All species

[a]Ratings of productivity are derived from SCS-5 interpretations for the major soils in each group. (U.S. Department of Agriculture, Soil Conservation Service, *National Soils Handbook*, Washington, D.C., 1983.)

[b]Rating based on 0 to 100, with 100 being highest rating.

Table 4.5. Wildlife habitat potential[a]

Soil group	Habitat elements for				Potential for		
	Grain crops	Herbs and grasses	Hardwoods	Conifers	Open land	Woodland	Wetland
			Residuum				
Rome	Very poor	Good	Fair	Fair	Poor	Fair	NA[b]
Conasauga	Very poor-fair	Poor-good	Fair	Fair	Poor	Fair	NA
Knox	Poor-fair	Poor-good	Fair-good	Fair-good	Fair-good	Fair	NA
Chickamauga Gladeville[c]	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	NA
			Colluvium				
Rome/Conasauga	Fair	Good	Good	Good	Good	Good	NA
Knox	Fair-good	Good	Good	Good	Good	Good	NA
			Alluvium				
Holocene/Modern							
Well drained	Good	Good	Good	Good	Good	Good	Poor
Poorly drained	Good	Good	Good	Good	Fair	Good	Fair
Pleistocene	Good	Good	Good	Good	Good	Good	Good

[a]Habitat ratings derived from U.S. Department of Agriculture, Soil Conservation Service, *National Soils Handbook*, Washington, D.C., 1983.

[b]NA = not applicable.

[c]Other soils of the Chickamauga group compare with the Conasauga group.

to the surface as seeps during wet periods. On north-facing slopes, the dip is into the slope. Consequently, a north-facing slope tends to be more stable if a cut is made into it.

4.4.2 Conasauga Soils

Much of the radioactive waste from ORNL and Y-12 has been buried in the Maryville Formation of the Conasauga Group, primarily because this group is of low permeability and the clays in the residuum are highly absorptive to radionuclides. However, since the soil horizons terminate at a shallow depth, most waste is placed in saprolite, Cr horizon, which does not have many desirable chemical properties in its undisturbed state. Water tables also rise and fall, which is not always possible to determine or predict. As more of a disposal area is used, watershed hydrologic properties also change as trees are removed and more surface water infiltrates porous trench fill. Using fragmental materials dug from trenches for cover material only hides the waste. This cover material is very porous and possesses very little adsorptive capacity. It takes from 5 to 7 years for fragmental materials to weather sufficiently

Table 4.6. Ratings for site development[a]

Soil group	Roads and streets	Cut and fill	Landfill	Sewage and sludge	Roadfill
		Residuum			
Rome	Poor	Poor	Very poor	Very poor	Poor
Conasauga	Poor	Poor-fair	Poor	Poor-fair	Poor
Knox	Fair	Fair	Fair	Fair-good	Poor-fair
Chickamauga	Very poor-poor	Very poor-poor	Very poor	Unsuited	Very poor
		Colluvium			
Rome/Conasauga	Fair	Fair	Poor-fair	Good	Fair
Knox	Fair	Fair	Fair	Good	Fair
		Alluvium			
Holocene/ Modern	Poor	Poor-fair	Very poor	Poor	Poor
Pleistocene	Fair-good	Good	Good	Good	Good

[a]Ratings based on U.S. Department of Agriculture, Soil Conservation Service, *National Soils Handbook*, Washington, D.C., 1983.

to reduce permeability. Cover material, or at least the final cover material, should be obtained from the colluvial soils present on waste burial grounds. The colluvial soil has much better cover properties, including lower porosity. Raw shale fragments also make a poor seedbed for establishing vegetative cover. Establishing this cover is important for two reasons: for erosion control and to enhance evapotranspiration and thereby lessen deep-water flow into the waste. Burial ground soil should be tested once a year, and recommended applications of lime and fertilizer should be carefully applied until soil pH is adjusted to a suitable level and adequate soil levels of phosphorous and potassium have been obtained. Grass cover will not maintain itself without periodic additions of nitrogen, a nutrient that does not exist in raw shale cover materials. A shallow-rooted legume should be planted along with a suitable grass species, which will allow the grass to maintain itself.

4.4.3 Knox Soils

Knox soils occupy the largest portion of the ORR and are among the least utilized. Most Knox soils are very deep, but it is common to find pinnacles and ledges whenever a large trench is excavated. The

Table 4.7. Soil series placed into soil groups

Soil group	Soil series
Residuum	
Geologic formation	
Rome Group	Lehew, Armuchee-Muskingum, Calvin
Conasauga Group	Sequoia, Armuchee, Apison, Montevallo, Colledgedale
Knox Group	Fullerton, Bodine, Clarkesville, Dunmore
Chickamauga Group	Gladeville, Talbott, Colledgedale, Colbert, Upshur-Variant
Colluvium	
Source of colluvium	
Rome and Conasauga groups	Jefferson, Shouns, Leadvale, Shelocta
Knox Group	Minvale, Tasso, Roane, Emory, Greendale, Tarklin
Alluvium	
Age of soil material	
Holocene/Modern	Hamblen, Pope-Philo, Newark, Melvin
Pleistocene	Allen, Dewey, Claiborne Holston, Waynesboro, Etowah, Nolichucky

presence of pinnacles cannot be predicted, even with closely spaced drilling. Even though Knox soils have a subsoil clay content of up to 80%, they are relatively permeable and do not have a high erosion potential under forest vegetation. Thus, Knox soil landforms are the oldest and most stable on the Reservation. Preserved on Knox soils are the remnants of much older landscapes from previous weathering and erosion cycles. Ancient alluvium is located on some of the most stable parts of Chestnut Ridge, Melton Hill, Blackoak Ridge, and McKinney Ridge.

Knox soils on less-sloping hillsides have good potential for a variety of uses, including building sites. Knox soils can be used for waste disposal, but design of burial trenches or of the area fill method of waste burial must be much different from current practice in Conasauga soils. Trenches in Knox soils must be made impermeable, and the trench bottom must be sloped so that any leachate will come

to the trench end and be subjected to treatment rather than percolate downward. Trench bottoms can also be suitably doped with chemicals, special clays, or zeolites to filter and contain contaminants. This same type of design could also be used in the Solid Waste Storage Area 7 (SWSA 7) burial ground on the steeper slopes and in the northwest sector of the SWSA 6 burial ground. One substantial advantage to using Knox soils for waste burial is the suitable soil properties of cover materials. Clayey cover can be compacted and made relatively impermeable, thus slowing the infiltration of water. Layers of gravel can also be placed near the surface, and a final clayey cover can be added to reduce downward movement of water. Tile drains placed in the gravel will remove ponded water and prevent it from breaking through into the clayey soil beneath. Of course, waste must be precompacted and carefully placed in trenches so that large voids do not occur. Differential settlement would ruin any attempts to keep water from infiltrating and percolating down through trench cover. Differential settlement, which is a major problem in current burial sites at ORNL and Y-12, also presents a long-term maintenance problem. Water ponds and infiltrates wherever differential settlement has occurred.

Knox soils, if properly managed, have fair to good potential for forestry production and wildlife habitat.

4.4.4 Chickamauga Soils

Most shallow-to-rock Chickamauga soils have few properties conducive to intensive land use. Soils deeper to rock have fair to good potential for forest production and natural wildlife. The best land use for most Chickamauga soils is sustained intensive forest production because of the gentle slopes, relatively low erosion potential under forested conditions, and naturally high fertility. Rock outcrops present management problems for intensive forestry where site preparation is a soil management practice. Most Chickamauga soils are unsuited for waste disposal either because of shallow depth or because of numerous solution channels in the rock beneath.

4.4.5 Colluvium and Alluvium Soil Groups

Soils in these groups have great potential for forestry and wildlife. Most of these soils, except for very wet areas, were intensively farmed or gardened. Holocene/modern alluvium soils provide final filtering to surface and lateral flow of water before it enters the stream channel. Consequently, these soils are important in maintaining stream-water quality. Vegetation should be maintained in a natural state along with a buffer strip during forest clear-cutting and site preparation activities to prevent sediment from entering the stream. Stream floodplains and low terraces should not be filled with land-clearing debris in waste burial grounds nor should all the trees be cut in the bottom or in a strip adjacent to the bottom. Colluvial soil groups are a good source of trench cover material in the currently active burial grounds located on Conasauga Group soils.

Table 4.8 shows the various soils' potentials for use.

4.5 HYDROLOGY

The location of floodplains is important for the design and placement of structures or waste disposal sites. Floodplains

Table 4.8. Utilization potential of soil groups for land use zoning

Soil group	Use							
	Production	Research and development	Support	Waste	Administration	Buffer	Public	Natural
Rome	Very poor	Poor	Poor	Poor	Fair	Good	Good	Good
Conasauga	Fair	Good	Good	Fair	Good	Fair	Fair	Good
Knox	Fair	Good	Good	Fair	Good	Good	Good	Good
Chickamauga	Poor	Poor	Poor	Very poor	Good	Good	Poor	Good
Colluvium	Poor	Poor	Poor	Poor	Poor	Good	Fair	Good
Alluvium	Poor	Poor	Poor	Poor	Poor	Good	Poor	Good

have been mapped by TVA and the operating contractor's Engineering Division. Figure 4.4 shows the normal pool elevation, TVA structural profile (what TVA can legally flood), 500-year flood, and probable maximum flood. Flooding and resulting damage have occurred in the City of Oak Ridge along East Fork Poplar Creek as well as within the major plant sites. As this mapping indicates, some existing facilities at each major plant site can be and have been affected. Cleaning of drainage channels has substantially reduced flooding problems. Controlling or prohibiting development within flood zones will ensure that flood damage will be kept to a minimum on the ORR.

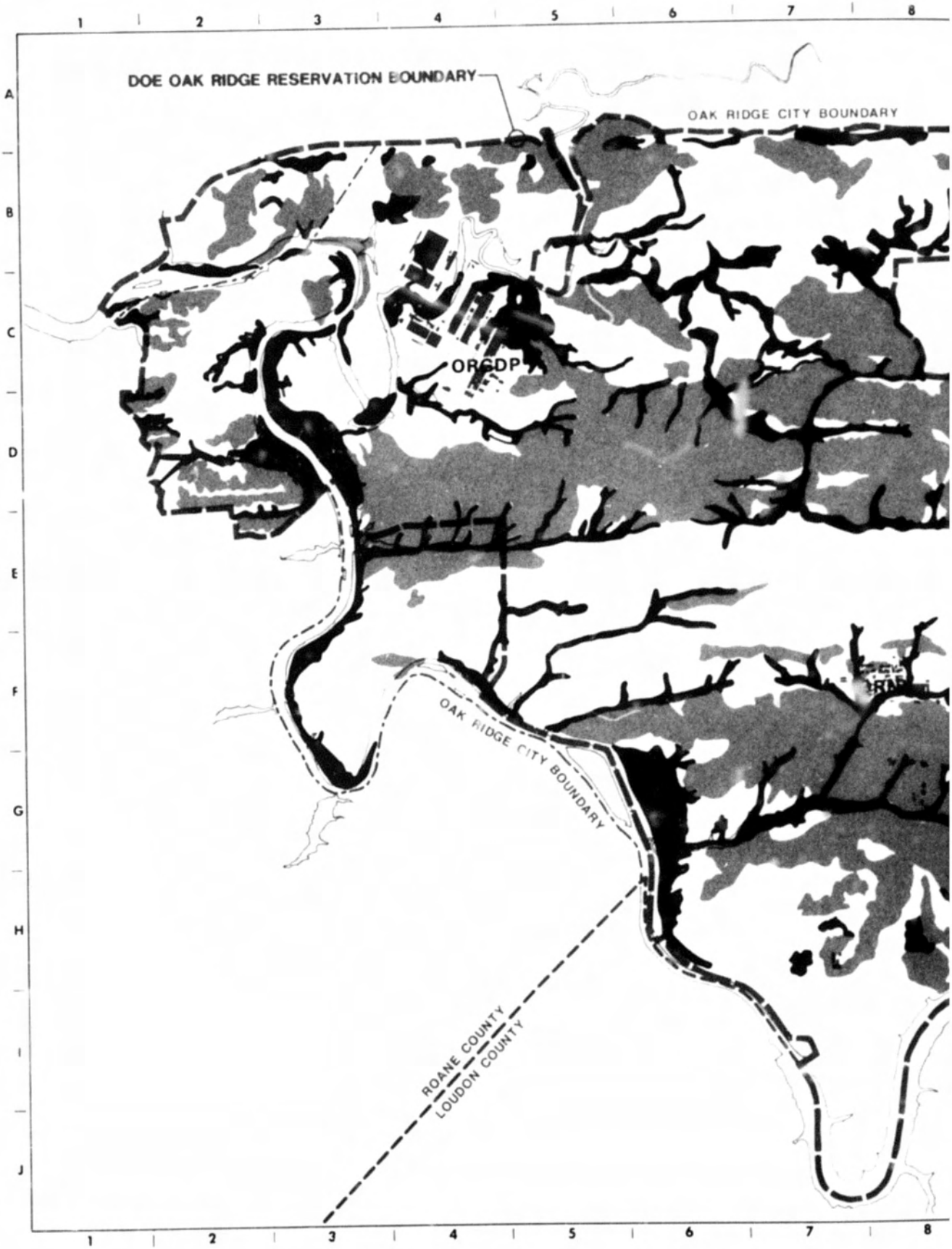
4.6 CONSTRAINTS AND OPPORTUNITIES

The ability to isolate and combine the separate features that impact or influence how the land resource can be used is very important. It allows planners to make rapid comparisons and intelligent decisions based on measured influences that contribute to the site's capabilities. As each type of constraint (flood, slope, geology, existing use, etc.) is mapped and then combined through layering, another map (Fig. 4.5) is produced that identifies all of the combined constraints. Depending on the number of constraints and their individual level(s) of constraint, an order of magnitude is assigned. The mapped areas that have no constraints or only minor constraints are deemed the areas of greatest opportunity for future development (Table 4.9).

Note that certain uses are constrained by various natural and manmade features. Health, safety, and security buffers, for example, may be influenced (but not constrained) by ridges or flat topography.

4.7 LAND USE CLASSIFICATIONS

The organizational structure of the ORR, with all its facilities and programs, is complex. This complexity is compounded by the large number of functions that fall under the direction of this structure. To classify all of the multifaceted programs and functions separately would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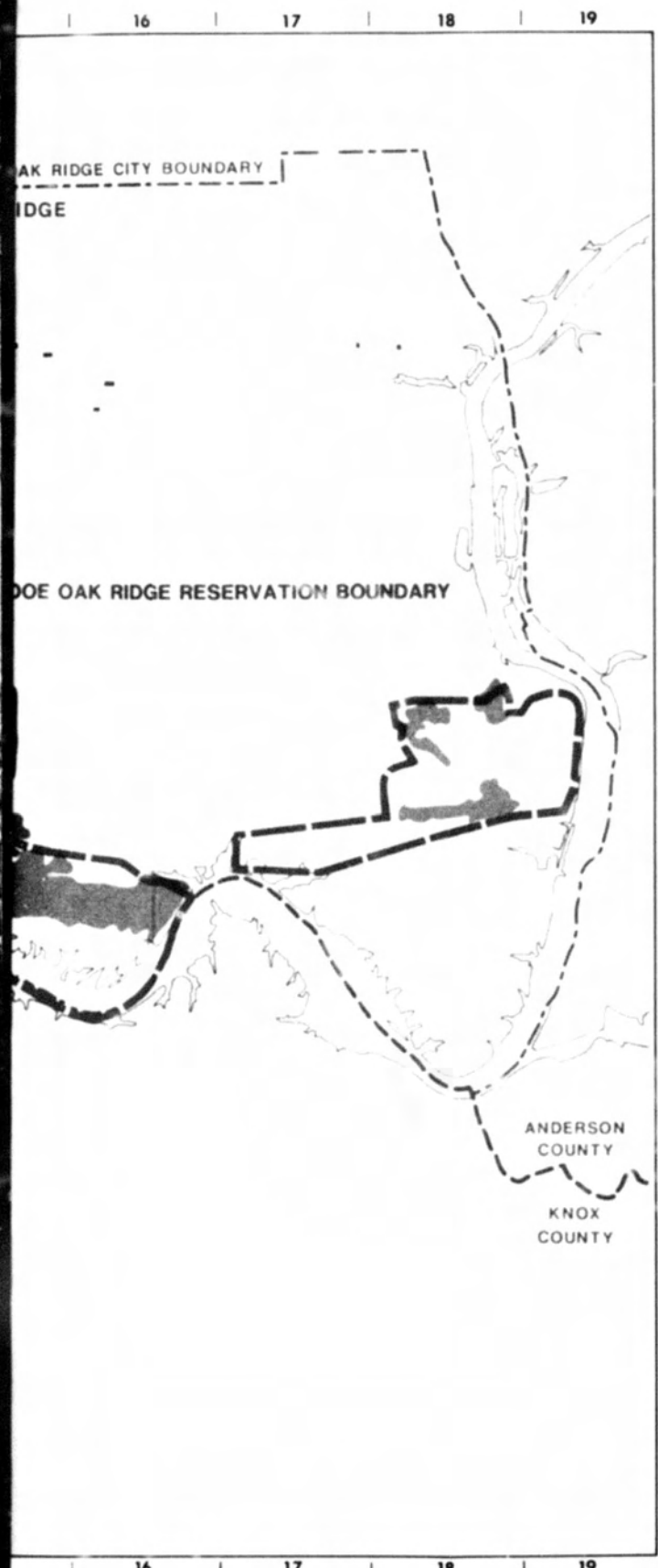


Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- FRAGILE LANDS
- PRIME LANDS

kilometers 0 1 2 3

0 1 2 miles

NORTH

TRUE GRID

Date **NOV. 1986** Rev. **1**

FIG. 4.3

FRAGILE LANDS

Table 4.9. Land areas of opportunities and constraints within the Oak Ridge Reservation

Classification	Area		Percent of total
	ha	(acres)	
Developable areas with major constraints	7,397	(18,270)	50
Developable areas with minor constraints	3,457	(8,540)	23
Areas with greatest opportunities	3,972	(9,810)	27
Total	14,826	(36,620)	100

only tend to complicate the planning process. Conceptually, the decision-making process is enhanced by keeping the planning process as simple as possible. Therefore, reducing the number of programs and functions to the "lowest common denominator" is desirable. To this end, generic land use classifications have been selected to encompass the various functions:

- *Administration:* This classification consists of "white collar" office functions—computer sciences, engineering, accounting, law, executive offices, employment, auditing, administration, quality assurance, purchasing, employee relations, general health, safety, and environmental, safeguards administration, operations, analysis and planning, and any other similar functions.
- *Research and development:* The R&D classification encompasses research and/or development that supports research activities at ORGDP, ORNL, Y-12, ORAU, and specific sites within the NERP.
- *Production:* This classification consists of weapons component manufacturing, uranium enrichment activities, and other industrial functions.
- *Support:* This classification encompasses all general and technical support dedicated to maintenance, supply, and protection of all other land use functions. These activities include maintenance, shipping and receiving, stores (materials management), process support, fire and guard functions, food services, medical services, operational safety, industrial hygiene, and shift operations.
- *Waste:* This consists of all waste and scrap materials functions, including waste handling, storage, burial, and incineration. Types of waste include hazardous, nonhazardous, contaminated, and construction.
- *Buffer:* The buffer classification consists of land areas that are used for health, safety, and security and areas that are designated as setbacks from public thoroughfares for health, safety, and aesthetic purposes.
- *Natural:* This classification consists primarily of undeveloped lands. These lands are generally wooded and include such resources as FM, Wildlife Management, the NERP, Endangered Animals, Endangered Plants, Aquatic Habitats, and Archaeological Sites.

- *Public:* This consists of land areas that are open to the general public (e.g., state, county, and city roads, visitors' overlooks, historical sites, recreational areas, cemeteries, and certain portions of some impoundments).

Although simplification enhances the basic understanding of the whole, a simplified land use scheme lacks sufficient detail to support specific siting decisions. An in-depth understanding of specific functions and their interrelationships is necessary. This understanding must be achieved as an integral part of any project's site selection analysis.

Each major facility within the ORR has its own generic land use classifications to fit its specific needs. The number of classifications and the descriptive terminology may vary slightly, but the concept and process are much the same. For the purposes of this document, each facility's primary mission function is reflected (i.e., ORNL and Scarboro are shown as R&D facilities, while ORGDP and Y-12 are shown as production facilities).

As the planning process progresses, more in-depth refinement is required. Each generic classification may be subdivided into as many subclassifications (coded) as needed to show precisely how the land is being or will be utilized. (Section 4.5 contains more discussion of zoning and coding.)

4.8 EXISTING LAND USE

When generic land use classifications are used to map current utilization of the ORR, three predominant clusters of intensive use are revealed (Fig. 4.6). These clusters are related to the primary plant sites. The remainder of the ORR is predominantly Natural Use with many areas dedicated to Waste; these remaining areas are crisscrossed by numerous utilities, which are designated as Support. Table 4.10 shows the distributions of land classification by area and percentage.

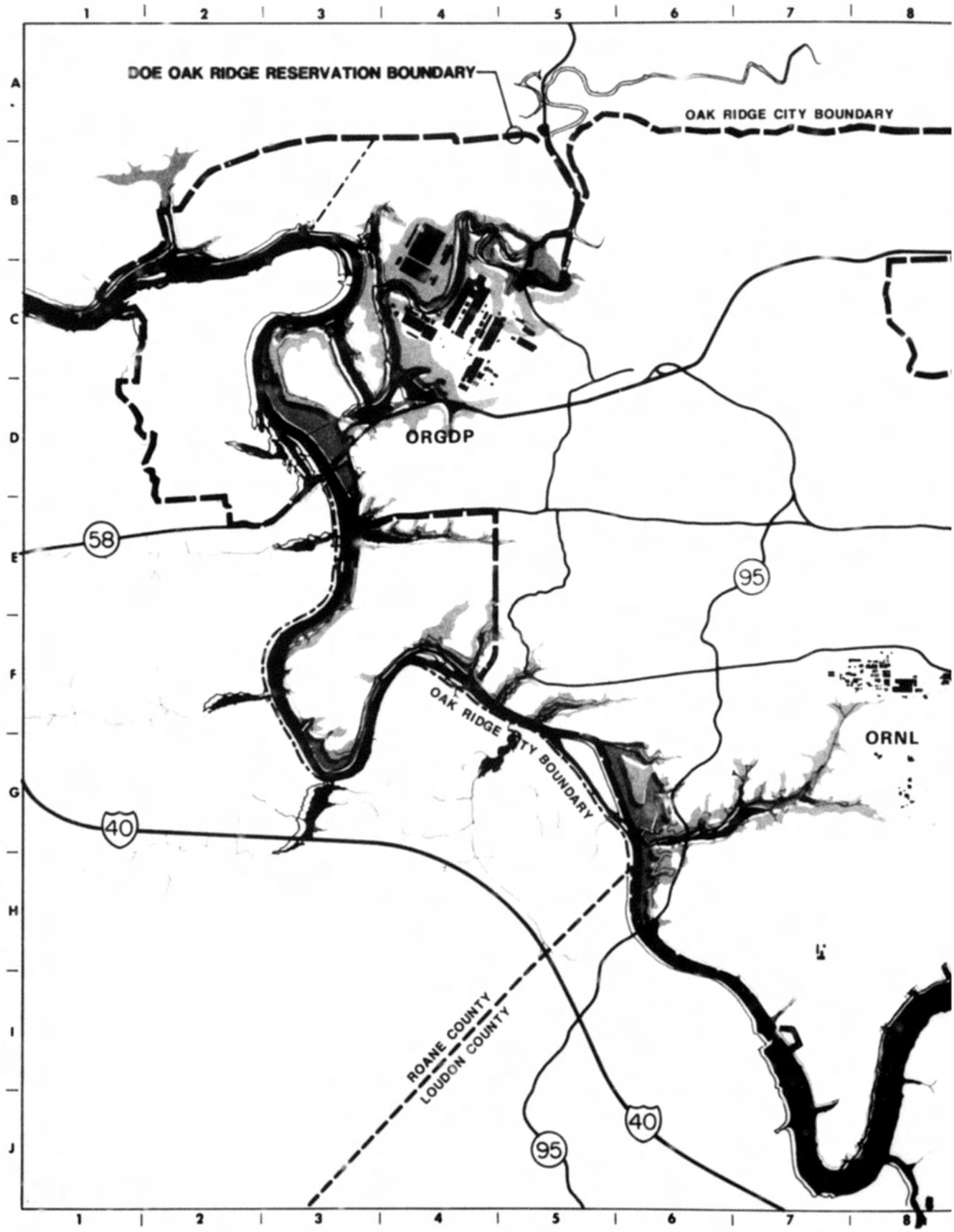
4.9 FUNCTIONAL RELATIONSHIPS

Most functions, because of their innate characteristics, need to be located near other functions, facilities, and utilities. Others, for special reasons, require isolation. A basic understanding of these functional characteristics is needed for general planning purposes, and an in-depth understanding is essential for specific siting of facilities and programs.

Integration with the natural, local, and regional environments will be enhanced by taking into consideration the constraints and opportunities imposed by these environments. The natural topography, with its ridges and watercourses, isolates the ORR from the local populace and thus mitigates impacts. The lush native vegetation provides a maximum of evapotranspiration, erosion control, and natural beauty. By identifying the many opportunities for protecting and using these natural assets, development and operating costs can be minimized and the quality of life can be enhanced. The land use planner must carefully consider the interrelationships of the ORR, its major plant facilities, the City of Oak Ridge, and surrounding communities in terms of compatible land use, adequate and safe transportation systems, life support systems, and environmental concerns.

An important part of the analysis process involves looking separately at the various component phases of land use (i.e., existing, ideal, potential, and future).

Paramount in the analysis process is the thorough evaluation of each of the site's various development phases and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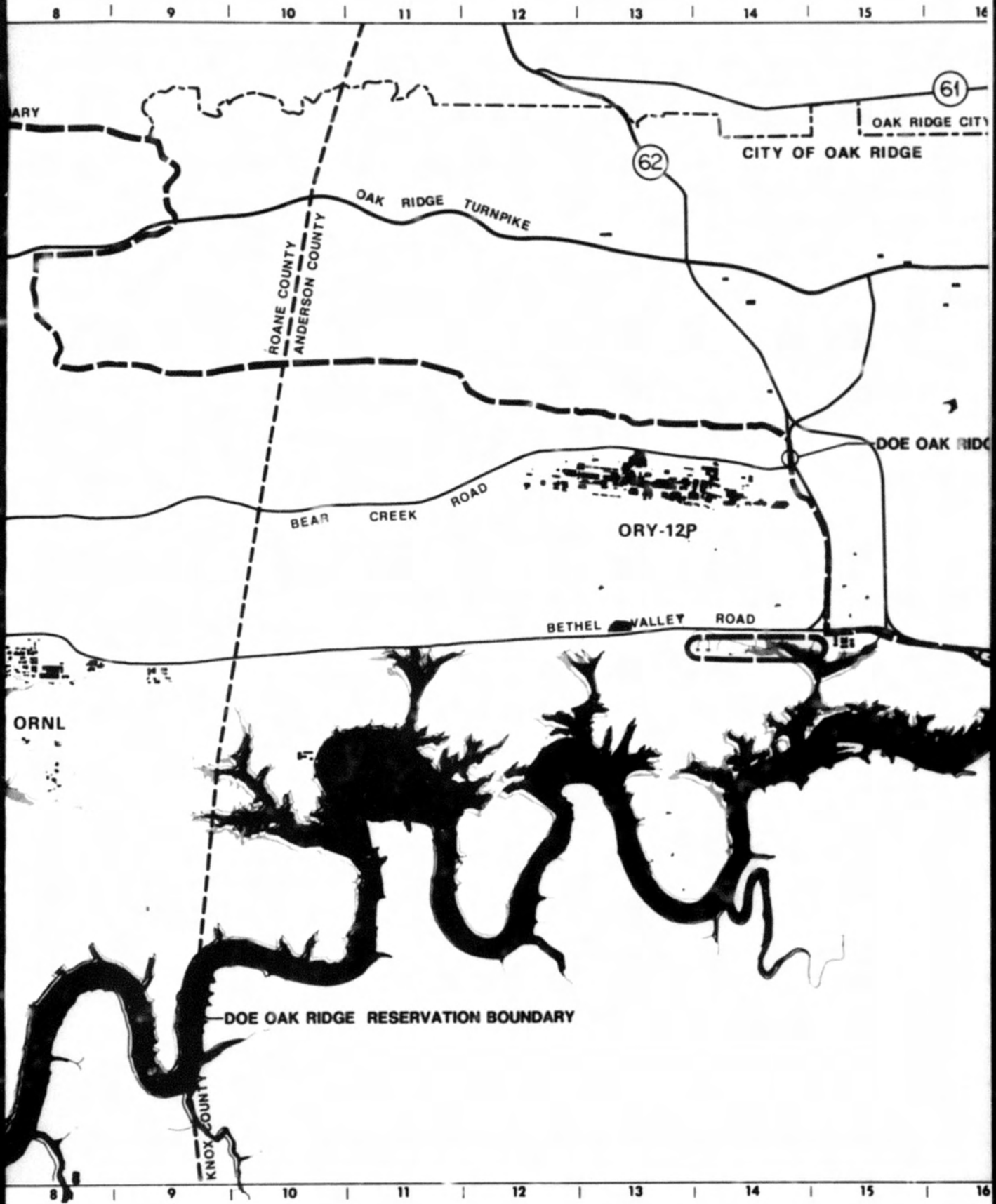
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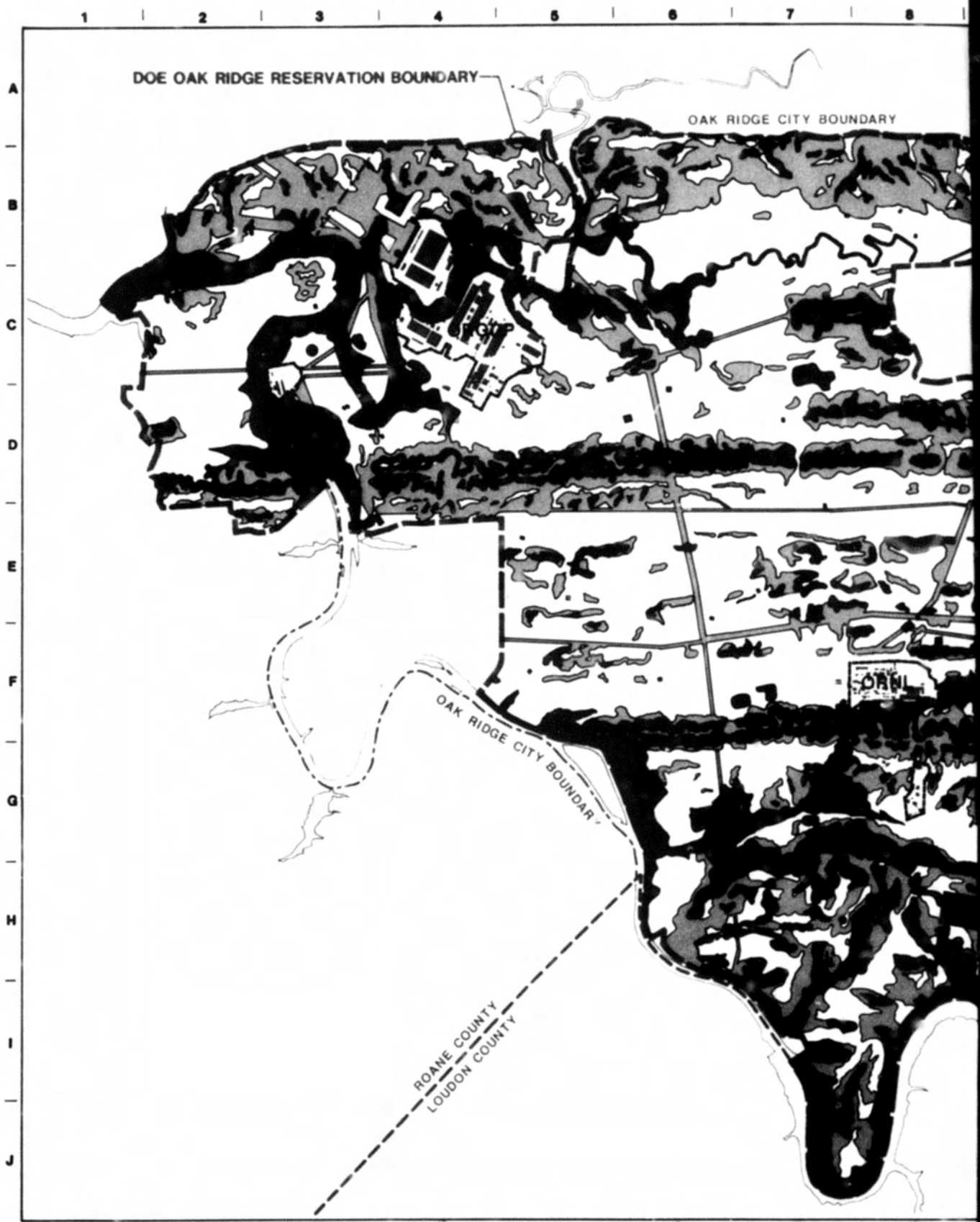
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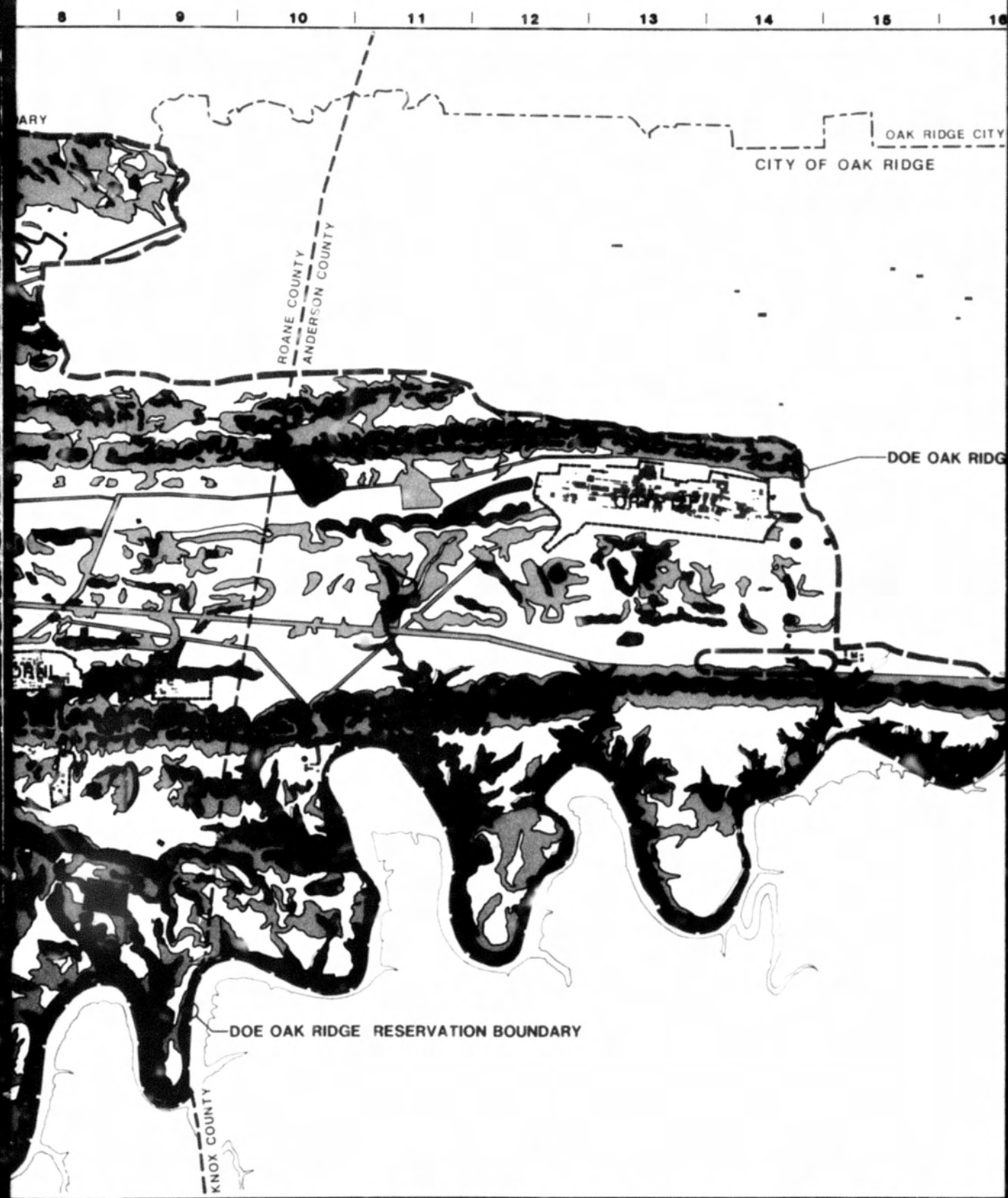
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Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- AREAS WITH MAJOR CONSTRAINTS
- AREAS WITH MODERATE CONSTRAINTS
- AREAS WITH GREATEST OPPORTUNITIES

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TRUE GRID

Date **NOV. 1986** Rev. **1**

FIG. 4.5

CONSTRAINTS AND OPPORTUNITIES

Table 4.10. Land areas of existing land use within the Oak Ridge Reservation

Classification	Area		Percent of total
	ha	(acres)	
Administration/technical services	49	(120)	0.3
Research and development	2,470	(6,100)	16.6
Production	180	(445)	1.2
Support	1,721	(4,250)	11.6
Waste	304	(750)	2.1
Public	320	(790)	2.2
Natural	9,289	(22,945)	62.7
Buffer	494	(1,220)	3.3
Total	14,827	(36,620)	100.0

constituent land uses (i.e., existing, potential, projected, and optimum). This document contains two diagrams that depict the Reservation's *existing* human, facility, and natural resources. Figure 4.7 graphically illustrates the current workforce population distribution, order of magnitude, and population relationships. Figure 4.8 schematically indicates the relative location, land use area, and vehicular accessibility of existing on-site and off-site facilities; all are shown in relationship to the major waste disposal areas and the extensive natural environment of the ORR. During development of the analysis and planning processes for specific plans (such as an SDP or a land use plan), other site and population diagrams should be prepared (e.g., a projected site diagram, a projected population diagram, and an optimum site diagram).

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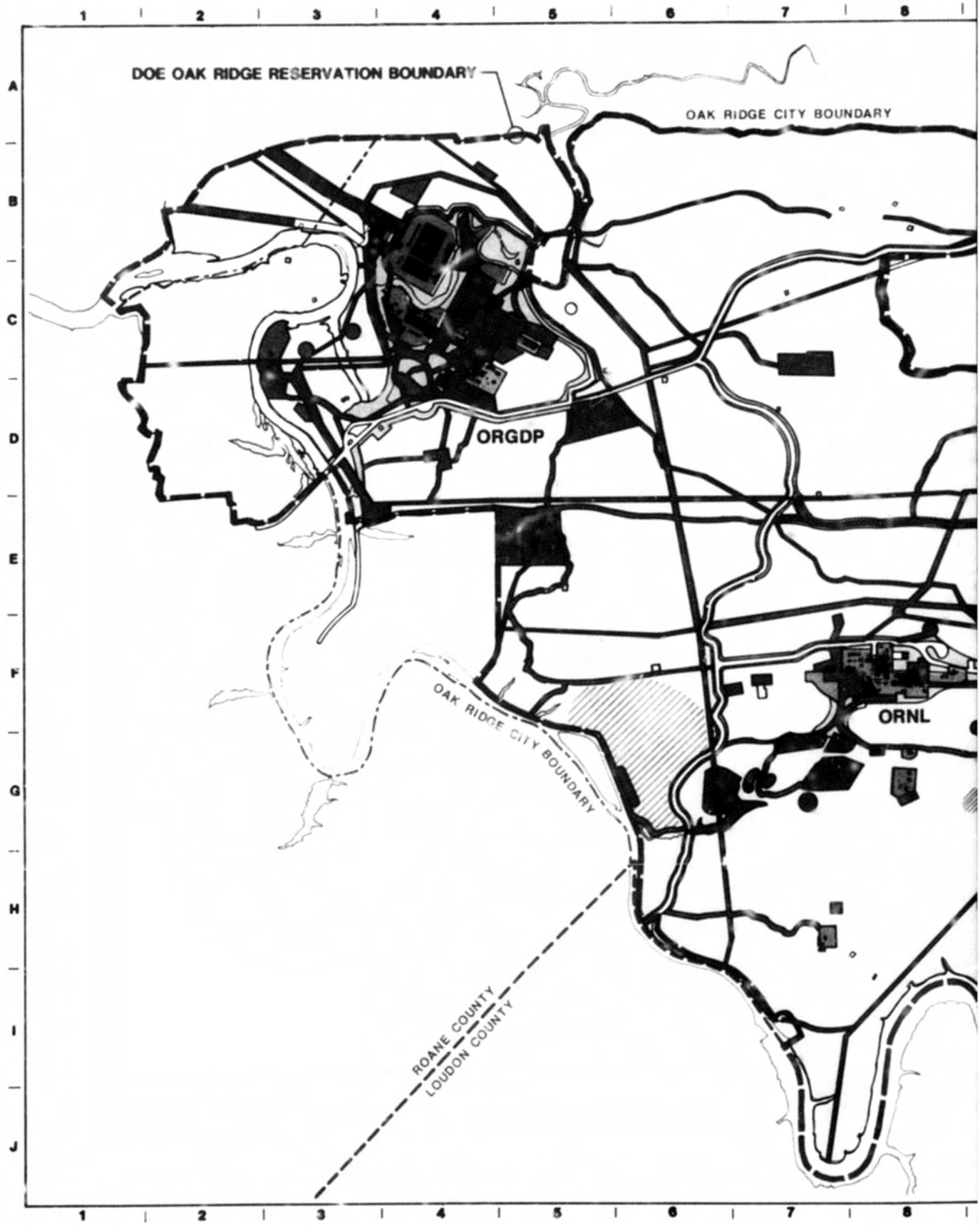
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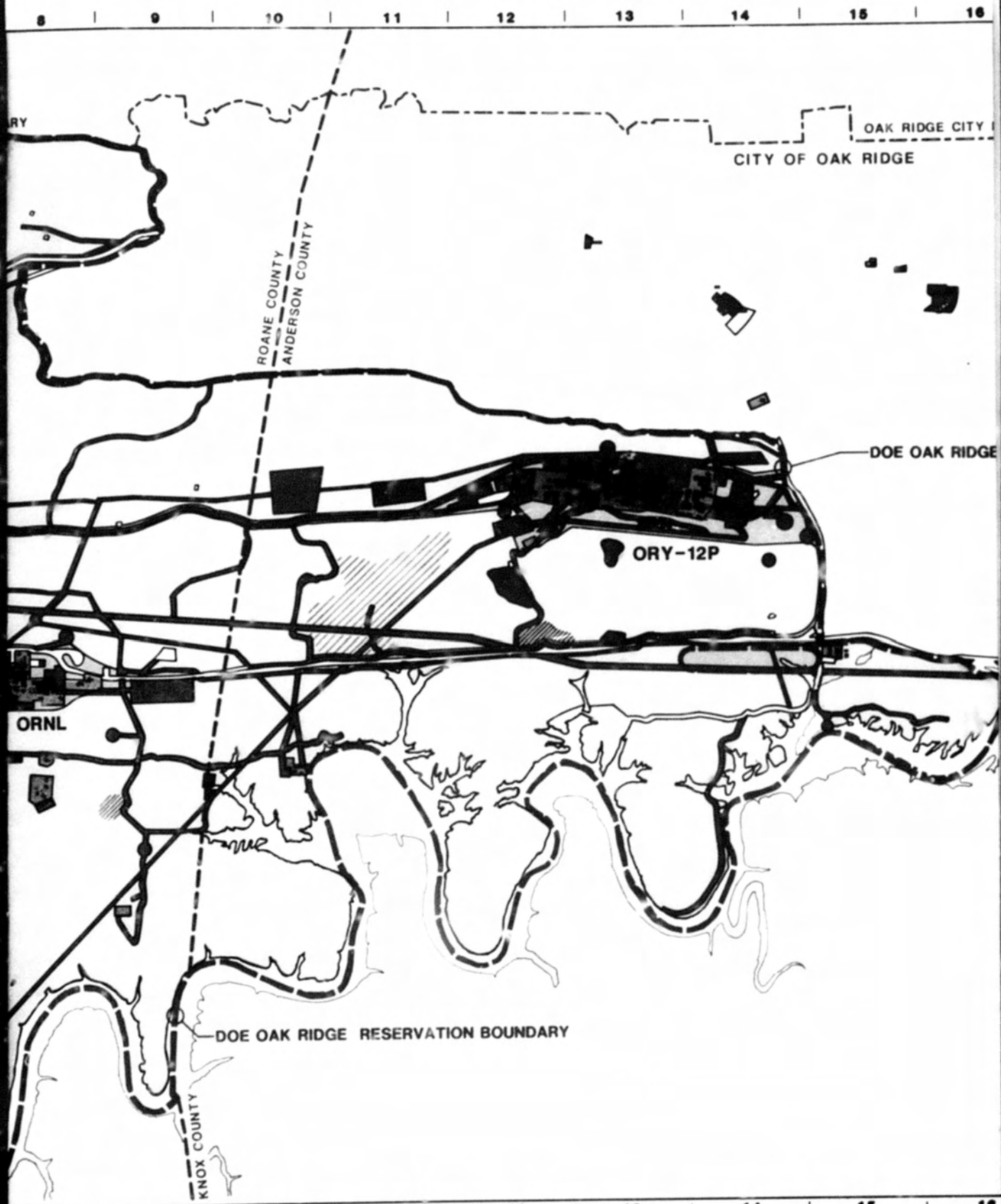
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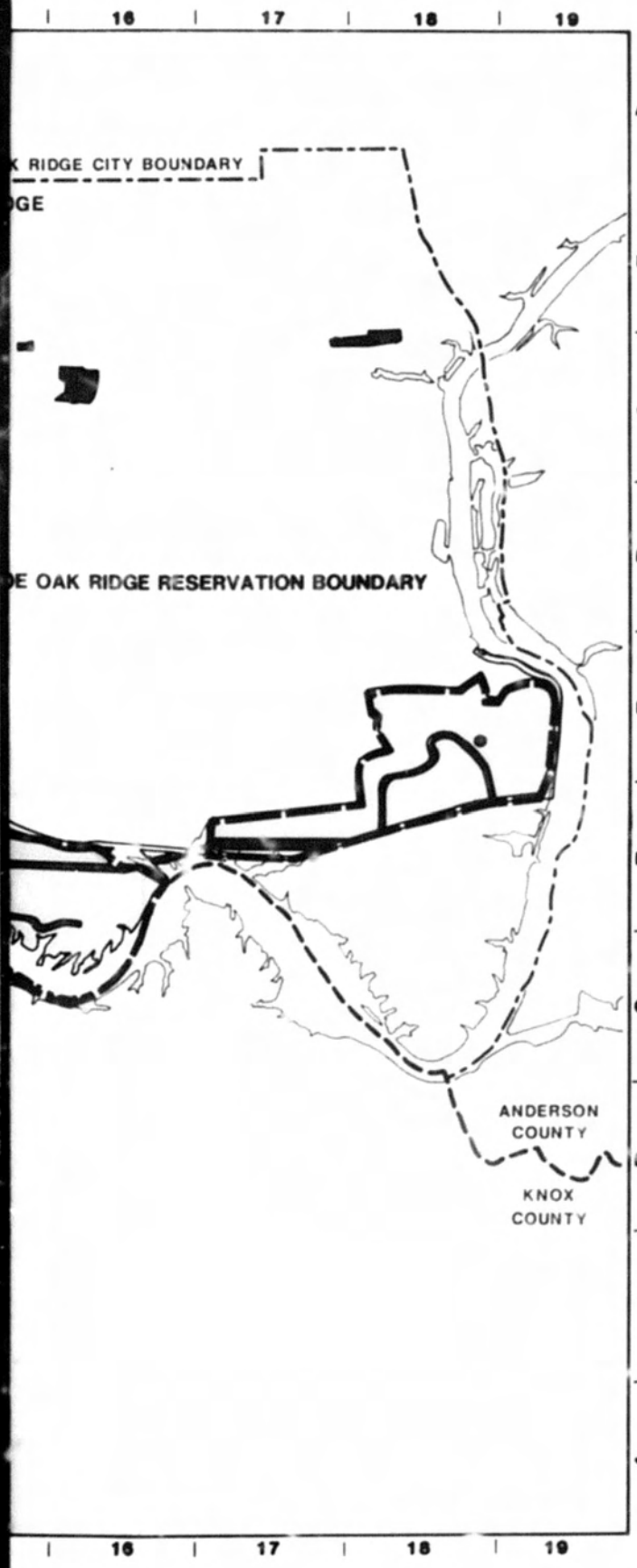
ORNL DWG 86-14634



Resource Management Plan

For The:

U.S. DEPARTMENT OF ENERGY

OAK RIDGE RESERVATION

Prepared By:

MARTIN MARIETTA ENERGY SYSTEMS, INC.

LEGEND:

- ADMINISTRATION
- RESEARCH AND DEVELOPMENT
- PRODUCTION
- SUPPORT
- WASTE
- PUBLIC
- NATURAL
- BUFFER

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0 1 2 miles

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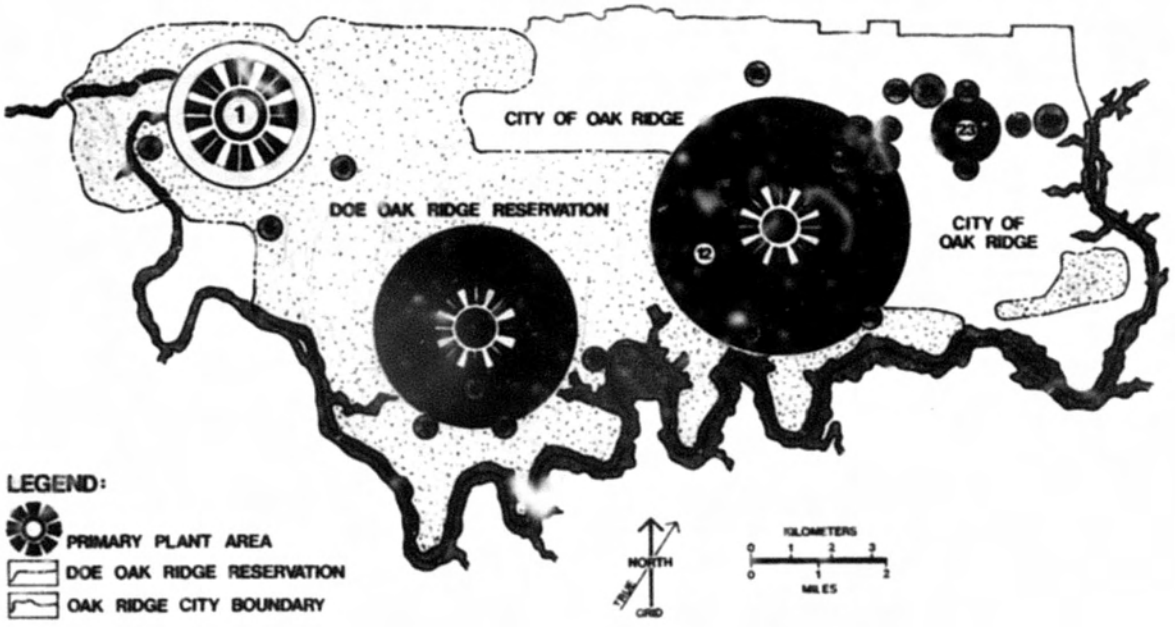
TRUE GRID

Date NOV. 1986 Rev. 1

FIG. 4.6

EXISTING LAND USE



LEGEND:

- PRIMARY PLANT AREA
- DOE OAK RIDGE RESERVATION
- OAK RIDGE CITY BOUNDARY

EXISTING POPULATION INDEX

- 8,000 - 6,001
- 6,000 - 4,001
- 4,000 - 2,001
- 2,000 - 351
- 350 - 101
- 100 - 0

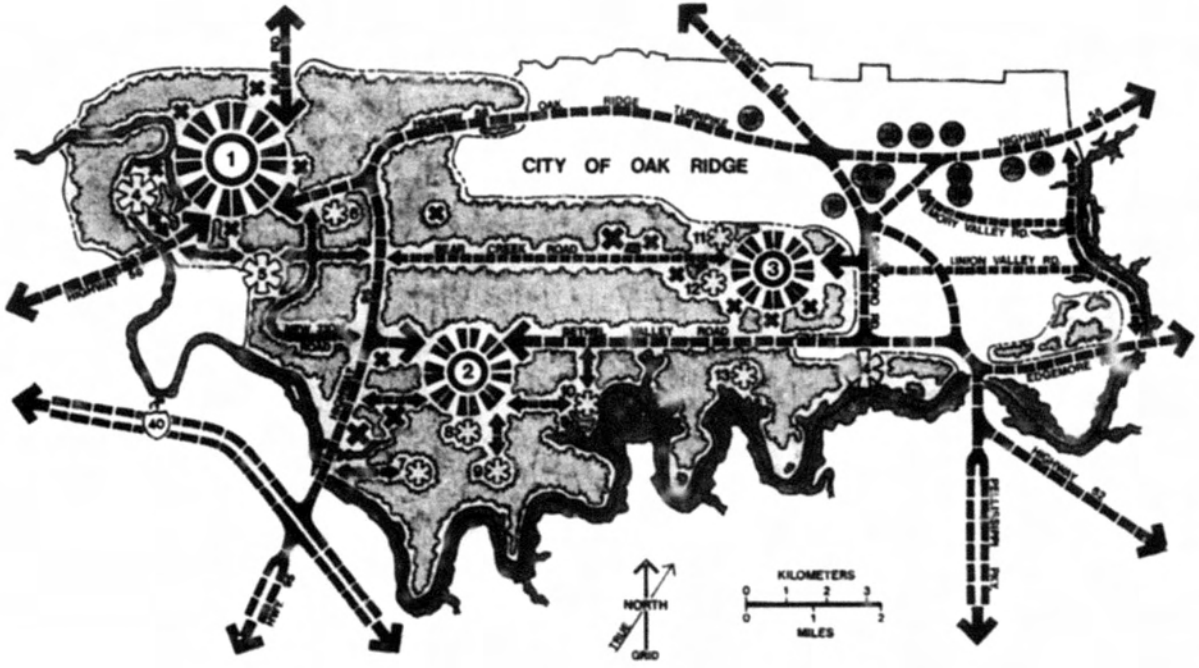
SITE POPULATION DISTRIBUTION

1. ORGDP = 2,449
2. ORNL = 4,958
3. ORY-12P = 7,247
4. OLD POWERHOUSE AREA = 12
5. CENTRAL TRAINING FACILITY = 5
6. TRANSP. SAFEGUARDS (HWY. 58) = 30
7. TSF = 0
8. HFIR = 80
9. HPRR = 12
10. CFRF = 70
11. TRANSPORTATION SAFEGUARDS = 120
12. RUST ENGINEERING = 1,135
13. CLARK CENTER RECREATION PARK = 2
14. SCARBORO FACILITY = 49
15. FORMER MUSEUM SITE = 100
16. ATDL - NOAA = 33
17. ORAU - MAIN CAMPUS = 213
18. [ ]NTOWN CONCOURSE = 31
19. MUSEUM OF SCIENCE & ENERGY = 145
20. ORAU - MEDICAL FACILITY = 64
21. TOWNSITE = 210
22. COMMERCE BUILDING = 55
23. DOE-ORO FEDERAL BUILDING = 447
24. ORAU-MERT PROGRAM = 89
25. ORAU-WAREHOUSE = 34
26. OSTI = 320

Date: December, 1986

EXISTING POPULATION DIAGRAM
RESOURCE MANAGEMENT PLAN
OAK RIDGE RESERVATION - U.S. DEPARTMENT OF ENERGY

FIG. 4.7



LEGEND:

- MAJOR LAND USE AREA
- MINOR LAND USE AREA (ON-SITE)
- MINOR LAND USE AREA (OFF-SITE)
- PRIMARY VEHICULAR CIRCULATION
- SECONDARY VEHICULAR CIRCULATION
- MAJOR WASTE DISPOSAL AREA
- NATURAL AREA
- DOE OAK RIDGE RESERVATION
- OAK RIDGE CITY BOUNDARY

SITE FACILITIES INDEX:

1. ORGDP
2. ORNL
3. ORY-12P
4. OLD POWERHOUSE AREA
5. CENTRAL TRAINING FACILITY
6. TRANSPORTATION SAFEGUARDS (HWY. 58)
7. TSF
8. HFIR
9. HPRR
10. CFRF
11. TRANSPORTATION SAFEGUARDS
12. RUST ENGINEERING
13. CLARK CENTER RECREATION PARK
14. SCARBORO FACILITY
15. FORMER MUSEUM SITE
16. ATDL-NOAA
17. ORAU-MAIN CAMPUS
18. DOWNTOWN CONCOURSE
19. MUSEUM OF SCIENCE & ENERGY
20. ORAU-MEDICAL FACILITY
21. TOWNSITE
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25. ORAU-WAREHOUSE
26. OSTI

EXISTING SITE DIAGRAM
RESOURCE MANAGEMENT PLAN
OAK RIDGE RESERVATION - U.S. DEPARTMENT OF ENERGY

FIG. 4.8

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