DOE/EA - 1548

FINDING OF NO SIGNIFICANT IMPACT AND FINAL ENVIRONMENTAL ASSESSMENT FOR THE Y-12 POTABLE WATER SYSTEM UPGRADE

National Nuclear Security Administration

U.S. Department of Energy
Oak Ridge Y-12 Site Office
National Nuclear Security Administration

March 2006

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing materials
AHP	Analytical Hierarchy Process
ALARA	As Low As Reasonably Achievable
AQCRs	Air Quality Control Regions
BEA	Bureau of Economic Analysis
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practices
CD	Critical Decision
CDL VII	Construction Demolition Landfill VII
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	Code of Federal Regulation
CY	calendar year
DOE	U.S. Department of Energy
DNL	Day-Night Average Sound Level
DSWM	Division of Solid Waste Management
EA	Environmental Assessment
EDE	effective dose equivalent
EFPC	East Fork Poplar Creek
EM	Environmental Management
EMWMF	Environmental Management Waste Management Facility
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FFC Act	*Federal Facility Compliance Act*
FY	fiscal year
HVAC	Heating, Ventilation, and Air Conditioning
ICRP	International Commission on Radiological Protection
ILFV	Industrial Landfill V

LDR	land disposal restrictions
LLW	low level waste
LLRW	low-level radioactive waste
MEI	maximally exposed individual
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	*National Historic Preservation Act*
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
ORR	Oak Ridge Reservation
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PIDAS	Perimeter Intrusion Detection and Assessment System
PWSU	Potable Water System Upgrade
R&D	Research and Development
RCRA	*Resource Conservation and Recovery Act*
ROI	Region of Influence
SLEP	Stockpile Life Extension Program
SSP	Stockpile Stewardship Program
SWEIS	Site-Wide Environmental Impact Statement
SWMU	Solid Waste Management Unit
SR	state route
T&E	threatened and endangered
TCPs	traditional cultural properties
TDE	Tennessee Department of Education
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TSCA	*Toxic Substances Control Act*
TSRs	Tennessee State Routes
TVA	Tennessee Valley Authority
TYCSP	Ten-Year Comprehensive Site Plan

UEFPC	Upper East Fork Poplar Creek
USC	United States Code
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
WETF	West End Treatment Facility
Y-12	Y-12 National Security Complex

CHEMICALS AND UNITS OF MEASURE

$\mu g/m^3$	microgram per cubic meter
BTEX	benzene, toluene, ethylbenzene, and xylene
^oC	degree Celsius
cm	centimeter
CO	carbon monoxide
dB	decibel
dBA	decibel A weighted
DCE	1,1-dichloroethane
ft	feet
ft^3/s	cubic feet per second
^oF	degree Fahrenheit
ha	hectares
HF	hydrogen fluoride
hr	hours
in	inches
km	kilometer
m^3/s	cubic meters per second
m	meter
mi	miles
MGD	million gallons per day
MGY	million gallons per year
MLD	million liters per day
MLY	million liters per year
mph	miles per hour
mrem	millirem
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
O_3	ozone
Pb	lead
PCBs	polychlorinated biphenyls
PCE	tetrachloroethylene
pCi	picocurie
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
ppb	parts per billion
ppm	parts per million
psig	pounds per square inch gauge
SO_2	sulfur dioxide
SO_x	sulfur oxides
Tc	Technetium

TCE	trichloroethylene
VOCs	volatile organic compounds
yd^3	cubic yard
yr	year

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile (Statute)
Area					
square inches	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
acre-foot	1233.48	cubic meters	cubic meters	0.00081	acre-foot
Volume					
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
gallon	0.0039	cubic meter	cubic meter	256.14	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
Weight					
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
Force					
dyne	0.00001	newton	newton	100,000	dyne
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor	
exa-	E	1 000 000 000 000 000 000 =	10^{18}
peta-	P	1 000 000 000 000 000 =	10^{15}
tera-	T	1 000 000 000 000 =	10^{12}
giga-	G	1 000 000 000 =	10^{9}
mega-	M	1 000 000 =	10^{6}
kilo-	k	1 000 =	10^{3}
hecto-	h	100 =	10^{2}
deka-	da	10 =	10^{1}
deci-	d	0.1 =	10^{-1}
centi-	c	0.01 =	10^{-2}
milli-	m	0.001 =	10^{-3}
micro-	μ	0.000 001 =	10^{-6}
nano-	n	0.000 000 001 =	10^{-9}
pico-	p	0.000 000 000 001 =	10^{-12}
femto-	f	0.000 000 000 000 001 =	10^{-15}
atto-	a	0.000 000 000 000 000 001 =	10^{-18}

1.0 INTRODUCTION

The National Nuclear Security Administration (NNSA) Y-12 Site Office proposes to upgrade its potable water system by installing two new elevated water tanks on the north side of the Y-12 National Security Complex (Y-12), and if inspection warrants, repairing or replacing existing potable water lines within the site. The NNSA is preparing this environmental assessment (EA) as part of the decision-making process to assess potential environmental impacts of the project in accordance with the *National Environmental Policy Act* (NEPA) of 1969 and the U.S. Department of Energy (DOE) NEPA Implementing Procedures (10 Code of Federal Regulations [CFR] Part 1021).

1.1 PURPOSE AND NEED FOR ACTION

Purpose of the Action. The purpose of the proposed action is to install two new elevated water tanks, a pumping station, and system supply lines north of Bear Creek Road; inspect and repair or replace, if necessary, the remaining original cast iron potable water distribution lines; inspect and replace where necessary, the original water supply lines (potable, process, and fire) to individual buildings expected to remain in use past 2010; replace approximately 40 obsolete fire hydrants; and install backflow prevention, convert to dry pipe, or isolate approximately 85 existing fire suppression loops in order to prevent cross contamination from propylene glycol sprinkler systems. The proposed action would allow Y-12 to (1) upgrade the fire protection system backflow protection for known cross connections and maintain proper chlorine residual in the system; (2) provide Y-12 control and monitoring of water coming into the Y-12 distribution system to ensure adequate water flow and pressure to support current and future Y-12 operational needs; and (3) address deferred maintenance and ensure continued system reliability.

Need for the Action. The Y-12 potable water distribution system was originally constructed in the 1940s. Replacement of most of the underground piping occurred in the mid-1980s, however, several main distribution lines and many building feeds were not replaced at that time due to a lack of funding. These older lines are cast iron with lead joints and have in some cases reached the end of their useful life.

Potable water is a mission-essential utility service because it supports the operation and protection of every facility and production process at Y-12. Upgrades to the potable water system are necessary for Y-12 to continue its mission of supporting the NNSA Defense Programs Stockpile Stewardship Program (SSP) and Stockpile Life Extension Program (SLEP).

The Potable Water System Upgrade (PWSU) project is included in the Y-12 Ten-Year Comprehensive Site Plan (TYCSP) as part of the Facility Infrastructure and Recapitalization Program. It directly supports the recommendation of the December 2001 Nuclear Posture Review to revitalize the defense infrastructure to increase confidence in the deployed forces, eliminate the unneeded weapons, and mitigate the risks of technological surprise. It directly

contributes to the DOE Strategic Plan's Defense Strategic Goal: To protect our national security by applying advanced science and nuclear technology to the Nation's defense. It also supports achievement of DOE General Goal 1 of Nuclear Weapons Stewardship: Ensure our nuclear weapons continue to serve their essential deterrence role by maintaining and enhancing the safety, security, and reliability of the U.S. nuclear weapons stockpile. In August 2004, the Administrator for Infrastructure and Environment, NA-50, approved Critical Decision 0 (CD-0), which constituted approval of mission need for the project.

The PWSU project would support Y-12's missions by making needed repairs and upgrades to meet operational requirements and by ensuring continued reliability of the potable water distribution system. If the PWSU project is not approved, the reliability of the existing water system would continue to degrade and would require major maintenance actions to continue operation. There would also be an increased risk of system failure or contamination, resulting in a direct impact on the Y-12 mission.

1.2 BACKGROUND

The original distribution system and treatment plant were installed when Y-12 was built in 1943. Upgrades in the mid-1980s replaced most of the distribution mains and a few building laterals (feeds), but most of the building laterals and a few of the water mains are still the original cast iron piping. In the early 1970s, storage tanks on Chestnut Ridge and associated transmission mains and pump station were installed as a secondary water supply. At that time, the Pine Ridge water treatment system plant was a Y-12 operation. The system was owned and operated by DOE, who sold water to the City of Oak Ridge for distribution to Oak Ridge residents and businesses. In 1998, an agreement was reached between DOE Oak Ridge Operations and the City of Oak Ridge to transfer ownership of the water treatment plant and associated water tanks to the City. Ownership was transferred to the City of Oak Ridge in April 2000. Upgrades to the treatment plant have been performed by the City and include a new treatment system and rework of the reservoirs.

Potable water is fed directly into the Y-12 distribution network from the City of Oak Ridge water treatment plant. Average demand for all water uses at Y-12 is more than four million gallons per day (MGD) which is used for the following Y-12 needs:

- Sanitary/potable water systems, including emergency showers and eyewash stations, personnel decontamination facilities, drinking fountains, rest rooms, change houses, kitchens, and cafeterias.
- Process water systems, including feedwater for the steam plant and makeup water for cooling towers, process cooling, cleaning and decontamination systems, chemical makeup systems, laboratories, and other miscellaneous needs.
- Fire protection systems, including sprinkler systems and fire hydrants.

The potable water system supplies sanitary water to approximately 300 buildings and serves approximately 225 fire hydrants, 460 fire suppression sprinkler systems and 250 process water systems.

There are three two-million-gallon water storage tanks on Chestnut Ridge which serve as a secondary water supply for Y-12. The tanks are normally isolated from the potable water system, and are filled directly from the Y-12 distribution system. The secondary system is put in service quarterly to exercise the valves and ensure proper working condition.

1.3 SCOPE OF EA ANALYSIS

This EA conforms to the requirements of the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508) implementing the NEPA and DOE NEPA Implementing Procedures (10 CFR 1021).

This EA is tiered from the Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex (Y-12 SWEIS) (DOE 2001a). One of the primary purposes of the Y-12 SWEIS is to provide an overall NEPA baseline for all DOE activities at Y-12, including modernization. Much of the "Affected Environment" discussion for this EA is taken or referenced from the Y-12 SWEIS (DOE 2001a).

1.4 PUBLIC INVOLVEMENT

No public meetings were conducted for this EA. However, NNSA provided the public an opportunity to review and comment on the EA, prior to the issuance of the Final EA. A public notice announcing the availability of the draft EA, the length of the comment period, and where copies of the draft could be obtained was placed in local newspapers.

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2.0 DESCRIPTION OF ALTERNATIVES

This EA analyzes several alternatives for the required upgrades to the Y-12 potable water supply in order to ensure the system's reliability and regulatory compliance. These alternatives were identified as part of an alternatives analysis study conducted by NNSA (DOE 2005a). The analysis was based on the alternatives satisfying the following functional and operational requirements:

1. Water Quality/Personnel Protection requirements
   - Provide additional protection from cross connection with known contamination sources (propylene glycol sprinkler systems).
   - Enhance water circulation in all distribution piping in order to maintain required chlorine residuals.
2. Pressure Requirements
   - Provide minimum system pressure and capacity to ensure adequate fire protection water flow under all conditions.
   - Increase average system operating pressures to provide a nominal 10 pounds per square inch gauge (psig) margin over required system pressures during normal operating conditions.
   - Provide a minimum of 1,800,000 liters (480,000 gallons) of potable water storage to be reserved for fire suppression.
   - Provide a combined potable water storage capacity (to be used for potable, process, and fire protection) of 4,270,000 liters (1,128,000 gallons).
3. Reliability and Maintainability Requirements
   - Ensure continued system ability to support operations by providing capability for necessary repairs and addressing deferred maintenance.
   - Ensure system can meet minimum fire protection water flow with any single break isolated. Building feeds and area affected by break are not included in this requirement.
   - Provide Y-12 control and monitoring of system availability to ensure adequate water pressure and flow.
   - Ensure system is capable of meeting primary and secondary fire protection water supply requirements.

The analysis also considered the following assumptions in the selection of the alternatives:

- Backflow prevention and repair/replacement of cast iron pipe and hydrants are included for alternatives except for No Action.
- All applicable codes and standards would be met by the preferred alternative.
- None of the alternatives would cause the system classification to change.
- All analyzed alternatives are within the line item funding.

Alternatives that could potentially perform the function and meet the requirements were identified. A Systems Engineering approach was used in the evaluation of alternatives; and the alternatives were ranked using the Analytical Hierarchy Process (AHP) method. The AHP method was used to determine the relative importance, or weight, for the following five criteria: (1) system acceptability to users; (2) utilities operations (i.e., issues associated with system operability and maintainability); (3) minimizing operations and maintenance (O&M) costs; (4) reducing construction and start-up complexity and risk; and (5) minimizing capital costs. Included in the specified criteria were safety issues, environmental issues, and other risks.

Five viable alternatives were initially identified by NNSA. However, in order to minimize the amount of new pipe required for tie-ins and to maximize operational flexibility, an alternate location for the new tanks was considered (i.e., Option C1). In addition, the lower ground elevation at the C1 location requires that the water tanks be elevated. The following is the list of the viable alternatives identified by NNSA:

Option A – Pump station feed loop directly, existing Chestnut Ridge tanks continue as backup water supply and float on system pressure;
Option B – Existing Chestnut Ridge tanks feed loop;
Option C – New tanks on Pine Ridge;
Option C1 – New elevated water tanks on Bear Creek Road;
Option D – Use existing tanks on Chestnut Ridge to feed loop, plus add one new tank on Pine Ridge to address fire systems;
Option E – Local pumping stations for fire systems.

Five alternatives are considered and analyzed in this EA. For the purpose of the discussion of these alternatives in the following sections, the Options outlined above are cross-referenced to the following alternatives analyzed in this EA in Table 2-1.

Table 2–1. List of Alternatives Analyzed

Options in Alternatives Analysis Study	Alternatives in EA
Option C1 – New elevated tanks feed loop	Alternative 1 – New Elevated Water Tanks along Bear Creek Road (Proposed Action)
Option C – New tanks on Pine Ridge	Alternative 2 – New Water Tanks on Pine Ridge
Option A – Pump station feed loop directly, existing Chestnut Ridge tanks continue as backup water supply and float on system pressure	Alternative 3 – Pump Station Feed Loop
Option E – Local pumping stations for fire systems	Alternative 4 – Local Pumping Stations

Option B, "Existing Chestnut Ridge tanks feed loop" and Option D, "Use existing tanks on Chestnut Ridge to feed loop, plus one new tank on Pine Ridge to address fire systems" alternatives are not analyzed separately in this EA since these alternatives are essentially

encompassed by Option A, "Pump station feed loop directly, existing Chestnut Ridge tanks continue as backup water supply and float on system pressure" and/or Option C, "New tanks on Pine Ridge". For all the alternatives analyzed, the City of Oak Ridge would continue to provide potable water to Y-12.

2.1 ALTERNATIVE 1 – NEW ELEVATED WATER TANKS ON BEAR CREEK ROAD (PROPOSED ACTION)

Under the Proposed Action, two new elevated water tanks would be installed north of Bear Creek Road, across from the North Portal parking area and approximately 91 meters (m) (300 feet [ft]) west of the entrance to the City of Oak Ridge Water Treatment Facility (Figure 2.1-1). The new elevated tanks, each approximately 2.5 million gallons, would serve as both primary and backup water supply. The top of the tanks would be approximately 76 m (250 ft) above grade. They would allow the system to be operated at higher pressures to address pressure loss as a result of proposed backflow preventers, to provide additional operating pressure margin, and to allow control of water flow and pressure by Y-12 (DOE 2005b). Two fill lines would be run to the tanks, which would be top fed to prevent backflow into the City of Oak Ridge mains. The tanks would be centrally located at Y-12 to take advantage of dual tie-in points on the City of Oak Ridge mains, limit the amount of new piping needed, and reduce the amount of City of Oak Ridge main which would be depended on by Y-12 (DOE 2005b).

Backflow preventers would be installed on approximately 85 of the 140 sprinkler systems containing propylene glycol. The remaining systems would be converted to dry pipe or removed from service. Each installation would be located to minimize operational impact and construction cost. The backflow preventers would provide improved separation between Y-12 potable water and fire protection systems. These sprinkler systems are expected to remain in service for the long-term (i.e., after 2010) (DOE 2005b, c).

The original potable water distribution lines not replaced in the mid-1980s and the original water supply lines (potable and fire) to individual buildings would be inspected and/or evaluated and replaced if necessary. The water supply lines would not be replaced in buildings scheduled for demolition through 2009. Buildings scheduled for demolition in 2010-2012 would be considered on a case-by-case basis, with length of expected occupancy and consequences of failure taken into consideration. The underground lines would be refurbished by directly replacing the existing pipe, adding new pipe above or adjacent to the existing pipes, rerouting or repairing existing pipe. Where feasible, existing pipe would be replaced by bursting in place and new pipe would be pulled through. Other deferred maintenance work that would be completed under the Proposed Action includes replacing obsolete fire hydrants for which parts are no longer available.

The planned approach for implementing the Proposed Action is to divide the project into three areas, each with different access requirements, risk levels and operational impacts. These work areas are as follows:

- Area O: The scope of work to be conducted in Area O includes operational modifications to provide Y-12 control of the system and to increase system pressure. Specific activities include installing new water tanks, pumps, and transmission piping and piping modifications, north of Bear Creek Road and up to the first valve north of the Y-12 fence, on all transmission lines. Controls for new equipment valves, and pressure monitoring of the new tie-in points is also included. Construction for these activities has the least impact on the existing operating system.

- Area F: The scope of work to be conducted in Area F includes fire protection system modifications and distribution system work outside the Perimeter Intrusion Detection and Assessment System (PIDAS), the Y-12 Complex high security area.

- Area P: The scope of work to be conducted in Area P includes fire protection system modifications and distribution system work inside the PIDAS fence. The work includes underground piping work, hydrant replacement, and fire protection propylene glycol system modifications inside the current PIDAS fence. This work is considered highest risk because of the potential impact to operations.

Areas F and P are further divided into zones. The division of work into areas and zones allows NNSA to subcontract and manage the work in the most effective manner.

Site Development. The following site development actions would prepare the project site on Bear Creek Road for construction. Temporary utility services such as electricity, telephone service, and potable water would be provided to the project site from existing Y-12 infrastructure utilities. Sanitary service would be provided by collection tanks or portable toilets which would be pumped as needed. Existing roads would support all construction needs.

Erosion and sediment control would be provided prior to any land disturbance to prevent both erosion and transport of sediment beyond the limits of the site. The project site would be graded and topsoil removed and stockpiled with appropriate run-on/run-off protection. Site development activities would be conducted to minimize environmental impacts and to be in compliance with applicable laws and regulations.

Temporary construction fencing, signs and flagging would surround the construction work area to warn and restrict access. A staging area would be developed.

Construction Laydown Area. The construction staging and laydown area would be located on site. The staging area would be sufficiently graded to accommodate a number of temporary construction trailers, storage buildings, and material storage yards.

2.2 ALTERNATIVE 2 – NEW WATER TANKS ON PINE RIDGE

Alternative 2 is similar in all aspects and planned approach to the Proposed Action except for the location and type of the tanks (i.e., ground-level tanks). The new tanks would be installed on Pine Ridge, at the west end of Y-12, because this location would provide the highest natural elevation to allow the system to be operated at higher pressures. Alternative 2 would require additional pipe installation, considerable grading work, and construction of an access road and a pump house.

2.3 ALTERNATIVE 3 – PUMP STATIONS FEED LOOP

Under this alternative, two pumping stations would be installed, one on either end of the Y-12 Complex and connected to the existing Y-12 distribution system. New transmission lines would be installed to ensure that all areas of Y-12 received adequate pressure and flow. Each pumping station would have two 100 percent pumps with variable speed/pressure controls. The new pump houses would be humidity controlled, heated, and ventilated to maintain a minimum of 4 degrees Celsius (°C) (40 degrees Fahrenheit [°F]) in the winter and a maximum of 37.8 °C (100 °F) during the summer. In addition, the three existing Chestnut Ridge tanks would be provided with remote operated isolation valves. Two of the tanks would float on the water system at all times while one would remain isolated for backup. The tanks would be refurbished to meet the design life of the project. A third feed line from the tanks would likely be required to the east end of Y-12. Tank piping would be reworked to feed tanks from the top and allow for automatic control and isolation.

2.4 ALTERNATIVE 4 – LOCAL PUMPING STATIONS

This alternative involves the installation of pumping stations at six to eight locations for high pressure, safety basis fire systems.

2.5 ALTERNATIVE 5 – NO ACTION

Under the No Action alternative, the Y-12 potable water system would not be upgraded. Y-12 would have to spend additional operating funds to maintain the potable water system or continue to operate with a system only marginally capable of meeting operational needs. The main distribution lines and building feeds not repaired/replaced in the mid-1980's would be replaced, as required, during routine maintenance activities. As a result, there would be a greater risk of system failure.

3.0 AFFECTED ENVIRONMENT

3.1 LAND USE

3.1.1 Land Use Designation

Oak Ridge Reservation. The Oak Ridge Reservation (ORR) consists of approximately 13,943 hectares (ha) (34,453 acres) and is located mostly within the corporate limits of the City of Oak Ridge, approximately 24 kilometers (km) (15 miles [mi]) west of the City of Knoxville. Approximately one-third of the ORR is occupied by the facilities of Y-12, Oak Ridge National Laboratory (ORNL), and East Tennessee Technology Park (ETTP). All of this land is titled to the United States of America and is under the jurisdictional control of DOE for administration and management.

DOE classifies land use on the ORR into five categories: Institutional/Research, Industrial, Mixed Industrial, Institutional/Environmental Laboratory, and Mixed Research/Future Initiatives. Development on the ORR accounts for about 35 percent of the total acreage, leaving approximately 65 percent of the Reservation undeveloped. Land bordering the ORR is predominately rural, with agricultural and forest land being predominant.

Y-12. Figure 3.1-1 shows the boundary of Y-12. The main industrialized area of Y-12 encompasses 328 ha (810 acres), with approximately 580 buildings that house about 1 million square meters of laboratory, machining, dismantlement, and research and development (R&D) areas. Land use at Y-12 is classified as Industrial.

The eastern portion of the Y-12 is occupied by Lake Reality and the former New Hope Pond (now closed), maintenance facilities, office space and training facilities, change houses, and former ORNL Biology Division facilities. The far western portion of the Y-12 consists primarily of waste management facilities and construction contractor support areas. The central and west-central portions of the Complex encompass the high-security portion, which supports core NNSA missions (DOE 2001a).

3.1.2 Future Land Use and Leasing Agreements

Future land use at the ORR will continue to incorporate the principles associated with ecosystem management. For the most part, the land uses will expand and build on current uses, not replace them. For additional information on future land uses and leasing agreements, refer to Section 4.1 of the Y-12 SWEIS (DOE 2001a).

3.2 GEOLOGY AND SOILS

3.2.1 Physiography

The ORR lies in the Valley and Ridge Physiographic Province of eastern Tennessee, which has developed on thick, folded beds of sedimentary rock deposited during the Paleozoic era. The topography consists of alternating valleys and ridges that have a northeast-southwest trend, with most of the ORR facilities occupying the valleys. In general, the ridges consist of resistant siltstone, sandstone, and dolomite units, and the valleys consist of the less-resistant shales and shale-rich carbonates.

The topography within the ORR ranges from a low of 229 m (751 ft) above mean sea level (MSL) along the Clinch River to a high of 384 m (1,260 ft) above MSL along Pine Ridge.

3.2.2 Geology

Y-12 is located within Bear Creek Valley, which is underlain by middle to late Cambrian strata of the Conasauga Group. The Conasauga Group consists primarily of high fractured and jointed shale, siltstone, calcareous siltstone, and limestone in the Y-12 Site area. The upper part of the group is mainly limestone, while the lower part consists of mostly shale. This group is divided into six discrete formations, which are, in ascending order, the Pumpkin Valley Shale, the Rutledge Limestone, the Rogerville Shale, the Maryville Limestone, the Nolichucky Shale, and the Maynardville Limestone. The thickness of each formation varies throughout the Conasauga Group. The bedrock at Y-12 is adequate to support structures using standard construction techniques.

Y-12 is located in the Upper East Fork Poplar Creek (UEFPC) watershed. Unconsolidated materials overlying bedrock in the UEFPC watershed include alluvium (stream-laid deposits), colluvium (material transported downslope), man-made fill, fine-grained residuum from the weathering of the bedrock, saprolite (a transitional mixture of fine-grained residuum and bedrock remains), and weathered bedrock. The overall thickness of these materials in the Y-12 area is typically less than 12 m (40 ft). In the undeveloped areas of Y-12, the saprolite retains primary texture features of the unweathered bedrock including fractures.

Y-12 is situated on carbonate bedrock such that groundwater flow and contaminant transport are controlled by solution conduits in the bedrock. These karst features, including large fractures, cavities, and conduits, are most widespread in the Maynardville Limestone and the Knox Group. These cavities and conduits are often connected and typically found at depths greater than approximately 33 m (100 ft) (DOE 2001a).

3.2.3 Soils

Y-12 lies on soils of the Armuchee-Montevallo-Hamblen, the Fullerton-Claiborne-Bodine, and the Lewhew-Armuchee-Muskinghum associations. Due to extensive cut-and-fill grading during the construction of Y-12, very few areas within the UEFPC watershed have a sequence of natural soil horizons. Soil erosion due to past land use has ranged from slight to severe. Finer textured soils of the Armuchee-Montevallo-Hamblen association have been designated as prime farmland when drained. The soils at Y-12 are generally stable and acceptable for standard construction techniques.

3.2.4 Seismicity

The Oak Ridge area lies in seismic Zone 2A of the Uniform Building Code, indicating that minor to moderate damage could typically be expected from an earthquake. Y-12 is cut by many inactive faults formed during the late Paleozoic Era but there is no evidence of capable faults in the immediate area of Oak Ridge. The nearest capable faults are approximately 480 km (300 mi) west of the ORR in the New Madrid Fault zone.

3.3 CLIMATE AND AIR QUALITY

3.3.1 Climate

The City of Oak Ridge lies in a valley between the Cumberland and Great Smoky Mountain ranges and is bordered on two sides by the Clinch River. The Cumberland Mountains are located about 16 km (10 mi) to the northwest; and the Great Smoky Mountains are 51 km (32 mi) to the southeast (DOE 2005d). The Region of Influence (ROI) specific to air quality is primarily the Bear Creek Valley for Y-12. This valley is bordered by ridges that generally confine facility emissions to the valley between the ridges.

The climate of the region may be broadly classified as humid continental. Local terrain often exhibits significant influences on the local climate resulting in seasonal changes to cloud cover, precipitation, air masses, and wind flow regimes which vary with season. Local winters consist of migratory cyclones that produce significant precipitation events every 3 to 5 days. Snow and ice are infrequently associated with these events, but snowfall does occur with some regularity each winter. Severe thunderstorms are most frequent during spring; however tornadoes are relatively rare. Summers are characterized by warm, humid conditions. The occurrence of precipitation during the fall tends to be less cyclic than during other seasons; and October tends to be the driest month of the year (DOE 2005d).

The mean annual temperature for the Oak Ridge area is 14.2 °C (57.6°F). The coldest month is usually January with an average temperature of about 2.6 °C (36.7°F) and low temperatures that occasionally drop as low as –31 °C (–23.8 °F). July is typically the hottest month of the year with an average temperature of about 25.2 °C (77.4 °F) and high temperatures that occasionally

exceed 37.8 °C (100 °F). In the course of a year, the average difference between the maximum and minimum daily temperatures is 12.6 °C (22.7 °F). Average temperature in 2004 was 15.4 °C (59.7 °F) (DOE 2005d).

Winds in the Oak Ridge area are controlled in large part by the valley-and-ridge topography. Prevailing winds are either up-valley (northeasterly) daytime winds or down-valley (southwesterly) nighttime winds. Wind speeds are less than 11.9 kilometers per hour (km/hr) (7.4 miles per hour [mph]) 75 percent of the time. Tornadoes and winds that exceed 30 km/hr (18.7 mph) are rare in the Oak Ridge area. However, in February 1993 a tornado struck the east end of Y-12 and uprooted trees and downed some primary electrical powerlines but caused minimal damage to buildings and equipment (DOE 2001a).

The 30-year annual average precipitation is 139.8 centimeters (cm) (55.0 inches [in]) which includes about 24.4 cm (9.6 in) of snowfall. Precipitation in 2004, measured at the Oak Ridge meteorological tower on Laboratory Road, was 170.8 cm (67.24 in) (DOE 2005d). Precipitation in the region is greatest in the winter months (December through February). Precipitation in the spring exceeds the summer rainfall, but the summer rainfall may be locally heavy because of thunderstorm activity. The driest periods generally occur during the fall months when high-pressure systems are most frequent (DOE 2001a).

3.3.2 Air Quality

Regional Air Quality. As directed by the *Clean Air Act* of 1970 (42 U.S.C. §7401), the U.S. Environmental Protection Agency (EPA) has set the National Ambient Air Quality Standards (NAAQS) for several criteria pollutants to protect human health and welfare (40 CFR 50). These pollutants include particulate matter with an aerodynamic diameter less than or equal to 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). In 1997, the EPA finalized new air quality standards for ozone and $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to 2.5 microns). Despite a series of legal challenges in the U.S. Court of Appeals, in February 2001 the U.S. Supreme Court upheld the NAAQS for $PM_{2.5}$ and O_3. Based on the ambient (outdoor) levels of the criteria pollutants, EPA evaluates individual Air Quality Control Regions (AQCRs) to establish whether or not they satisfy the NAAQS. Areas that satisfy the NAAQS are classified as attainment areas, and areas that exceed the NAAQS for a particular pollutant are classified as non-attainment areas for that pollutant.

The ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia AQCR 207, and Y-12 is completely within Anderson County. The EPA has designated Anderson County as a basic non-attainment area for the 8-hour O_3 standard, as part of the larger Knoxville basic 8-hour O_3 non-attainment area that encompasses several counties; and for $PM_{2.5}$ based on a revision to the standards (EPA 2005a). For all other criteria pollutants for which EPA has made attainment designations, existing air quality in the greater Knoxville and Oak Ridge areas is in attainment with the NAAQS.

Nonradiological air quality is defined by the concentration of various pollutants in the atmosphere expressed in units of parts per million (ppm) or in micrograms per cubic meter ($\mu g/m^3$). The standards and limits set by Federal and state regulations are provided in concentrations averaged over incremental time limits (e.g., 30 minutes, 1 hour, 3 hours). The averaging times shown in the tables in this section correspond to the regulatory averaging times for the individual pollutants. Table 3.3–1 presents the NAAQS and state of Tennessee ambient air quality standards.

Air Quality and Emissions on the Oak Ridge Reservation. Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by the EPA, the Tennessee Department of Environment and Conservation (TDEC) Division of Air Pollution Control, and DOE Orders. Y-12 has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne emissions satisfy all regulatory requirements and do not adversely affect ambient air quality. Common air pollution control devices employed on the ORR include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role to regulate emissions (DOE 2005d).

Table 3.3–1. National and Tennessee Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS (μg /m³)	Tennessee Standard (μg /m³)
SO_2	Annual[1]	80 (0.030 ppm)	80 (0.030 ppm)
	24-Hour[2]	365 (0.14 ppm)	365 (0.14 ppm)
	3-Hour[2]	1,300 (0.5 ppm)	1,300 (0.5 ppm)
PM_{10}	Annual[1]	50	50
	24-Hour[2]	150	150
$PM_{2.5}$	Annual[1]	15	15
	24-Hour[2]	65	65
CO	8- Hour[2]	10,000 (9 ppm)	10,000 (9 ppm)
	1- Hour[2]	40,000 (35 ppm)	40,000 (35 ppm)
Ozone	8- Hour[3]	157 (0.08 ppm)	157 (0.08 ppm)
	1- Hour[2]	235 (0.12 ppm)	235 (0.12 ppm)
NO_2	Annual[1]	100 (0.05 ppm)	100 (0.05 ppm)
Lead	Quarter[1]	1.5	1.5
Gaseous Fluorides (as HF)[a]	30-day	-	1.2 (1.5 ppb)
	7-day	-	1.6 (2.0 ppb)
	24-hr	-	2.9 (3.5 ppb)
	12-hr	-	3.7 (4.5 ppb)

Key:
[a] Secondary State Standard
μg/m³ = micrograms per cubic meter
ppm = parts per million
ppb = parts per billion
HF = hydrogen fluoride

1. Arithmetic mean.
2. Block average.
3. Rolling average.

Source: DOE 2001a.

Both effluent and ambient air are sampled on the ORR. Effluent air flows into the environment from a source, such as an exhaust stack, and ambient air is the air that exists in the surrounding area. Both radiological and nonradiological air emissions are monitored. Sample results show that ORR operations have an insignificant effect on local air quality (DOE 2005d).

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of plant production, maintenance, waste management operations, and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. The air permits issued by TDEC for Y-12 emission sources were combined into a single site-wide operations permit 554701, issued in October 2004. The allowable level of air pollutant emissions from emission sources in 2005 was about 9,100 metric tons per year (10,033 tons per year) of regulated pollutants. Actual emissions are much lower than the allowable emissions (DOE 2005d).

The primary source of criteria pollutants at Y-12 is the steam plant, where coal and natural gas are burned. Actual and allowable emissions from the steam plant are illustrated in Table 3.3-2.

Table 3.3–2. Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Complex, 2004

Pollutant	Emissions (tons/year)		Percentage of allowable
	Actual	Allowable	
Particulate	36	945	3.8
Sulfur dioxide	2,110	20,803	10.1
Nitrogen oxides[a]	674	5,905	11.4
Nitrogen oxides (ozone season only)	144.6	232	66.3
Volatile organic compounds[a]	3	41	7.3
Carbon monoxide[a]	27	543	5.0

[a]When there is no applicable standard or enforceable permit condition for some pollutants, the allowable emissions are based on the maximum actual emissions calculation as defined in Tennessee Department of Environment and Conservation Rule 1200-3-26.02(2)(d)3 (maximum design capacity for 8760 hr/year). The emissions for both the actual and allowable emissions were calculated based on the latest EPA compilation of air pollutant emission factors. (EPA 1995 and 1998. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources.* U.S. Environmental Protection Agency, Research Triangle Park, N.C. January 1995 and September 1998.)

Radiological and Hazardous Air Emissions. The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs as a result of plant production, maintenance, and waste management activities. Atmospheric emissions of radionuclides from DOE facilities are limited by EPA regulations found under National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations (40 CFR 61, Subpart H), which have been delegated to TDEC for implementation. All three ORR facilities are operated in accordance with the Tennessee regulatory dose limits for Hazardous Air Pollutants for Radionuclides and have met all emission and test procedures. The NESHAP establishes a dose limit of 10 millirem (mrem) per year for any member of the public. The total 2004 dose to the maximally exposed individual (MEI) from the Y-12 activities was 0.4 mrem (DOE 2005d). Details on the annual

radionuclide compliance modeling and other NESHAP that cover asbestos and specific source categories on the ORR are reported in the 2004 *Oak Ridge Reservation Annual Site Environmental Report* (DOE 2005d). No releases of reportable quantities of asbestos were reported at Y-12 in 2004.

Ambient air monitoring of mercury concentrations has been conducted at Y-12 since 1986 as a best management practice. Two atmospheric mercury monitoring stations located near the east and west boundaries of the Y-12 Complex are currently in operation. These stations have monitored mercury in ambient air continuously since 1986, except for short periods of downtime due to electrical or equipment outages. Average mercury vapor concentrations at Y-12 monitoring stations have declined significantly since monitoring began. Annual average mercury concentrations during 2004 at the Y-12 east and west boundary monitoring stations are comparable to reference levels measured on Chestnut Ridge in 1988 and 1989 and approach values reported for continental background. These concentrations are well below current environmental and occupational health standards for inhalation exposure to mercury vapor (DOE 2005d).

The ORR maintains a perimeter air monitoring network of eight stations at the reservation perimeter and one at an offsite reference location. Surveillance of airborne radionuclides includes measurement of ambient levels of alpha-, beta-, and gamma-emitting radionuclides and tritium. Additional information on monitoring locations and activities is provided in the Y-12 SWEIS (DOE 2001a).

3.4 NOISE

The acoustic environment along the Y-12 site boundary, in rural areas, and at nearby residences away from traffic noise, is typical of a rural location with a Day-Night Average Sound Level (DNL) in the range of 35 to 50 decibel (dBA). Areas near the Y-12 site within Oak Ridge are typical of a suburban area, with a DNL in the range of 53 to 62 dBA. The primary source of noise at the Y-12 site boundary and at residences located near roads is traffic. During peak hours, the Y-12 worker traffic is a major contributor to traffic noise levels in the area.

Major noise emission sources within Y-12 include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so that noise levels at the boundary from these sources are not distinguishable from background noise levels. Within the Y-12 site boundary, noise levels from Y-12 mission operations range between 50 and 70 dBA which is typical for industrial facilities.

The State of Tennessee has not established specific community noise standards applicable to Y-12; however, Anderson County has quantitative noise-limit regulations as shown in Table 3.4–1 **(**DOE 2004).

Table 3.4–1. Allowable Noise Level by Zoning District in Anderson County, Tennessee

Zoning		Allowable Noise Level (dBA)	
District	**Abbreviation**	**7 a.m. – 10 p.m.**	**10 p.m. – 7 a.m.**
Suburban-residential	R-1	60	55
Rural-residential	A-2	65	60
Agricultural-forest	A-1	65	60
General commercial	C-1	70	65
Light industrial	I-1	70	70
Heavy industrial	I-2	80	80
Floodway	F-1	80	80

Source: DOE 2004.

3.5 WATER RESOURCES

3.5.1 Groundwater

Y-12, bound on the north by Pine Ridge and on the south by Chestnut Ridge, is located near the boundary between the Knox Aquifer and the ORR aquitards. The ORR aquitards underlie Pine Ridge and Bear Creek Valley, which contains the main plant area of Y-12 and the disposal facilities of western Bear Creek Valley. The Knox Aquifer underlies Chestnut Ridge and the stream channels of Bear Creek and UEFPC. Bedrock formations comprising the aquitards are hydraulically upgradient of the aquifer, which functions as a hydrologic drain in Bear Creek Valley. Fractures provide the principal groundwater flowpaths in both the aquifer and aquitards. Dissolution of carbonates in the aquifer has enlarged fractures and produced solution cavities and conduits that greatly enhance its hydraulic conductivity relative to the aquitards.

Groundwater at Y-12 is divided into three hydrogeologic regimes, which are delineated by surface water drainage patterns, topography, and groundwater flow characteristics. The regimes are further defined by the waste sites they contain. These regimes include the Bear Creek Hydrogeologic Regime, the UEFPC Hydrogeologic Regime, and the Chestnut Ridge Hydrogeologic Regime. For more details on these hydrogeologic regimes, refer to Section 4.5 of the Y-12 SWEIS (DOE 2001a).

Recharge occurs over most of the area but is most effective where overburden soils are thin or permeable. Groundwater flow in the aquitard and the aquifer is primarily parallel to bedding planes. Refer to Section 4.5 of the Y-12 SWEIS for discussion on groundwater flow for the aquitard and the aquifer. There are no Class I sole-source aquifers that lie beneath the ORR. All aquifers are considered Class II aquifers (current potential sources of drinking water). Because of the abundance of surface water and its proximity to the points of use, very little groundwater is used at the ORR. Only one water supply well exists on the ORR and it serves as a supplemental water supply to an aquatics laboratory during extended droughts.

Groundwater Quality. Groundwater samples are collected semiannually and annually from a representative number of monitoring wells throughout the ORR. Historical monitoring efforts have shown that four types of contaminants have affected groundwater quality at Y-12: nitrates, volatile organic compounds (VOCs), metals, and radionuclides. Of these, nitrates and VOCs are the most widespread. Some radionuclides, particularly uranium and technetium (^{99}Tc), are found principally in the Bear Creek regime and the western and central portions of the UEFPC regime.

Groundwater in Bear Creek Valley west of Y-12 has been contaminated by hazardous chemicals and radionuclides from past weapons production waste disposal activities. The primary groundwater contaminants in the Bear Creek Regime are nitrates, trace metals, VOCs, and radionuclides. The contaminant sources include past waste disposal facilities sited on aquitard bedrock north of Bear Creek. Former disposal facilities and Solid Waste Management Units (SWMUs) include the S-3 Ponds, Oil Landfarm, Boneyard/Burnyard site, New Hope Pond, and the Bear Creek Burial Grounds, all closed since 1988 (DOE 2001a, DOE 2005d).

Among the three hydrogeologic regimes at Y-12, the UEFPC regime encompasses most of the known and potential sources of groundwater contamination. The groundwater contamination is the result of a commingling of releases from multiple sources within Y-12. Nitrates and ^{99}Tc from the S-3 Site are the primary groundwater contaminants in the western portion of the UEFPC regime, while groundwater in the eastern portion including Union Valley is predominantly contaminated with VOCs, such as tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1-dichloroethane (DCE), carbon tetrachloride, and chloroform; and fuel components such as benzene, toluene, ethylbenzene and xylene (BTEX). The most frequently detected metals are boron, beryllium, cobalt, copper, chromium, lead, lithium, mercury, manganese, nickel, and total uranium (DOE 2001a, DOE 2005d).

The Chestnut Ridge hydrogeologic area is dominated by several closed and operating disposal facilities, including the closed Chestnut Ridge Security Pits, Chestnut Ridge Sediment Disposal Basin, United Nuclear Corporation Site, and five nonhazardous waste landfills. Groundwater monitoring data collected since the mid-1980s indicate limited groundwater contamination. The only definable VOC contaminant plume in groundwater is associated with the Chestnut Ridge Security Pits and extends approximately 792 m (2,600 ft) east of that facility.

In addition, shallow groundwater within the water table interval near New Hope Pond (closed SWMU), Lake Reality, and UEFPC is monitored. Historically, VOCs have been detected near Lake Reality from wells, a dewatering sump, and the New Hope Pond distribution channel underdrain. In this area, shallow groundwater flows north-northeast through the water table interval east of New Hope Pond and Lake Reality, following the path of the distribution channel for UEFPC. During Calendar Year (CY) 2004, the observed concentrations of VOCs at the New Hope Pond distribution channel continue to remain low (DOE 2005d).

3.5.2 Surface Water

Waters drained from the ORR eventually reach the Tennessee River via the Clinch River, which forms the southern and western boundaries of the ORR. Within the Y-12 Site, the two major surface water drainage basins are those of Bear Creek and East Fork Poplar Creek (EFPC). The upper reaches of the EFPC drains the majority of the industrial facilities at Y-12. The in-plant portion of EFPC has been designated as the UEFPC. EFPC, which discharges into Poplar Creek east of the ETTP, flows northeast along the south side of Y-12. Various Y-12 wastewater discharges to the UEFPC from the late 1940s to the early 1980s left a legacy of contamination, such as mercury, polychlorinated biphenyls (PCBs), and uranium that has been the subject of water quality improvement initiatives over the past 22 years.

The natural drainage pattern of UEFPC has been radically altered by the construction of Y-12. The creek flows in a modified and straightened channel lined with riprap and concrete. Flow in UEFPC is derived partially from groundwater captured by the buried channels and funneled to the creek. In addition, outfalls into UEFPC add a combination of groundwater, storm water, and water generated by plant operations. As a result of reduced operations and elimination of direct discharges to UEFPC, flow in UEFPC decreased from 38 to 57 million liters per day (MLD) (10 to 15 million gallons per day [MGD]) in the mid-1980s to about 9 MLD (2.4 MGD) in the mid-1990s. To improve downstream water quality, Y-12's 1995 National Pollutant Discharge Elimination System (NPDES) permit required supplementing flow in UEFPC by the addition of raw water from the Clinch River. Since mid-1996, water has been added to the western portion of the open channel in order to maintain flow of 26 MLD (7 MGD) at Station 17, downstream of Lake Reality just before the creek exits the Y-12 boundary on the east end.

Bear Creek Valley west of Y-12 is drained by Bear Creek. Bear Creek begins near the westernmost portion of Y-12 and flows west for approximately 8.3 km (5.2 mi). At the location where Bear Creek reaches U.S. Highway 95, it turns north and flows through a gap in Pine Ridge to its confluence with EFPC, just above its confluence with Poplar Creek. Bear Creek flow is maintained by inputs from tributary streams flowing in from the north from Pine Ridge. Flow in Bear Creek is further supplemented by discharges from several springs at the base of Chestnut Ridge and underdrains from the Environmental Management Waste Management Facility (EMWMF).

The Clinch River is the source of potable water for the City of Oak Ridge which provides potable water for Y-12 and ORNL. The Clinch River has an average flow of 132 cubic meters per second (m^3/s) (4,662 cubic feet per second [ft^3/s]) as measured at the downstream side of Melton Hill Dam at mile 23.1. The average flow of Bear Creek near Y-12 is 0.11 m^3/s (3.88 ft^3/s). Base flow without augmentation in UEFPC, measured downstream of Y-12 averages 1.3 m^3/s (45.9 ft^3/s). Y-12 uses approximately 7,530 million liters per year (MLY) (2,000 million gallons per year [MGY]) of water while the ORR uses approximately twice as much. The ORR water supply system, which includes the City of Oak Ridge treatment facility and the ETTP treatment facility, has a capacity of 44,347 MLY (11,715 MGY).

Clinch River water levels in the vicinity of the ORR are regulated by a system of dams operated by the Tennessee Valley Authority (TVA). Melton Hill Dam controls the flow of the Clinch River along the northeast and southeast sides of the ORR. Watts Bar Dam, located on the Tennessee River downstream of the lower end of the Clinch River, affects the flow of the Clinch River along the southeast side of the ORR.

Surface Water Quality. The streams and creeks of Tennessee are classified by TDEC and defined in the State of Tennessee Water Quality Standards. Classifications are based on water quality, designated uses, and resident aquatic biota. The Clinch River is the only surface water body on the ORR classified for domestic water supply. Most of the streams at the ORR are classified for fish and aquatic life, livestock watering, wildlife, and recreation. White Oak Creek and Melton Branch are the only streams not classified for irrigation. Portions of Poplar Creek and Melton Branch are not classified for recreation.

There are seven wastewater treatment facilities which operate under NPDES permits at Y-12. Another facility known as Big Spring Water Treatment Facility began operation in 2005 as an interim remedial action to remove mercury under a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) Record of Decision. Sanitary and certain industrial wastewaters are permitted for discharge to the City of Oak Ridge wastewater collection and treatment systems. During 2004, Y-12 experienced no NPDES excursions, and zero exceedences of the Industrial and Commercial User Wastewater Discharge Permit (DOE 2001a, 2005d).

The water quality of surface streams in the vicinity of Y-12 is affected by current and past operations. While stormwater, groundwater, and wastewater flows may contribute contaminants to UEFPC, the water quality and ecological health of this stream has greatly improved over the last 20 years. This is primarily due to rerouting of discharge pipes, construction and operation of wastewater treatment facilities, dechlorination of process waters, and other ongoing environmental protection activities at Y-12.

Among the three hydrogeologic regimes at Y-12, the UEFPC regime contains most of the known and potential sources of surface water contamination. Surface water contaminants in UEFPC include metals (particularly mercury and uranium), organics, and radionuclides (especially uranium isotopes). Water quality in Bear Creek is influenced significantly by a groundwater hydraulic connection either directly to Bear Creek or to tributaries to Bear Creek. Contaminants in Bear Creek, from multiple formerly used waste burial trenches and pits, include nitrates, metals (e.g., uranium), radionuclides (e.g., uranium isotopes, technetium [^{99}Tc]), and chlorinated organics (DOE 2001a, DOE 2005d).

Routine surface water surveillance monitoring, above and beyond that required by the NPDES permit, is performed as a best management practice. Y-12 monitors the surface water as it exits each of the three hydrogeologic regimes that serve as an exit pathway for surface water. Monitoring is conducted at Station 17, near the junction of Scarboro and Bear Creek roads. More than 6,000 surface water samples were collected in 2004. Comparisons with the Tennessee water

quality criteria indicate that only mercury, cadmium, zinc and copper from samples collected at Station 17 were detected above the criteria maximum (DOE 2005d).

Surface Water Rights and Permits. In Tennessee, the state's water rights are codified in the *Water Quality Control Act*. In effect, the water rights are similar to riparian rights in that the designated usages of a water body cannot be impaired. The only requirement to withdraw from surface water would be a TDEC Chapter 1200-5-8 Water Registration Requirement, and the U.S. Army Corps of Engineers and TVA permits to construct intake structures.

3.6 ECOLOGICAL RESOURCES

This section describes the ecological resources at the ORR, including threatened and endangered (T&E) species, and floodplains and wetlands. The proposed project site is located inside the ORR, within the boundaries of Y-12.

The ORR is mostly contiguous native eastern deciduous forest. Forested (hardwood and pine) areas are found throughout the reservation. Less than 2 percent of the ORR remains as open agricultural fields. The forests are mostly oak-hickory, pine-hardwood, or pine. Minor areas of other hardwood forest cover types are found throughout the ORR, including northern hardwoods, a few small natural stands of hemlock or white pine, and floodplain forests (ORNL 2002).

Plant communities are characteristic of the intermountain regions of central and Southern Appalachia, pine and pine-hardwood forest and oak-hickory forest are the most extensive plant communities found at the ORR (DOE 2001a). Over 1,100 vascular plant species are found on the ORR (ORNL 2002). Animal species found on the ORR include approximately 63 species of fish; 59 species of amphibians and reptiles; up to 260 species of migratory, transient, and resident birds; and 38 species of mammals (DOE 2001a).

Within the fenced, developed portion of Y-12, grassy and unvegetated areas surround the entire facility. Building and parking lots dominate the landscape at Y-12, with limited vegetation present. Fauna within the Y-12 area is limited due to the lack of large areas of natural habitat. Under the Proposed Action, two new elevated water tanks would be installed on Bear Creek Road. The proposed project site is currently an open, grassy area that has been previously disturbed with the construction of Bear Creek Road. This site provides little habitat for terrestrial resources. The top of Pine Ridge is forested. Birds, reptiles and large mammals such as raccoons are likely to occur in the forested areas along the ridge. Additional information and listing of species found at the ORR can be found in the Section 4.6 of the Y-12 SWEIS (DOE 2001a).

3.6.1 Threatened and Endangered Species

Forty-five Federal- and state-listed threatened, endangered, and other special status species have been identified on the ORR. Among these, 20 Federal- or state-protected vertebrate species have been confirmed in recent surveys (Table 3.6-1) (ORNL 2002, DOE 2001a). The only federally threatened or endangered species that has been recently observed at Y-12 is a gray bat (*Myotis grisescens*), which has been recorded foraging over a pond on the ORR and over waters bordering the ORR (DOE 2005d). The U.S. Fish and Wildlife Service (USFWS) records indicate that the federally endangered Indiana Bat (*Myotis sodalis*) may also be present in the vicinity of Y-12, however, this bat has not been observed at Y-12 or other parts of the ORR (DOE 2001a). The federally threatened bald eagle is increasingly observed in winter. The Federal and state threatened species, the spotfin chub (*Cyprinella monnacha*) has been sighted and collected in the City of Oak Ridge and is possibly present on the ORR (DOE 2005d).

There are no federally listed threatened or endangered plant species on the ORR. State threatened and endangered species observed on the ORR include 22 plants, 1 mammal, and 2 raptor species (DOE 2001a, DOE 2005d). A number of rare or state-listed animals and plants are present in the vicinity of Y-12. No critical habitat for threatened or endangered species, as defined in the *Endangered Species Act*, exists on the ORR (DOE 2001a).

3.6.2 Floodplains and Wetlands

Floodplains. A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. The TVA has conducted floodplain studies along the Clinch River, Bear Creek, and EFPC (DOE 2001a). Portions of Y-12 lie within the 100- and 500-year floodplains of EFPC. The proposed new tank installation on Pine Ridge is not within the 100- or 500-year floodplain of the EFPC. Excavations and repair/replacement of piping may occur within or adjacent to the 500-year floodplains along the UEFPC.

Wetlands. Approximately 235 ha (581 acres) of wetlands have been identified on the ORR, with most classified as forested palustrine, scrub/shrub, and emergent wetlands (DOE 2001a). Wetlands occur across the ORR at low elevation, primarily in the riparian zones of headwater streams and their receiving streams, as well as in the Clinch River embayments. Wetlands identified to date range in size from several square yards at small seeps and springs to approximately 10 ha (24.7 acres) at White Oak Lake (ORNL 2002).

A wetlands survey of the Y-12 area found palustrine, scrub/shrub, and emergent wetlands. An emergent wetland was found at the eastern end of Y-12, at a seep by a small tributary of EFPC, between New Hope Cemetery and Bear Creek Road. Eleven small wetlands have been identified north of Bear Creek Road in remnants of the UEFPC. A relatively undisturbed, forested wetland was identified in the stream bottomland of Bear Creek Tributary 1, between Bear Creek Road and the powerline right-of-way. For additional discussion of wetlands, refer to

Section 4.6.2 of the Y-12 SWEIS (DOE 2001a). The dominant aquatic feature in the area of the water pipeline repair/replacement is UEFPC.

Table 3.6–1. Federal or State–Listed Threatened and Endangered Species Reported on the Oak Ridge Reservation

	Common Name	Scientific Name	Status[a]	
			Federal	State
Mammals				
	Gray bat	*Myotis grisescens*	E	E
	Indiana bat	*Myotis sodalis*	E	E
Birds				
	Bald eagle	*Haliaetus leucocephalus*	T(DL)	T
	Peregrine falcon	*Falco peregrinus*	NL	E
Plants				
	American ginseng	*Panax quinquefolius*	NL	S-CE
	Appalachian bugbane	*Cimicfuga rubifolia*	SC	T
	Branching whitlow-grass	*Draba ramosissima*	SC	T
	Butternut	*Juglans cinera*	NL	T
	Canada lily	*Lilium canadense*	NL	T
	Fen orchid	*Liparis loeselii*	NL	E
	Golden seal	*Hydrastis Canadensis*	NL	S-CE
	Hairy sharp-scaled sedge[b]	*Carex oxylepis var. pubescens*	NL	S
	Heavy sedge	*Carex gravida*	NL	S
	Large-tooth aspen	*Populus grandidentata*	NL	S
	Michigan lily[c]	*Lilium michiganense*	NL	T
	Mountain witch alder	*Fothergilla major*	NL	T
	Northern bush honeysuckle	*Diervilla lonicera*	NL	T
	Northern white cedar	*Thuja occidentalis*	NL	S
	Nuttall waterweed	*Elodea nuttallii*	NL	S
	Pink lady's-slipper	*Cypripedium acaule*	NL	E-CE
	Pursh's wild-petunia	*Ruellia purshiana*	NL	S
	River bulrush	*Scirpus fluviatilis*	NL	S
	Shining ladies-tresses	*Spiranthes lucida*	NL	T
	Small-head rush	*Juncus brachycephalus*	NL	S
	Spreading false foxglove	*Aureolaria patula*	SC	T
	Tall larkspur	*Delphinium exaltatum*	SC	E
	Three-parted violet	*Viola tripartite var. tripartite*	NL	S
	Tuberculed rein-orchid	*Platanthera flava var. herbiola*	NL	T

[a] Status codes: CE-candidate endangered; DL-proposed for delisting; E-endangered; NL-not listed; P-possibly extirpated; S-special concern in Tennessee; SC-Federal species of concern; T-threatened.

[b] *Carex oxylepis var. pubescens* has not been observed during recent surveys.

[c] *Lilium michiganense* is believed to have been extirpated from the ORR by the impoundment at Melton Hill.

Sources: DOE 2001a, DOE 2005d.

3.7 CULTURAL RESOURCES

3.7.1 Introduction

Cultural resources are those aspects of the physical environment that relate to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources have been organized into three categories for this EA: prehistoric resources, historic resources, and traditional cultural properties and practices. These types are not exclusive and a single resource may fall within more than one category due to the presence of multiple components. Prehistoric cultural resources refer to any material remains, structures, and items used or modified by Native American people before the establishment of a Euro-American presence in the region in the 17th century. Historic cultural resources include material remains and landscape alterations that have occurred since the arrival of Euro-Americans in the region. These resources can be associated with either Euro-American or Native American people. Traditional cultural properties (TCPs) refer to sites, locations, natural resources, or manmade objects that are important to a particular living community, and this importance is "derived from the role the TCP plays in the community's historically rooted beliefs, customs, and practices" (Parker and King 1990). Traditional cultural practices and beliefs that are based in a community's history are important for maintaining the cultural identity of the community, and are essential to the preservation and viability of a culture.

3.7.2 Significance of Cultural Resources

The long history of legal jurisdiction over cultural resources, dating back to 1906 with the passage of the *Antiquities Act* (16 United States Code [U.S.C.] 431-433), demonstrates a continuing concern on the part of Americans for their cultural resources. Foremost among these statutes are the *National Historic Preservation Act* (NHPA) of 1966, as amended (16 U.S.C. 470), and its revised implementing regulations (36 CFR Part 800). This statute describes the process for identification and evaluation of cultural resources, assessment of effects of Federal actions on its resources, and consultation to avoid, reduce, or mitigate adverse effects. The NHPA does require Federal agencies to ensure that decisions concerning the treatment of these cultural resources result from meaningful consideration of cultural and historic values, and identification of options available to protect these resources.

Identified cultural resources are fully recorded and evaluated to determine if they are eligible for listing on the National Register of Historic Places (NRHP). To be determined as eligible, a resource must retain most of 7 aspects of integrity[1], be at least 50 years old (although there are exceptions to this), and meet 1 of 4 criteria of significance[2]. Resources that are determined to be

[1] Seven aspects of integrity are location, design, setting, materials, workmanship, feeling, and association.

[2] Significance may be found in four aspects of American History recognized by the National Register Criteria: (1) association with historic events or activities; (2) association with important persons; (3) distinctive design or physical characteristics; or (4) potential to provide important information about prehistory or history.

eligible are afforded consideration under the NHPA. If a Federal action will adversely affect an eligible resource, then measures must be taken to avoid, reduce, or mitigate the effect.

3.7.3 Cultural Resources at Y-12

Architectural and archaeological surveys have been conducted for the Y-12 site (Thomason and Associates 2003). In 1999, Thomason and Associates completed a comprehensive architectural and historical evaluation of Y-12. A total of 248 properties were individually recorded and evaluated. The remaining 325 facilities were identified and categorized by design and use. At least 10 major archaeological reconnaissance-level surveys have been conducted on the ORR. Y-12 contains only one known archaeological site.

A survey conducted of Y-12 in the early 1990s identified one archeological site (40AN68) which is located on a flat rise overlooking the EFPC within the boundaries of Y-12. This site is of the ephemeral nature and is not eligible for inclusion in the NRHP pursuant to 36 CFR 60.4 (DuVall and Associates 1999). It was concluded that the potential is low for identifying significant archeological sites within Y-12.

No cultural resources at Y-12 are currently listed on the NRHP. Y-12 has a historic district that has been determined eligible for listing and the Tennessee State Historic Preservation Officer has concurred with this determination (Thomason and Associates 2003). The district currently includes 60 contributing buildings and structures. The district is eligible under Criterion A for its historical associations with the Manhattan Project, development as a nuclear weapons component plant within the post-World War II scientific movement, and early nuclear development activities. It is also eligible under Criterion C for the engineering merits of many of the properties and their contributions to science. Figure 3.7-1 shows the location of the historic district at Y-12 in relation to the proposed site.

Two of the 60 contributing buildings and structures within the historic district have been determined as eligible for National Historic Landmark status (Figure 3.7-1). Building 9731 is the oldest process facility at Y-12 and played a major part in the Manhattan Project (DOE 2001a). Building 9204-3 (Beta-3) functioned as a uranium enrichment facility during World War II and is significant for its pioneering role in nuclear research for enriched uranium and the separation of stable isotopes (DOE 2001a).

Ancestors of the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma may be culturally affiliated with the prehistoric use of the Y-12 area. Procedures for consulting with the Cherokee regarding TCPs are in place. No Native American traditional use areas or religious sites are known to be present on the Y-12 Site. Also, no artifacts of Native American religious significance are known to exist or to have been removed from the Y-12 Site (DOE 2001a).

There are at least 68 cemeteries on the ORR, 7 of which are located on the Y-12 Site. These cemeteries are associated with Euro-American use of the area prior to World War II (DOE 2001a) and are likely to have religious or cultural importance to descendants and the local community. All are currently maintained and protected.

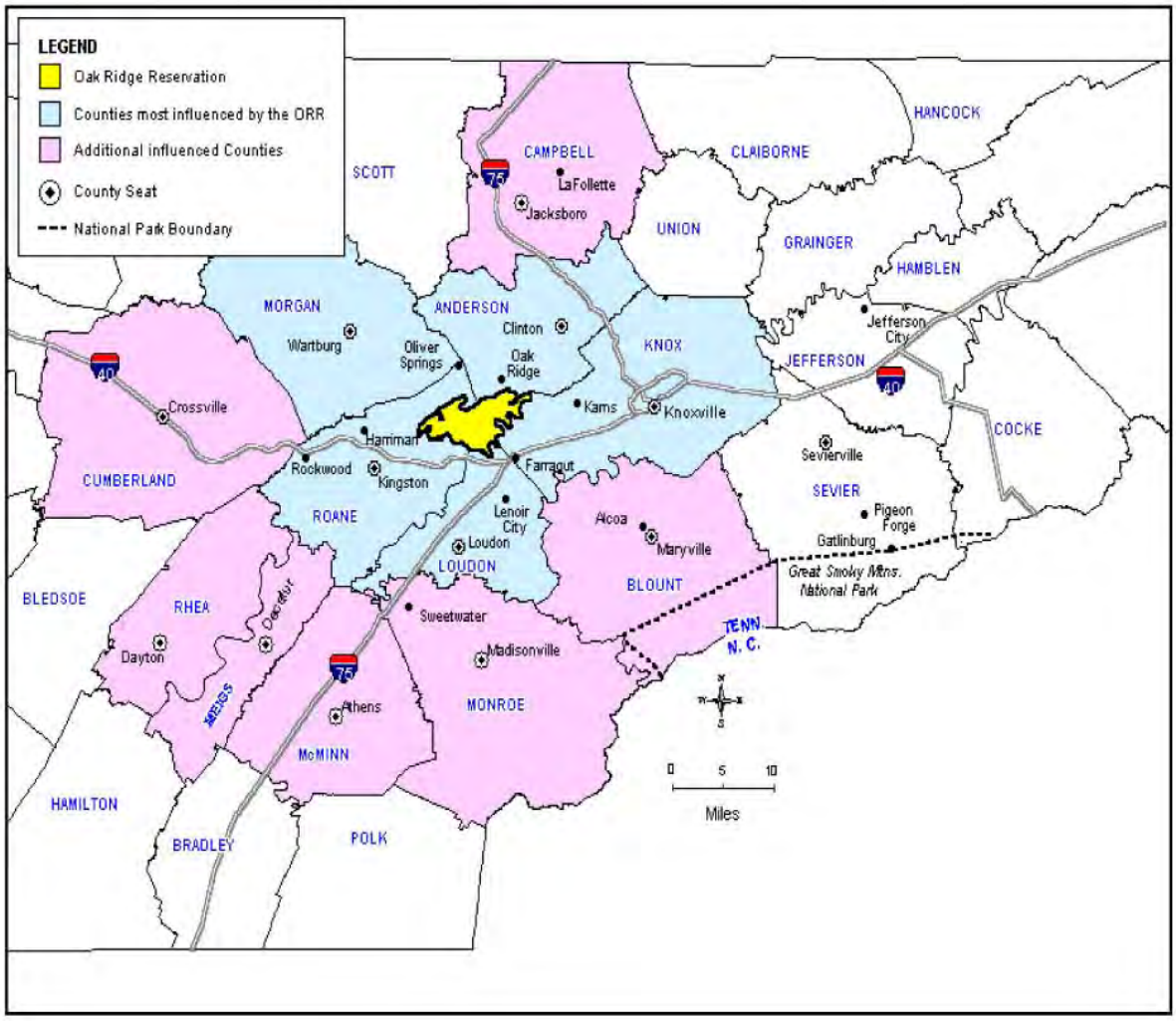
3.7.4 Cultural Resources at Proposed Site

The historic district includes much of the Y-12 Site; however the proposed site is not located within the district or near the two buildings proposed for National Historic Landmark status or other properties eligible for inclusion in the National Register (Figure 3.7-1). The proposed undertaking to install two new elevated water tanks on Bear Creek Road would not adversely affect any properties eligible for listing in the NRHP.

Although the proposed site is undeveloped, it has been previously disturbed with the construction of Bear Creek Road and the installation of underground utilities. A field survey of the project site has been conducted and a negative findings report was prepared by DuVall and Associates, Inc. (Appendix A). There will be no disturbance to this area until the archeological report has been submitted, reviewed, and approved by the State Historic Preservation Office.

3.8 SOCIOECONOMICS

This section describes current socioeconomic conditions within a ROI where more than 90 percent of the ORR workforce resides. The ROI is a four-county area in Tennessee comprised of Anderson, Knox, Loudon, and Roane Counties. Figure 3.8–1 shows the surrounding counties influenced by ORR. Approximately 40 percent of the current ORR workforce resides in Knox County, 29 percent in Anderson County, 16 percent in Roane County, and 6 percent in Loudon County. The remaining 9 percent of the workforce resides in other counties across Tennessee, none of which are home to more than 3 percent of the workforce (DOE 2001b).



Source: DOE 2001a.

Figure 3.8–1. Location of Oak Ridge Reservation and Surrounding Counties.

3.8.1 Employment and Income

The ORR ROI has historically been dependent on manufacturing and government employment. More recent trends show growth in the service sector and a decline in manufacturing and government employment. Table 3.8–1 presents current and historical employment for the major sectors of the ROI economy. Although there have been fluctuations in these estimates, the ROI labor force grew by approximately 4.7 percent from 280,982 in 1995 to 294,937 in 2004. Overall, ROI employment grew from 270,151 in 1995 to 282,500 in 2004 and continued to grow despite the fluctuations in the labor force (BLS 2005).

Table 3.8–1. Employment by Sector (%)

Sector	1980	1990	2000
Services	19.1	27.3[a]	32.2
Wholesale	5.5	5.5	5.0
Retail	15.6	19.3[a]	18.3
Government (including Federal, State, local, and military)	20.3	15.4	13.7
Manufacturing	21.9	15.8	10.7
Farm	2.0	1.5	1.2
Construction	4.9	5.4	6.3
Finance, Insurance, and Real Estate	6.0	5.1	6.3
Transportation and Public Utilities	3.7	4.0	5.1
Agricultural Service, Forestry, and Other	0.3	0.6	1.1[b]
Mining	0.7	0.4	0.2[b]

[a] Percentage only includes Knox and Loudon Counties. Data for Roane and Anderson Counties not available.
[b] Percentage only includes Knox and Roane Counties. Data for Loudon and Anderson Counties not available.
Source: BEA 2003.

The ROI unemployment rate was 4.2 percent in 2004, continuing on an upward trend after a 10-year low of 2.7 percent in 2000, as shown in Table 3.8–2. In 2004, unemployment rates within the ROI ranged from a low of 3.9 percent in Knox County to a high of 5.8 percent in Roane County. The unemployment rate in Tennessee was 5.4 percent (BLS 2005).

Table 3.8–2. Region of Influence Unemployment Rates (%)

County	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Anderson	3.9	4.8	5.6	3.7	3.6	3.7	4.1	3.9	4.6	4.9
Knox	3.4	3.4	3.6	3.1	2.6	2.3	2.5	2.8	3.1	3.9
Loudon	4.0	3.9	4.5	3.2	3.0	2.9	3.6	4.2	4.2	4.4
Roane	5.8	5.3	7.3	5.0	4.6	4.2	4.4	5.3	5.5	5.8
ROI Total	3.8	3.8	4.3	3.4	2.9	2.7	3.0	3.3	3.6	4.2
Tennessee	5.2	5.2	5.4	4.2	4.0	3.9	4.4	5.1	5.8	5.4

Source: BLS 2005.

Per capita income in the ROI was $27,854 in 2003, a 65 percent increase from the 1990 level of $18,198. Per capita income in 2003 in the ROI ranged from a low of $25,332 in Roane County to a high of $30,901 in Knox County. The per capita income in Tennessee was $26,641 in 2003 (BEA 2005a).

Y-12 employs approximately 5,400 workers, including DOE employees and multiple contractors. This represents approximately 3.1 percent of area employment. DOE has a significant impact on the economy of the ROI and Tennessee. As a whole, DOE employees and contractors number more than 13,700 individuals in Tennessee, primarily in the ROI. These jobs have an average salary of $40,000 in comparison to the statewide average of $32,919 (BEA 2005b).

DOE employment and spending generate additional benefits to the ROI and state economies through the creation of additional jobs in sectors providing support to DOE and its workers.

Current projections of the future plant population indicate that, in the long term, the population necessary for Y-12's mission will decrease 20 percent. However, within the next 5 years, nearly half of the current workforce will be eligible for full, unreduced retirement. To combat a possible shortage of critical skills, a robust recruiting effort has been put in place. Therefore, in the short term, Y-12 will experience a brief peak in its employee population as the transition is made from one generation to another.

3.8.2 Population and Housing

Between 1960 and 1990, population growth in the ROI was slightly slower than population growth in the State of Tennessee. The ROI population increased at an average annual rate of 1 percent while the state population increased 1.2 percent annually. Between 1990 and 2002, ROI population growth increased 1.2 percent annually while the state population increased 1.6 percent annually. Loudon County experienced the fastest rate of population growth, averaging 2.5 percent annually between 1990 and 2002, while Anderson County population has increased an average of only 0.4 percent annually (DOE 2001b, USCB 2005). Populations in all counties in the ROI are projected to continue to grow at a slower rate between 2000 and 2020, as shown in Table 3.8–3.

Table 3.8–3. Historic and Projected Population Levels in the Region of Influence

County	1960	1970	1980	1990	2000	2002	2010	2020
Anderson	60,032	60,300	67,346	68,250	71,330	71,627	75,163	77,226
Knox	250,523	276,293	319,694	335,749	382,032	389,327	427,593	481,842
Loudon	23,757	24,266	28,553	31,255	39,086	40,631	48,362	58,729
Roane	39,133	38,88	48,425	47,227	51,910	52,316	57,042	61,836
ROI	373,445	399,740	464,018	482,481	544,358	553,901	608,160	679,633
Tennessee	3,567,089	3,923,687	4,591,120	4,877,203	5,689,283	5,797,289	6,425,969	7,195,375

Source: DOE 2001b, USCB 2005, State of Tennessee 2003.

Knox County is the largest county in the ROI with a 2003 population of 392,995. Knox County includes the City of Knoxville, the largest city in the ROI. Loudon County is the smallest county in the ROI with a total population of 41,624. The City of Oak Ridge and the ORR are located in both Roane and Anderson Counties which had 2003 populations of 52,424 and 71,904, respectively (USCB 2005).

There were a total of 244,536 housing units in the ROI in 2000. A summary of ROI housing characteristics is shown in Table 3.8-4.

Table 3.8–4. Region of Influence Housing Characteristics (2000)

County	Total Number of Housing Units	Number of Owner-Occupied Units	Homeowner Vacancy Rates (percent)	Median Value	Number of Occupied Rental Units	Rental Vacancy Rates (percent)	Median Monthly Contract Rent
Anderson	32,451	21,592	1.9	$87,500	8,188	12.8	$450
Knox	171,439	105,562	2.5	$98,500	52,310	10.0	$493
Loudon	17,277	12,612	1.9	$97,300	3,332	9.0	$462
Roane	23,369	16,453	1.7	$86,500	4,747	13.1	$398
ROI	244,536	156,219	NA	NA	68,577	NA	NA

Note: NA - Not applicable.
Source: USCB 2000a.

Approximately 8 percent of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Rental vacancy rates ranged from 9 percent in Loudon County to 13.1 percent in Roane County, while homeowner vacancy rates ranged from 1.7 percent in Roane County, to 2.5 percent in Knox County. Owner-occupied housing units accounted for 64 percent of the total housing units while renter-occupied units accounted for approximately 28 percent (USCB 2000a). In 2000, the median value of owner-occupied housing units ranged from $86,500 in Roane County to $98,500 in Knox County, while the median contract rent ranged from $398 in Roane County to $493 in Knox County.

3.8.3 Community Services

Community services in the ROI include public schools, law enforcement, and medical services. Eight public school districts (DOE 2001b), with approximately 130 K-12 schools, provide educational services for approximately 75,000 students in the ROI (TDE 2004). Higher education opportunities in the ROI include the University of Tennessee as well as several private colleges and two community colleges (DOE 2001b).

Law enforcement is provided by 20 municipal, county, and local police departments that employ over 1,500 officers and civilians. Security at Y-12 is provided by Wackenhut Services, Inc. (DOE 2001b).

There are 13 hospitals in the ROI with a total of 2,833 beds. These hospitals operate at an average of 67 percent occupancy. There are 1,525 doctors in the ROI with the majority (1,279) in Knox County (DOE 2001b).

3.9 ENVIRONMENTAL JUSTICE

Environmental justice has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA 2005b).

Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led President Clinton to issue an Executive Order (EO) in 1994 to address these issues. That Order, EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", directs Federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. When conducting NEPA evaluations, DOE incorporates environmental justice considerations into both its technical analyses and its public involvement program in accordance with EPA and the CEQ regulations (CEQ 1997).

Demographic information from the U.S. Census Bureau was used to identify minority and low-income populations in the area of influence. Information on locations and numbers of minority and low-income populations was obtained from the 2000 U.S. Census. Census data are reported on the level of census tracts, a geographical area that varies with size depending largely on population density (low-population density census tracts generally cover larger geographical areas).

Minority refers to people who classified themselves in the 2000 U.S. Census as Black or African American, Asian or Pacific Islander, American Indian or Alaskan Native, Hispanic of any race or origin, or other non-White races (CEQ 1997). Environmental Justice guidance defines "low-income" using statistical poverty thresholds used by the U.S. Census Bureau. Information on low-income populations was developed from 1999 incomes reported in the 2000 U.S. Census. In 1999, the poverty weighted average threshold for an individual was $8,501 (USCB 2002).

The CEQ identifies minority and low-income populations when either (1) the minority or low-income population of the affected area exceeds 50 percent or (2) the minority or low-income population percentage in the affected area is meaningfully greater (i.e., 20 percentage points greater) than the minority population percentage in the general population or appropriate unit of geographical analysis. The geographic area of comparison for this analysis is the State of Tennessee.

Any disproportionately high and adverse human health or environmental effects on minority populations and/or low-income populations that could result from the alternatives being considered for Y-12 are assessed for the census tract which contains the site, the area for which health effects are assessed. Health effects resulting from discharge to water pathways would also be assessed for this area.

Figure 3.9-1 shows the census tracts containing the ORR. Minority populations for these tracts are shown in Table 3.9-1 and low-income populations are shown in Table 3.9-2. Socioeconomic impacts associated with environmental justice concerns are assessed for the four-county ROI described in Section 4.8, Socioeconomics.

Table 3.9–1. Population Distribution by Race in Census Tracts Containing the ORR

		White		Black		Aggregate: Non-White		Hispanic[a]	
Census Tract	**Total Population**	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
201	2,471	1,433	58.0	831	33.6	1038	42.0	92	3.7
202	7,227	6,458	89.4	343	4.7	769	10.6	125	1.7
203	3,932	3,584	91.2	236	6.0	348	8.9	64	1.6
204	4,373	3,913	89.5	270	6.2	460	10.5	94	2.2
205	3,413	2,968	87.0	313	9.2	445	13.0	64	1.9
206	2,556	2,306	90.2	131	5.1	250	9.8	31	1.2
301	3,028	2,826	93.3	68	2.2	202	6.7	48	1.6
Total	**27,000**	**23,488**	**87.0**	**2,192**	**8.1**	**3,512**	**13.0**	**518**	**1.9**
Tennessee	5,689,283	4,563,310	80.2	932,809	16.4	1,125,973	19.8	123,838	2.8

[a] Hispanic of any race or origin and is included in other totals.
Shaded box represents a 20 percentage point exceedance of State of Tennessee percentage.
Source: USCB 2000b, 2000c.

Table 3.9–2. Individuals Living Below Poverty Level in Census Tracts Containing the ORR

Census Tract	Total Population[a]	Number of Individuals Below Poverty Level	Percentage of Total Individuals in Census Tract Below Poverty Level
201	2,363	374	15.8
202	6,961	471	6.8
203	3,917	440	11.2
204	4,351	526	12.1
205	3,589	1,000	27.9
206	2,453	53	2.2
301	3,028	58	1.9
Total	**26,662**	**2,922**	**11.0**
Tennessee	5,539,896	746,789	13.5

[a]Population for whom poverty status is determined. Assuming less than 100 percent response.
Source: USCB 2000d.

Approximately 12,726 people live within the three census tracts containing the ORR. Minorities comprise 15.8 percent of this population. In 2000, minorities comprised 24.9 percent of the population nationally and 19.8 percent of the population in Tennessee. There are no federally-recognized Native American groups within 80 km (50 mi) of the Y-12 Complex. For census tract 201 in Anderson County, the Aggregate of All Minorities category represents 42 percent of the total population. This meets one of the criteria for determining the existence of sensitive populations within the area (i.e., more than 20 percentage points greater than the average for a geographic area of comparison; in this case, the State of Tennessee). None of the census tracts met the "greater than 50 percent" criterion. The percentage of persons below the poverty level is 11 percent, which is significantly lower than the 2000 national average of 12.4 percent and the

statewide figure of 13.5 percent (USCB 2000d). The Scarboro community is predominately a minority community located approximately 1 km (0.6 mi) north of Y-12.

3.10 TRAFFIC AND TRANSPORTATION SAFETY

3.10.1 On-site Traffic

Y-12 is located within 80 km (50 mi) of three interstate highways: I-40, I-75, and I-81. Primary roads on the ORR serving Y-12 include Tennessee State Routes (TSRs) 58, 62, 95, and 170 (Bethel Valley Road) and Bear Creek Road. The daily traffic numbers for various roads at the ORR are provided in Table 3.10–1.

Table 3.10–1. Existing Average Daily Traffic Counts on the ORR Serving Y-12 National Security Complex

Road	To	From	Average Daily Traffic Vehicles/day
TSR 58	TSR 95	I-40	13,970
TSR 95	TSR 62	TSR 58	25,150
TSR 62	TSR 170	–	31,620
Bethel Valley Road	TSR 62	–	9,350

Source: TDOT 2005.

3.10.2 Off-site Traffic

Y-12 is located within 80 km (50 mi) of three interstate highways: I-40, I-75, and I-81. Interstate 40, an east-west highway, extends from North Carolina to California. Interstate 75 is a north-south highway extending from Michigan to Florida. Interstate 81 is a north-south interstate extending from New York to Tennessee. Interstate 81 connects with I-40 east of Knoxville, and I-40 and I-75 connect west of Knoxville near the City of Oak Ridge. In addition, State Route (SR) 61, SR 162, and US 25W at Clinton also serve Y-12 transportation needs off site (DOE 2001a).

3.11 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

Current activities associated with routine operations at Y-12 have the potential to affect worker and public health. Air emissions at Y-12 can expose both groups to radioactive and non-radioactive materials. Liquid effluents discharged to near waterbodies may affect downstream populations using the water for drinking water purposes or recreation. Additionally, workers are exposed to occupational hazards similar to those experienced at most industrial work sites.

3.11.1 Worker Health

The Y-12 potable water system is monitored for free residual chlorine levels, bacteriological agents, disinfection byproducts, copper, and lead. The distribution system was last sampled in 2002 and is scheduled to be sampled in 2005. The potable water distribution system was compliant with the lead and copper requirements when last sampled in 2002. Bacteriological

analyses conducted in 2004 were satisfactory (DOE 2005d). The Y-12 Complex also has cross connection prevention programs and is working with TDEC to obtain approval on these programs.

Chemicals present at Y-12 that are of particular concern due to their nature and potential for causing adverse health effects include mercury, beryllium, PCBs, polycyclic aromatic hydrocarbons, and VOCs. In addition to the risks from these chemicals, workers at Y-12 are at risk from potential industrial accidents, injuries, and illnesses due to everyday operations.

The DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, regulates the health and safety of workers at all DOE sites. This comprehensive standard directs the contractor facilities to establish the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing DOE Federal and contractor workers with a safe and healthful workplace. Baseline exposure assessments are outlined in this requirement, along with day-by-day health and safety responsibilities.

Industrial hygiene limits for occupational chemical exposures at Federal sites are regulated by 29 CFR 1910 and 29 CFR 1926, *Occupational Safety and Health Standards*, including the permissible exposure limits (PELs) set by the Occupational Safety and Health Administration (OSHA). DOE requires that all sites comply with the PELs unless a lower limit (more protective) exists in the American Conference of Governmental Industrial Hygienists Threshold Limit Values.

The Y-12 Safety Program conducts investigations of plant accidents according to DOE Order 225.1A, *Accident Investigations,* and reports work-related fatalities, injuries, and illnesses according to DOE Order 231.1, *Environment, Safety and Health Reporting*.

One of the major goals of DOE is to keep worker exposures to radiation and radioactive material As Low As Reasonably Achievable (ALARA). The purpose of an ALARA program is to minimize doses from both external and internal exposures. The average annual dose to an involved worker at Y-12 during 2000 was 20.1 mrem. The dose to the involved workforce of 3,264 radiation workers was estimated to be 65.7 person-rem (DOE 2001a). Y-12 worker doses have typically been well below DOE worker exposure limits.

3.11.2 Public Health

In 2004, the total effective dose equivalent (EDE) to the MEI from Y-12 operations was 0.4 mrem. The MEI for Y-12 was located approximately 2,306 m (1.4 mi) east-northwest of the main Y-12 Complex release point. Inhalation and ingestion of uranium isotopes accounted for more than 99 percent of the dose to the MEI (DOE 2005d). The NESHAP standard for airborne releases is 10 mrem per year and applies to the sum of doses from all airborne pathways (inhalation, submersion in a plume, exposure to radionuclides deposited on the ground, and

consumption of foods contaminated as a result of deposition of radionuclides). The DOE Order 5400.5 MEI dose standard for all pathways is 100 mrem per year.

Waterborne releases using the worst case EDE for all pathways in a water-body segment resulted in an MEI dose of 0.4 mrem in 2004 (DOE 2005d). The DOE standard is 4 mrem per year to the MEI from the drinking water pathway.

The population within an 80 km (50 mi) radius of ORR was 1,040,041 in 2004. In 2004, based on the 2000 census data, the 50-year committed collective EDE to the population within 80 km (50 mi) of the ORR was 12 person-rem for all pathways, 5.8 person-rem from atmospheric releases at Y-12, and as high as 0.7 person-rem from waterborne releases (DOE 2005d). Based on a dose to risk conversion factor of 5.0×10^{-4} fatal cancers per person-rem (ICRP 1991), the collective EDE of 12 person-rem would statistically result in less than one additional latent cancer death within the population.

Several epidemiologic studies have been completed on Y-12 workers to evaluate the potential health effects from radiation and chemical exposures. Y-12 workers have also been included in many site-wide health studies. In addition to these reviews, community-wide health patterns have been studied in Anderson and Roane counties. There are several ongoing occupational health studies dealing with Y-12, including an ongoing study of the public health impact from releases of hazardous materials from the DOE operations at Oak Ridge. This assessment will help identify and characterize both the current and past exposures of offsite populations to radiological and chemical contaminants. For additional information on worker and surrounding public health, refer to the Y-12 SWEIS (DOE 2001a), Section 4.12.2 and Appendix D, Human Health and Worker Safety.

3.12 WASTE MANAGEMENT

There are several waste storage, treatment, and disposal facilities at Y-12. The majority of these facilities at Y-12 are operated under the Environmental Management (EM) Program but some are managed by NNSA. Waste management facilities are located in buildings or on sites, dedicated to their individual functions, or are located with other waste management facilities or operations.

The TDEC Division of Solid Waste Management (DSWM) regulates the management of waste streams under the *Tennessee Solid Waste Management Act*. Onsite waste disposal facilities in operation at Y-12 include industrial, construction/demolition landfills, and a CERCLA waste landfill.

3.12.1 Waste Generation from Routine Operations

The major waste types generated at Y-12 from routine operations include low level waste (LLW), mixed-LLW, hazardous waste, and nonhazardous waste. Table 3.12–1 presents a

summary of waste generation totals for routine operations at Y-12 for FY2003. Other waste includes sanitary and industrial wastewater, PCBs, asbestos, construction debris, general refuse, and medical wastes. Y-12 does not generate or manage high-level radiological waste or transuranic waste.

Table 3.12–1. Summary of Waste Generation Totals by Waste Type for Routine Operations at Y-12 National Security Complex

Waste Type	Waste Totals (FY-2003)
Low-Level Waste (Liquid)	13.32 m^3 (17.42 yd^3)
Low-Level Waste (Solid)	5,960.77 m^3 (7796.69 yd^3)
Mixed Low Level Waste (Liquid)	13.66 m^3 (17.87 yd^3)
Mixed Low Level Waste (Solid)	16.15 m^3 (21.12 yd^3)
RCRA Waste	13.04 metric tons (14.37 short tons)
TSCA Waste	13.46 metric tons (14.84 short tons)
Mixed TSCA	29.07 metric tons (32.04 short tons)
Sanitary Waste	7,188.34 metric tons (7923.71 short tons)

Source: Gilbert 2003.

Low-Level Waste. Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, and process equipment is generated at Y-12. In Fiscal Year (FY) 2003, Y-12 generated approximately 5,960 cubic meters (m^3) (7,797 cubic yards [yd^3]) of solid LLW. Liquid LLW is treated in several facilities, including the West End Treatment Facility (WETF). Y-12 is the largest generator of routine LLW in Oak Ridge. In FY2003, Y-12 generated 13.32 m^3 (17.42 yd^3) of liquid LLW (Gilbert 2003).

Mixed Low-Level Waste. Mixed waste subject to treatment requirements to meet Land Disposal Restrictions (LDRs) under RCRA are generated and stored at Y-12. DOE is under a State Commissioner's Order (October 1, 1995) to treat and dispose of these wastes in accordance with milestones established in the *Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation* and to comply with a *Federal Facilities Compliance Act* (FFC Act) that went into effect on June 12, 1992. *Toxic Substance Control Act* (TSCA)-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate Federal Facilities Compliance Agreement (FFCA), effective February 20, 1992 (DOE 2001a).

Hazardous Waste. RCRA-hazardous waste is generated through a wide variety of production and maintenance operations. The majority of RCRA-hazardous waste is in solid form. In FY 2003, Y-12 generated 13 metric tons (14.3 short tons) of RCRA waste. Hazardous waste is shipped offsite for treatment and disposal at either DOE or commercially-permitted facilities (Gilbert 2003).

Liquid Waste. Treated industrial wastewater is discharged to the UEFPC. Sanitary wastewater is discharged to the City of Oak Ridge publicly-owned treatment works under the Industrial and Commercial User Wastewater Discharge Permit No. 1-91. During 2004, the wastewater flow averaged about 2.5 million liters (663,000 gallons) per day. Non-radiological liquid

discharges from Y-12 processes flow into the EFPC before water exits the Y-12 Complex (DOE 2005d).

Other Waste Types. PCBs are transported to permitted facilities for treatment and disposal. Medical wastes are autoclaved to render them noninfectious and are then sent to a Y-12 sanitary industrial landfill, as are asbestos wastes and general refuse. Construction, demolition, and nonhazardous industrial materials are disposed of in a construction/demolition landfill at Y-12.

Capacities. Excess treatment and disposal capacity exist both onsite and offsite for hazardous waste at Y-12. Storage capacities at Y-12 are currently adequate for hazardous, mixed, and low-level waste.

3.12.2 Waste Generation from Environmental Restoration Activities

Environmental Restoration Waste. EPA placed the ORR on the National Priority List on November 21, 1989. DOE, EPA Region IV, and TDEC entered into a Federal Facility Agreement (FFA) effective January 1, 1992. This agreement established the procedural framework and schedule for developing, implementing, and monitoring response actions on the ORR in accordance with CERCLA (DOE 2005d). DOE has directed the transfer of a number of environmental activities from EM to the NNSA. These environmental activities are finite with specific end dates, and include environmental restoration, legacy waste management and disposition, and decontamination and decommissioning activities. The NNSA will corporately manage these activities within NNSA's newly established Environmental Project and Operations Program (DOE 2005e).

3.13 VISUAL RESOURCES

The ORR landscape is characterized by a series of ridges and valleys that trend in a northeast-to-southwest direction. The vegetation is dominated by deciduous forest mixed with some coniferous forest. Much of the ORR's open fields (about 2,020 ha [4,991 acres]) have been planted in shortleaf and loblolly pine. Smaller areas have been planted with a variety of deciduous and coniferous trees.

For the purpose of rating the scenic quality of Y-12 and surrounding areas, the Bureau of Land Management's (BLM) Visual Resource Management (VRM) Classification System was used. Although this classification system is designed for undeveloped and open land managed by BLM, this is one of the only systems of its kind available for the analysis of visual resource management and planning activities. Currently, there is no BLM classification for Y-12 however, the level of development at Y-12 is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes).

The viewshed, which is the extent of the area that may be viewed from the ORR, consists mainly of rural land. The City of Oak Ridge is the only adjoining urban area. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake, and the bluffs on the opposite side of the Clinch River. Views are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric conditions. Some partial views of the City of Oak Ridge Water Treatment Plant facilities, located on Pine Ridge at Y-12, can be seen from the urban areas of the City of Oak Ridge.

Y-12 is situated in Bear Creek Valley at the eastern boundary of the ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding Y-12 consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are brightly lit at night. There are no visible daytime plumes over Y-12.

Structures at Y-12 are mostly low profile, reaching heights of three stories or less, and built in the 1940s of masonry and concrete. The tallest structures are two meteorological towers erected in 1985 located on the east and west ends of Y-12. The east tower reaches a height of 100 m (328 ft). The tower is painted orange and white, and is the only structure at Y-12 tall enough to require aviation beacons. The west tower is located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road. Although this tower only reaches a height of 60 m (197 ft), it is actually higher in elevation than the east tower. These towers are used to measure and collect meteorological data to ETTP databases.

The Scarboro Community is the closest developed area to Y-12, and is located to the north of Y-12. However, as a result of their separation by Pine Ridge, Y-12 is not visible from the Scarboro Community (DOE 2001a).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 LAND USE

4.1.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. The main area of Y-12 is largely developed and because of the Site's defense support, manufacturing, and storage facilities, the land is classified in DOE's industrial use category. The Proposed Action, to construct two elevated water tanks, install additional pumping equipment, and inspect and repair or replace distribution and supply lines, would be consistent with the current land use patterns at Y-12. There would be no alterations of current land use patterns or planning resulting from the Proposed Action.

Operation. Operation of the new elevated water tanks would be consistent with the current land use patterns at Y-12. There would be no alteration of current land use patterns or planning resulting from the Proposed Action.

4.1.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Land use impacts from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. Land use impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.1.3 Alternative 3 – Pump Stations Feed Loop

Construction. Land use impacts from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. Land use impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.1.4 Alternative 4 – Local Pumping Stations

Construction. Land use impacts from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. Land use impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.1.5 Alternative 5 – No Action

Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur. The No Action alternative would not result in any changes to the current land use designations at Y-12.

4.2 GEOLOGY AND SOILS

4.2.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Construction of the elevated water tanks would have no impact on geological resources, and the hazards posed by geological conditions are expected to be minor. The bedrock at Y-12 is adequate to support structures using standard construction techniques.

The installation of the water tanks would require grading and excavation of soil for the placement of the tanks. Approximately 0.4 ha (1 acre) would be impacted for the installation of the tanks. Soil erosion due to past land use has ranged from slight to severe. Wind erosion is slight and shrink-swell potential is low to moderate. Due to moderate slopes in the project area, there is an increased potential for soil erosion and soil compaction due to large equipment used during the construction of the water towers. The soils at the Y-12 site are generally stable and acceptable for standard construction techniques.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. The new elevated water tanks would be designed and constructed to meet all regulatory requirements.

Operation. No impacts to geology and soils are anticipated from the operation of the Proposed Action.

4.2.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Construction of the two new water tanks on Pine Ridge would have no impact on geological resources. The bedrock at Y-12 is adequate to support structures using standard construction techniques.

The installation of the tanks on Pine Ridge would require construction of an access road, considerable grading, excavation of soil for the placement of the tanks and new pipe, and construction of a pump house. More than 0.4 ha (1 acre) would be impacted for the installation of the tanks and construction of the access road and pump house. Due to high slopes in the project area, there is an increased potential for soil erosion and soil compaction from large equipment used during construction. The soils at the Y-12 site are generally stable and acceptable for standard construction techniques.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. The new water tanks on Pine Ridge would be designed and constructed to meet all regulatory requirements.

Operation. No impacts to geology and soils are anticipated from the operation of Alternative 2, New Water Tanks on Pine Ridge.

4.2.3 Alternative 3 – Pump Stations Feed Loop

Construction. Construction of pumping stations on either end of the Y-12 Complex would have no impact on geologic resources. The bedrock at Y-12 is adequate to support structures using standard construction techniques.

The construction of the pump houses would require grading and excavation of soil. Less than 0.4 ha (1 acre) would be impacted from the installation of each pump station.

Operation. No impacts to geology and soils are anticipated from the operation of Alternative 3, Pump Stations Feed Loop.

4.2.4 Alternative 4 – Local Pumping Stations

Construction. The construction impacts to geology and soils would be the similar to impacts from Alternative 3, Pump Stations Feed Loop.

Operation. No impacts to geology and soils are anticipated from the operation of Alternative 4, Local Pumping Stations.

4.2.5 Alternative 5 – No Action

Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur. Therefore, no impacts to geology and soils are anticipated.

4.3 CLIMATE AND AIR QUALITY

4.3.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. The primary means by which air quality would be affected for this option would be from construction activities. Construction activities for the Proposed Action are expected to begin in February 2008 and continue for about 21 months.

During preparation and construction, the use of heavy equipment would generate combustion engine exhaust that contains air pollutants associated with diesel combustion (NO_x, CO, SO_x

[sulfur oxides], PM_{10} and VOCs). Similar air emissions would be generated from delivery vehicles that bring supplies and equipment to the construction site and from construction workers that commute to work in their personal vehicles. There would be a relatively limited amount of construction equipment and small number of construction workers. The quantities of air pollutants produced by vehicles and equipment associated with construction would not be a substantial contribution to the total emissions from mobile sources that already operate in the area and would not be expected to significantly change air quality at Y-12.

In addition, construction activities could generate an increase in fugitive dust (i.e., airborne particulate matter that escapes from a construction site) from earthmoving and other construction vehicle movement. Air emissions generated during construction would not be subject to additional permitting requirements, but would be subject to state regulations that limit nuisance conditions (TDEC Rules Chapter 1200-3-8) such as fugitive dust. Appropriate mitigation measures would be implemented in accordance with TDEC Rules for Fugitive Dust. These measures include, but are not limited to the following:

- Use, where possible, of water or chemicals for control of dust associated with land clearing and construction operations.
- Application of asphalt, water, or suitable chemicals on dirt roads, material stock piles, and other surfaces which can create airborne dusts.
- Installation and use of hoods, fans, and fabric filters to enclose and mitigate release of dusty materials. Adequate containment methods shall be employed during sandblasting or other similar operations.

The potential effect on ambient air quality from construction activities would be temporary and localized and would not affect the overall air quality of the region. The Proposed Action would not have a net effect on regional climatic conditions.

Operation. No additional boilers or other fuel-burning equipment would be added to operate the proposed facilities. There would be no increase in steam or power production from the Y-12 steam plant that would cause increased emissions of pollutants. Permit limits for the Y-12 steam plant would not be exceeded or increased. Once installed, the proposed system upgrades would not require additional workers, and therefore, no associated increase in emissions from private motor vehicles as workers commute to and from the site are expected.

4.3.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Alternative 2 would require significantly more excavation for additional pipe installation, and more grading work during site preparation and road construction. Construction would generate more fugitive dust emissions than under the Proposed Action, however, mitigation measures as described for the Proposed Action would be used. Impacts to air quality and regional climatic conditions from construction would be similar to those described for the Alternative 1, the Proposed Action.

Operation. There would be minimal impacts to air quality from the operation of Alternative 2, New Water Tanks on Pine Ridge.

4.3.3 Alternative 3 – Pump Stations Feed Loop

Construction. The potential effect on air quality from construction of Alternative 3 would be temporary, localized and less than that of the Proposed Action. Construction activities would generate fugitive dust emissions which would be addressed with the appropriate mitigation measures as discussed for the Proposed Action. Construction activities associated with Alternative 3 would not affect the overall air quality of the region or have a net effect on regional climatic conditions.

Operation. There would be minimal effect on air quality but no impact on regional climatic conditions from the operation of Alternative 3, Pump Stations Feed Loop.

4.3.4 Alternative 4 – Local Pumping Stations

Construction. The potential effect on air quality from construction of Alternative 4 would be temporary, localized and similar to the Proposed Action. Fugitive dust emissions generated during construction would be addressed with the appropriate mitigation measures as discussed for the Proposed Action.

Operation. Under Alternative 4, diesel-fired pumps may be used. There would be a minimal effect on air quality, but no impact to regional climatic conditions from the operation of Alternative 4, Local Pumping Stations.

4.3.5 Alternative 5 – No Action

Under the No Action alternative, no new construction, land disturbing activities, or operations beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur. The No Action alternative would not significantly impact the existing regional air quality or meteorology.

4.4 NOISE

4.4.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. The onsite and offsite acoustical environments would be impacted during construction of the proposed water tank installations and water distribution system upgrades. Construction activities would generate noise produced by heavy construction equipment, trucks, power tools, and percussion from pile drivers, and hammers. In addition, traffic and construction noise would be expected to increase during construction onsite and along offsite

local and regional transportation routes used to bring construction material and workers to the site. The levels of noise would be representative of levels at a medium-scale construction site. Table 4.4–1 describes peak attenuated noise levels expected from operation of construction equipment.

Relatively high and continuous levels of noise in the range of 89 to 108 dBA would be produced by heavy equipment operations during the site preparation phase of construction; however, after site preparation, heavy equipment noise would become more sporadic and brief in duration. The noise from trucks, power tools, and percussion equipment would be sustained through most of the tank construction and equipment installation activities on the proposed facility site. Because of the elevation of the tanks, approximately 381 m (1,250 ft), some construction and equipment noise would be heard outside the Y-12 Boundary.

Table 4.4–1. Peak Attenuated Noise Levels (in dBA) Expected from Operation of Construction Equipment

Source	Peak Noise Level	Distance from Source						
		15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	100 m (400 ft)	305 m (1,000 ft)	518 m (1,700 ft)	762 m (2,500 ft)
Heavy trucks	95	84-89	78-83	72-77	66-71	58-63	54-59	50-55
Dump trucks	108	88	82	76	70	62	58	54
Concrete mixer	108	85	79	73	67	59	55	51
Jackhammer	108	88	82	76	70	62	58	54
Scraper	93	80-89	74-82	68-77	60-71	54-63	50-59	46-55
Bulldozer	107	87-102	81-96	75-90	69-84	61-76	57-72	53-68
Generator	96	76	70	64	58	50	46	42
Crane	104	75-88	69-82	63-76	55-70	49-62	45-48	41-54
Loader	104	73-86	67-80	61-74	55-68	47-60	43-56	39-52
Grader	108	88-91	82-85	76-79	70-73	62-65	58-61	54-57
Dragline	105	85	79	73	67	59	55	51
Pile driver	105	95	89	83	77	69	65	61
Forklift	100	95	89	83	77	69	65	61

Note: 1ft = 0.305 m.
Source: Golden et al. 1980.

Construction activities normally would be limited to daytime hours and thus would not impact existing background noise levels at night. As construction activities reach their conclusion, sound levels on the proposed site would decrease to levels typical of daily facility operations (50 to 70 dBA). These construction noise levels would contribute to the ambient background noise levels for the duration of construction, after which ambient background noise levels would return to pre-construction levels (DOE 2001a).

The proposed site for tank installation is located about 458 m (1,500 ft) from the Y-12 boundary. Peak attenuated noise levels at offsite locations within the City of Oak Ridge from construction activities would be similar to background noise levels (53 to 62 dBA) as shown in Table 4.4–1.

The *Noise Control Act* of 1972 (42 U.S.C. §4901), and *Occupational Noise Exposure* (29 CFR 1910.95) include noise reduction and mitigation measures. For sound levels that exceed those listed in Table 4.4–2, feasible administrative or engineered controls would be used. If such controls fail to reduce sound levels to within the levels shown in Table 4.4–2, personal protective equipment (e.g., ear plugs) would be provided and used to reduce sound levels within acceptable levels. Continued compliance measures would be taken to ensure personnel do not experience hearing damage or loss.

Table 4.4–2. Permissible Noise Exposure

Duration Per Day, hours	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Note: When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

Source: DOE 2001a.

Operation. During operation of the proposed facilities, a low level of noise would be generated by operation of the water distribution equipment (pumps), the heating, ventilation, and air conditioning (HVAC) system, and the air intakes and exhaust fans. Because the water transfer pumps are indoors, the noise levels generated immediately outside the facility would be consistent with the operation of outdoor HVAC equipment at a typical office facility. Operation of the water transfer pumps and HVAC system would have a negligible effect on ambient noise levels, and the facility would satisfy the noise regulations established by Anderson County (Table 3.4–1). Operation of the elevated water tanks and other potable water systems would not require the addition of workers and would therefore not produce an increase in noise from private motor vehicles used by workers to commute to and from work.

4.4.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Noise impacts from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. Noise impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.4.3 Alternative 3 – Pump Stations Feed Loop

Construction. The onsite and offsite acoustical environments would be impacted during construction of the proposed upgrades (installation of new pump stations, connective pipe, and remote isolation valves). The level of noise would be representative of levels at a small-scale construction site. Table 4.4–1 describes peak attenuated noise levels expected from operation of construction equipment. Noise impacts from the use of heavy equipment would be the same as that of the Proposed Action.

The equipment and pipe upgrades would be installed several hundred meters from the Y-12 boundary. Peak attenuated noise levels at offsite locations within the City of Oak Ridge from construction activities would be similar to background noise levels (53 to 62 dBA) as shown in Table 4.4–1.

The *Noise Control Act* of 1972 (42 U.S.C. §4901), and *Occupational Noise Exposure* (29 CFR 1910.95) include noise reduction and mitigation measures. Similar feasible administrative or engineered control and/or personal protective equipment would be used to reduce sound levels within acceptable levels. Continued compliance measures would be taken to ensure personnel do not experience hearing damage or loss.

Operation. Operation of the new pumps would generate noise that is consistent with existing pump equipment. Operation of the new pumps would therefore have a negligible effect on ambient noise levels, and the facility would satisfy the noise regulations established by Anderson County (Table 3.4–1). Operation of the new pumps would not require the addition of workers and would therefore not produce an increase in noise from private motor vehicles used by workers to commute to and from work.

4.4.4 Alternative 4 – Local Pumping Stations

Construction. The onsite and offsite acoustical environments would be impacted during construction of the proposed six to eight pumping stations and the repair and replacement of water distribution and supply pipelines. The levels of noise would be representative of levels at a medium-scale construction site. Table 4.4–1 describes peak attenuated noise levels expected from operation of construction equipment. Noise impacts from the use of heavy equipment would be the same as that of the Proposed Action.

The equipment and pipe upgrades would be installed several hundred meters from the Y-12 boundary. Peak attenuated noise levels at offsite locations within the City of Oak Ridge from construction activities would be similar to background noise levels (53 to 62 dBA) as shown in Table 4.4–1. Noise reduction and mitigation measures would be the same as the Proposed Action.

Operation. Impacts from operation of the new pumps would be similar to those described for Alternative 3, Pumps Stations Feed Loop.

4.4.5 Alternative 5 – No Action

The No Action alternative would not have an effect on the existing acoustical environment beyond the impacts previously assessed in the Y-12 SWEIS (DOE 2001a) for continued operations and subsequent NEPA documents. Existing noise levels as described in the affected environment, Section 3.4, would be expected to continue.

4.5 WATER RESOURCES

4.5.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Under this Proposed Action, two new elevated water tanks would be installed on Bear Creek Road for both primary and backup water supply. At the project site, minimal alteration of the natural drainage pattern of the surface water would be expected during construction activities. The construction activities are not expected to impact groundwater flow or quality therefore, no impacts are expected.

Deferred maintenance activities would also be conducted as part of the Proposed Action. Fire hydrants would be replaced and backflow preventers installed. Underground water lines would be refurbished by either directly replacing (within the existing pipe), excavating above or adjacent to the existing pipes, and by rerouting of waterlines. Minimal alteration of surface water flow drainage pattern due to excavation activities along the pipeline and at building connections would be expected during construction activities. Some potential exists for temporary siltation due to surface erosion of construction and soil stockpile areas. This would be controlled by use of normal Y-12 construction techniques implementing best management practices (BMPs). The repair/replacement of underground water lines is not expected to impact groundwater flow or quality therefore, no impacts are expected.

Operation. There would be no impacts to water resources from the operation of the Proposed Action.

4.5.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. At the project site, minimal alteration of the natural drainage pattern of the surface water along the ridgetop may be expected due to construction activities. Construction activities are not expected to impact groundwater flow or quality.

Minimal alteration of surface water flow drainage pattern due to excavation activities along the pipeline and at building connections would be expected during construction activities. No effect

to groundwater flow or quality is expected from the repair/replacement of underground water lines. Surface erosion of the construction areas along Pine Ridge and from the soil stockpile areas would be controlled by use of normal Y-12 construction techniques implementing BMPs.

Operation. There would be no impacts to water resources from the operation of Alternative 2, New Water Tanks on Pine Ridge.

4.5.3 Alternative 3 – Pump Stations Feed Loop

Construction. Under Alternative 3, two pumping stations would be installed, one on either end of the plant and connected to the existing Y-12 distribution system. New transmission lines would be installed to ensure that all areas of the plant receive adequate pressure and flow. Construction would occur on previously disturbed areas, and is not expected to impact any water resources. During the repair/replacement of existing water lines surface water flow drainage pattern would be minimally altered. The repair/replacement of underground water lines and system improvements is not expected to impact groundwater flow or quality therefore, no impacts are expected.

Operation. There would be no impacts to water resources from the operation of Alternative 3, Pump Stations Feed Loop.

4.5.4 Alternative 4 – Local Pumping Stations

Construction. Under Alternative 4, no impacts to water resources are expected. The repair/replacement of underground water lines is not expected to impact groundwater flow or quality therefore, no impacts are expected.

Operation. There would be no impacts to water resources from the operation of Alternative 4, Local Pumping Stations.

4.5.5 Alternative 5 – No Action

Under the No Action alternative, the two elevated water tanks would not be installed on Bear Creek Road, and the water distribution and supply lines would not be repair or replaced. The tanks on Chestnut Ridge would continue to serve as a secondary backup water supply. There would be no change to the impacts to water resources from current operations.

4.6 ECOLOGICAL RESOURCES

4.6.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Under this Proposed Action, two new elevated water tanks would be installed on Bear Creek Road for both primary and backup water supply. The project site is an open, grassy area along Bear Creek Road, across from the North Portal parking area and approximately 300 feet west of the entrance to the City of Oak Ridge Water Treatment Facility. At the project site, ecological resources would not be affected. The Y-12 site contains no designated habitat for threatened and endangered species of plants or animals, therefore no significant impacts are expected.

Deferred maintenance activities would also be conducted as part of the Proposed Action. Underground water lines would be refurbished by either directly replacing (within the existing pipe), excavating above or adjacent to the existing pipes and reroutes. The only area of ecological resource of concern is the UEFPC. Portions of the potable water lines to be considered for repair or replacement include lines south of UEFPC. The primary concern is soil erosion into the creek due to excavation activities along the pipeline. Impact to the UEFPC would be minimized by using trenchless technologies such as pipe bursting, moving excavated material to the south side of Third Street, and implementing BMPs such as silt-fences and other control measures to prevent sediment from entering into the creek. With the implementation of construction BMPs minimal impact to UEFPC is expected.

Operation. There would be no impacts to ecological resources from the operation of the Proposed Action.

4.6.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Under Alternative 2, two water tanks would be installed on Pine Ridge at the west end of the Y-12 Complex. Pine Ridge consists of open grassy areas at the base of the ridge and forested areas on the side and top of the ridge. Installation of the tanks on Pine Ridge would require extensive grading and excavation, and the construction of an access road and pump house. Impacts to ecological resources from the installation of the new water tanks would result primarily from land clearing and result in the loss of mixed-hardwood/conifer forests which provide browse and cover. Clearing some of the forested area on Pine Ridge would increase forest fragmentation and may result in the dislocation of some small animals. However, the presence of surrounding forested areas would somewhat reduce the impact that clearing would have on habitat continuity and biological diversity. Impacts on federally and state listed species are not expected.

Operation. Impacts to ecological resources from the operation of Alternative 2, New Water Tanks on Pine Ridge, include disturbance of local fauna due to vehicle use along the access road and possible increased incidents of vehicle-induced mortality (i.e., road kills).

4.6.3 Alternative 3 – Pump Stations Feed Loop

Construction. Under Alternative 3, two pumping stations would be installed, one on either end of the Y-12 Complex and would be connected to the existing Y-12 distribution system. New transmission lines would be installed to ensure that all areas of the plant receive adequate pressure and flow. Construction would occur on previously disturbed areas, and would not impact any ecological resources. The only area of ecological resource of concern is the UEFPC during the repair/replacement of existing water lines. Minimal impacts are anticipated if BMPs are followed during the repair/replacement of existing water lines.

Operation. There would be no impacts to ecological resources from the operation of Alternative 3, Pump Stations Feed Loop.

4.6.4 Alternative 4 – Local Pumping Stations

Construction. This Proposed Action involves the installation of pumping stations at six to eight locations for high pressure, safety basis fire systems. Construction would occur on previously disturbed areas, and would not impact ecological resources. Implementation of BMPs would reduce impacts to the UEFPC during repair/replacement of existing water distribution and supply lines.

Operation. There would be no impacts to ecological resources from the operation of Alternative 4, Local Pumping Stations.

4.6.5 Alternative 5 – No Action

Under the No Action alternative, no new construction or land disturbing activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents are expected to occur. There would be no change to impacts on ecological resources from current operations or what has been previously assessed.

4.7 CULTURAL RESOURCES

4.7.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Y-12 has been previously surveyed for the presence of cultural resources. The proposed construction site for the new elevated water tanks is located in a previously disturbed area. The construction and laydown areas would be fenced during all construction activities to

prevent activities from being conducted outside these areas, and erosion control measures would be implemented during construction.

An archaeological survey has been conducted and a report was prepared in coordination with the State Historic Preservation Office (see Appendix A). There would be no effect to historic properties from construction of the new tanks. The proposed project area has been surveyed for the presence of archaeological resources. Based upon the survey, and a search of the NRHP and the site files at the Tennessee Division of Archaeology, no historic properties included in or eligible for inclusion in the NRHP, pursuant to 36 CFR 60.4, will be affected by construction on the site. The entire project lies on slopes in excess of 15 percent eliminating the potential for significant archaeological sites. Additionally, a large number of non-specific utilities (above and below ground) cross the area. No undisturbed areas were observed during the survey due to the maintenance of the slopes in the cleared state (DuVall 2005; Appendix A).

The historic district includes much of the Y-12 site; however the proposed site is not located within the district or near the two buildings proposed for National Historic Landmark status or other properties eligible for inclusion in the National Register. The proposed undertaking to install two new elevated water tanks on Bear Creek Road would not adversely affect any properties eligible for listing in the NRHP.

Operation. There would be no impact on historic properties from the operation the Proposed Action.

4.7.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. No historic properties included in or eligible for inclusion in the NRHP, pursuant to 36 CFR 60.4, would be affected by construction on the site. The entire project lies on slopes in excess of 15 percent eliminating the potential for significant archaeological sites.

Operation. There would be no impact on historic properties from the operation of Alternative 2, New Water Tanks on Pine Ridge.

4.7.3 Alternative 3– Pump Stations Feed Loop

Construction. Under Alternative 3, two pumping stations would be installed, one on either end of the Y-12 Complex, and connected to the existing Y-12 potable water system. New distribution and supply lines would be installed to ensure that all areas of Y-12 received adequate pressure and flow. Cultural impacts from construction and operation would be similar to those described for Alternative 1, the Proposed Action.

Operation. There would be no impact on historic properties from the operation of Alternative 3, Pump Stations Feed Loop.

4.7.4 Alternative 4 – Local Pumping Stations

Construction. Under Alternative 4, pumping stations would be installed at six to eight locations for high pressure, safety basis fire systems. Cultural impacts from construction and operation would be similar to those described for Alternative 1, the Proposed Action.

Operation. There would be no impact on historic properties from the operation of the Alternative 4, Local Pumping Stations.

4.7.5 Alternative 5 – No Action

Under the No Action alternative, no new construction or other activities beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents would occur. There would be no impacts to historic properties.

4.8 SOCIOECONOMICS

Socioeconomic impacts are determined relative to the context of the affected environment. Projected baseline conditions in the ROI, as presented in Section 3.8, provide the framework for analyzing the importance of potential socioeconomic impacts that could result from implementation of the Proposed Action or Alternatives.

4.8.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Under the Proposed Action, two elevated water tanks would be installed on Bear Creek Road, approximately 91 m (300 ft) west of the entrance to the City of Oak Ridge Water Treatment Facility. The construction period is scheduled for approximately 2 years beginning in 2008.

Construction under the Proposed Action would require approximately 40 workers annually, and would have short- and long-term positive benefits on employment and income in the region. It is expected that most of the construction jobs would be filled by the existing labor force, so there would be no noticeable effect on regional income, housing markets, or the demand for community services.

Operation. There would be no net change in employment because current personnel would be able to maintain and operate the improved potable water system.

4.8.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Under Alternative 2, two new water tanks would be constructed on Pine Ridge at the west end of the Y-12 Complex. While this location provides the highest natural elevation

for the tanks, it also requires additional construction beyond that required for the Proposed Action. A long run of new piping would need to be installed from the tanks on the ridge to the ties-ins near Bear Creek Road. Additional grading, road building and pump house construction would also be necessary. Because of the additional work required, Alternative 2 would require a yearly average of approximately 50 workers. Socioeconomic impacts from construction would be slightly more than those described for Alternative 1, the Proposed Action.

Operation. There would be no net change in employment because current personnel would be able to maintain and operate the improved potable water system.

4.8.3 Alternative 3 – Pump Stations Feed Loop

Construction. Under Alternative 3, two pumping stations would be installed at either end of Y-12 with additional piping to connect the stations to the existing grid. A yearly average of approximately 30 workers would be required under this alternative. Socioeconomic impacts from construction would be less than those described for Alternative 1, the Proposed Action.

Operation. There would be no net change in employment because current personnel would be able to maintain and operate the improved potable water system.

4.8.4 Alternative 4 – Local Pumping Stations

Construction. Under Alternative 4, six to eight local pumping stations would be installed at six to eight locations for high pressure, safety basis fire systems. This alternative would require a yearly average of approximately 50 workers. Socioeconomic impacts from construction would be slightly more than to those described for Alternative 1, the Proposed Action.

Operation. There would be no net change in employment because current personnel would be able to maintain and operate the improved potable water system.

4.8.5 Alternative 5 – No Action

Under No Action, none of the needed repairs or upgrades would be made to the Y-12 potable water system. There would be no construction workers employed from the pool of such workers in the ROI, and therefore there would be no short- or long-term positive benefits on employment and income in the region from construction work related to this action.

While the number of operations personnel is expected to remain the same under all alternatives, it is likely that under the No Action alternative, operations personnel would face greater burdens over time trying to maintain an aging and deteriorating potable water system. It is also possible that if maintenance is deferred for long enough, repair crews may be required if the potable water system deteriorates to such a point as to be beyond the capacity for the M&O contractor staff to repair. The hiring of repair crews from the ROI on an "as-needed" basis

would only have intermittent and short-term positive benefits on employment and income in the region, and no effects on the housing market or in the demand for community services.

4.9 ENVIRONMENTAL JUSTICE

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, environmental justice analyses identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations. Adverse health effects may include bodily impairment, infirmity, illness, or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment.

Disproportionately high and adverse human health effects are identified by assessing these three factors:

- Whether the adverse health effects, which may be measured in risks or rates, are significant or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.

- Whether health effects occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

- Whether the risk or rate of exposure to a minority population or low-income population to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.

As discussed in Section 3.9, of the three census tracts analyzed for the presence of minority and low-income populations, only census tract 201, in Anderson County, meets the criteria for having a minority population. When considering the aggregate of the minorities, the sum of all minorities in the tract, the total percentage is more than 20 percentage points higher than the state percentage.

4.9.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. As discussed in Sections 4.1 through 4.13, Alternative 1 would pose no appreciable health and/or environmental risks to the public, and therefore, no disproportionately high and adverse effects to minority populations or low-income populations. In addition, there are no special circumstances that would result in disproportionately high and adverse impacts on minority or low-income populations from any exposure pathway. Therefore, there would be no environmental justice impacts.

Operation. There would be no environmental justice impacts from the operation of the Proposed Action.

4.9.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. As discussed in Sections 4.1 through 4.13, Alternative 2 would pose no appreciable health and/or environmental risks to the public, and therefore, no disproportionately high and adverse effects to minority populations or low-income populations. There would be no environmental justice impacts from the construction of Alternative 2, New Water Tanks on Pine Ridge.

Operation. There would be no environmental justice impacts from the operation of Alternative 2, New Tanks on Pine Ridge.

4.9.3 Alternative 3 – Pump Stations Feed Loop

Construction. As discussed in Sections 4.1 through 4.13, Alternative 3 would pose no appreciable health and/or environmental risks to the public, and therefore, no disproportionately high and adverse effects to minority populations or low-income populations. There would be no environmental justice impacts from the construction of Alternative 3, Pump Stations Feed Loop.

Operation. There would be no environmental justice impacts from operation of Alternative 3, Pump Stations Feed Loop.

4.9.4 Alternative 4 – Local Pumping Stations

Construction. As discussed in Sections 4.1 through 4.13, Alternative 4 would pose no appreciable health and/or environmental risks to the public, and therefore, no disproportionately high and adverse effects to minority populations or low-income populations. There would be no environmental justice impacts from the construction of Alternative 4, Local Pumping Stations.

Operation. There would be no environmental justice impacts from operation of Alternative 4, Local Pumping Stations.

4.9.5 Alternative 5 – No Action

For environmental justice impacts to occur there must be disproportionately high and adverse human or environmental impacts on minority populations or low-income populations. As discussed in Sections 4.1 through 4.13, adverse impacts to human health or the environment from implementation of the No Action alternative would be negligible, and there are no special

circumstances that would result in disproportionately high and adverse impacts on minority or low-income populations. Therefore, there would be no environmental justice impacts.

4.10 TRAFFIC AND TRANSPORTATION SAFETY

4.10.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Under the Proposed Action there would be a minimal increase in traffic during installation of the new elevated water tanks. Minor traffic interruptions would be expected along Bear Creek Road at or near the project site due to construction vehicles entering and leaving the site. Tank installation activities would be temporary and would not result in long-term effects. Maintenance activities on the distribution and water supply lines are not expected to impact traffic and transportation at Y-12.

Operation. During operation, there would be no change in employee traffic along Bear Creek Road because the system would continue to be operated by current Y-12 employees.

4.10.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Impacts to traffic and transportation would be similar to those described for Alternative 1, the Proposed Action.

Operation. Under Alternative 2, there would be no change in employee traffic along Bear Creek Road and no impacts to traffic and transportation.

4.10.3 Alternative 3 – Pump Stations Feed Loop

Construction. Construction-related transportation impacts are expected to be temporary, localized to the general construction area, and minor since most construction traffic would occur during off-peak traffic periods.

Operation. Under Alternative 3, there would be no change in employee traffic along Bear Creek Road and no impacts to traffic and transportation.

4.10.4 Alternative 4 – Local Pumping Stations

Construction. Impacts to traffic and transportation from the construction would be similar to those described for Alternative 3, Pump Stations Feed Loop.

Operation. Under Alternative 4, there would be no change in employee traffic along Bear Creek Road and no impacts to traffic and transportation.

4.10.5 Alternative 5 – No Action

Primary roads on the ORR serving Y-12 include SRs 58, 62, 95, 170 (Bethel Valley Road) and Bear Creek Road. All are public roads except Bear Creek Road which traverses the ORR. Traffic statistics associated with No Action alternative are shown in Table 3.10–1. Average daily traffic on the ORR and area roads serving Y-12 ranges from 9,350 at Bethel Valley Road to 31,620 at SR 62. Major off-site area roads for long-distance transport of materials and waste include I-40, I-75, and I-81. There would be no change in traffic and transportation effects under the No Action alternative.

4.11 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

4.11.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Occupational hazards associated with construction of the facility would be considered standard industrial hazards. Such hazards are defined as meeting one of the following criteria: (1) routinely encountered or accepted by the public in everyday life; (2) encountered in general industry and significantly affecting a large number of people; or (3) encountered in general industry and controlled through the application of recognized codes and safety standards [e.g., OSHA standards]. Workers would comply with the applicable DOE Order 5480.9, "Construction Safety and Health Program" and all applicable OSHA regulations (e.g., 29 CFR 1926) and Y-12 safety provisions to mitigate the incidence of equipment-related injuries or illnesses. The estimated construction workforce was multiplied by the 5-year averaged non-fatal injury rate (per 100 workers) to obtain the total number of non-fatal injuries/illnesses for each alternative (Table 4.11-1). As shown in that table, construction of the Proposed Action would be expected to result in 6.6 non-fatal injuries.

Table 4.11–1. Non-Fatal Construction Injuries for the Alternatives

	Proposed Action	Pump Station Feed Loop	New Water Tanks on Pine Ridge/Local Pumping Stations	No Action
Total Construction (Man-years)	80	60	100	0
Projected Injuries[a]	6.6	5.0	8.3	0

[a] Based upon an average injury rate of 8.3 non-fatal construction injuries/100 man-years.
Source: DOE 2001a.

All activities would be conducted in full accordance with DOE/NNSA policies regarding protection of personnel and the environment. Any materials removed from the construction site, such as wastes, would be contained and checked for radioactivity/toxicity and disposed of based on the content of the waste. To avoid exposure from potential spills of liquids during

construction, construction personnel would be trained in accordance with Y-12 spill prevention control countermeasures and contingency plans.

Based on the seismic history of the area, a moderate seismic risk exists at Y-12. However, this should not impact the construction and operation of the water tanks on Bear Creek Road since the design criteria considers appropriate structural design factors for natural phenomena (seismic). There are no known currently active faults within or adjacent to the proposed project site. Slopes and underlying foundation materials are generally stable at Y-12. The foundation soils are not susceptible to liquefaction. The elevated water tanks would be designed to withstand the maximum expected earthquake-generated ground acceleration in accordance with DOE Order 420.1, *Facility Safety*, and accompanying safety guidelines. As such, catastrophic failure of the elevated water tanks is considered extremely unlikely.

Operation. Improvements to the Y-12 potable water system would result in a reduced risk to Y-12 workers and the surrounding public. The Proposed Action would: (1) provide Y-12 with control and monitoring of water coming into the Y-12 distribution system to ensure adequate water flow and pressure; (2) replace approximately 40 obsolete fire hydrants; and (3) install additional backflow prevention. These improvements ensure water circulation in all distribution lines to maintain chlorine residuals and provide adequate pressure and capacity to address abnormal system circumstances.

The Proposed Action could potentially involve the stockpiling, transport and disposal of hazardous materials generated by the excavations of contaminated soil addressed in Section 4.12 Waste Management. The Proposed Action would not introduce any new hazardous materials.

4.11.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Health and safety impacts from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. Health and safety impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.11.3 Alternative 3 – Pump Stations Feed Loop

Construction. Occupational hazards associated with construction of the pump station feed loops would be considered standard industrial hazards. Workers would comply with the applicable DOE Order 5480.9, all applicable OSHA regulations and Y-12 safety provisions to mitigate the incidence of equipment-related injuries or illnesses. As shown in Table 4.11-1, construction of the Pump Stations Feed Loop would be expected to result in 5 non-fatal injuries.

Operation. Health and safety impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.11.4 Alternative 4 – Local Pumping Stations

Construction. Occupational hazards associated with construction of Alternative 4 would be considered standard industrial hazards. Workers would comply with the applicable DOE Order 5480.9, all applicable OSHA regulations and Y-12 safety provisions to mitigate the incidence of equipment-related injuries or illnesses. As shown in that Table 4.11-1, construction of the Local Pumping Stations would be expected to result in 8.3 non-fatal injuries.

Operation. Health and safety impacts from operation would be similar to those described for Alternative 1, the Proposed Action.

4.11.5 Alternative 5 – No Action

Under the No Action alternative, the Y-12 potable water system would continue to degrade and would require major maintenance in order to continue to operate. Without the necessary upgrades, the system may violate drinking water protection requirements and risk future state findings. Furthermore, there would be an increased risk of system failure, resulting in a direct negative impact on the Y-12 mission, on the health and safety of workers, and the water quality of the UEFPC.

4.12 WASTE MANAGEMENT

4.12.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Under the Proposed Action, two new elevated water tanks would be installed on Bear Creek Road for both primary and backup water supply. The Proposed Action would correct deficiencies associated with deferred maintenance activities. Underground water lines would be refurbished by directly replacing (within the existing pipe), excavating above or adjacent to the existing pipes, and rerouting water lines. Waste and recycle materials would be surveyed or reviewed and tagged by Radiological Control personnel unless noted otherwise. Waste materials, not including recyclable materials, would be characterized and packaged in accordance with the requirements of the master waste profiles in effect at the time of generation. Should wastes not previously identified be generated during the course of the project, the project subcontract technical representative would be contacted for instructions.

Soil. The largest volume of material requiring disposition would be soil from the various excavations. All soil would be characterized. Large portions of excavated soil would be reused as fill material in excavated areas, where suitable. The disposition of excess soil that cannot be replaced into the excavated areas would be managed in accordance with the *Soil Management*

Plan for the Oak Ridge Y-12 National Security Complex (Y/SUB/92-28B99923C-Y05, Rev. 1). Soil exceeding 35 pCi/g specific activity would be managed as low-level radioactive waste (LLRW). LLRW containers would be managed in accordance with procedure Y71-936, *Radioactive Waste Management at the Y-12 Complex*. Soil from areas having a high probability of mercury contamination would be sampled for mercury and the presence of suspected contaminants (i.e., mercury, volatile organics, PCB, *Resource Conservation and Recovery Act* (RCRA) hazardous constituents, and heavy metals) would require that the soil be managed in special accumulation areas and sent to off-site facilities for treatment and disposal (DOE 2005f). Regulated PCB and/or RCRA waste would be managed in accordance with the requirements of the EPA and the TDEC. Excavated soil absent of regulated quantities of contaminants may be stockpiled for short periods with appropriate run-on/run-off protection prior to final disposition.

Project subcontractors would minimize the volumes of excess soil to be dispositioned by maximizing reuse of excavated material as backfill, spreading excess soil in the area where it originated, and avoiding excavation when alternative pipe refurbishment methods can be employed.

Containerized wastewater and water/glycol solution. Water that cannot be discharged in accordance with the BMP Plan would be collected in portable tanks such as intermediate bulk containers, tanker truck trailers, or drums for treatment. Propylene glycol would be drained from fire protection systems as necessary to allow installation of backflow prevention. The glycol that is not returned to the system would be dispositioned or managed in the same manner as wastewater (DOE 2005f).

*Storm water and groundwater***.** Control and discharge of storm water and groundwater would be in accordance with the BMP Plan and Storm Water Pollution Prevention Plan. Discharges to the storm drain that are not covered by the BMP Plan or Storm Water Pollution Prevention Plan would be evaluated on a case-by-case basis.

Sanitary trash. Sanitary trash such as lunch bags, food waste, plastic, and paper would be deposited in green sanitary waste dumpsters or transported to the onsite Industrial Landfill V (ILFV) or state-approved landfill.

Wood. Scrap wood, including excess pallets would be segregated into painted or treated wood and unpainted untreated wood. Painted or treated wood would be transported to the onsite Construction Demolition Landfill VII (CDL VII) or state-approved landfill. Unpainted untreated wood would be recycled (DOE 2005f).

Scrap metal. Unpainted scrap metal that has not been in a posted radiological area and that is approved by Radiological Control personnel for release to the public would be recycled. Scrap metal that is generated from a posted radiological area cannot be recycled. Clean scrap metal would be transported to the onsite CDL VII for disposal. Painted metal with PCB concentrations of 50 ppm or greater would be managed as bulk PCB regulated waste.

Radiologically-contaminated metal with bulk PCB concentration of 50 ppm or greater would be containerized as mixed waste.

Asphalt and concrete. Asphalt and concrete would be surveyed and evaluated by Radiological Control personnel before being disturbed. Any radiologically-contaminated asphalt or concrete would be removed and containerized as LLRW and managed in accordance with Procedure Y71-936, *Radioactive Waste Management at the Y-12 Complex*. Asphalt and concrete approved by Radiological Control personnel would be transported to the onsite CDL VII for disposal.

Sewer pipe. Clay, concrete or cast iron pipe from storm and sanitary sewer lines may be encountered. Pipe that can be approved by Radiological Control personnel would be disposed of in CDL VII. Large accumulations of sediment within the pipe should be evaluated by the Environmental Compliance organization to determine the need for sampling for possible hazardous constituents. Pipe that is determined to be radiologically-contaminated would be containerized for disposal as LLRW.

Asbestos insulation. Friable asbestos-containing materials (ACM), such as insulation, that can be approved by Radiological Control personnel would be packaged and sealed tightly in double-bagged 6-mil-thick plastic bags, double-wrapped 6-mil-thick plastic sheeting, or secured in drums or boxes. Asbestos insulation would be removed from pipes greater than 20 cm (8 in) in diameter. The pipes may then be handled as scrap metal if they are not coated with paint containing PCB at a concentration of 2 ppm or greater. Insulation may be left on pipes with diameter of 20 cm (8 in) or less, and the entire waste may be managed as ACM. ACM meeting the waste acceptance criteria would be disposed of as a special waste onsite at ILFV.

*Non-asbestos insulation***.** Non-asbestos insulation would be surveyed by Radiological Control personnel before removal. Insulation that meets the waste acceptance criteria of the ILFV would be packaged and tightly sealed in single 6-mil-thick plastic bags, wrapped in 6-mil-thick plastic sheets, fiber drums, metal drums, plywood boxes, or metal boxes. The packages would be transported to ILFV by the construction subcontractor in such a manner to prevent airborne release or loss of the waste.

Corrugated cardboard and aluminum beverage cans. Corrugated cardboard and aluminum beverage cans would be recycled. There would be no environmental impact resulting from waste management of generated wastes from the Proposed Action.

Operation. There would be no change to current waste generation from the operation of Alternative 1, the Proposed Action.

4.12.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Impacts to current waste management at Y-12 from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. There would be no change to current waste generation from the operation of Alternative 2, New Water Tanks on Pine Ridge.

4.12.3 Alternative 3 – Pump Stations Feed Loop

Construction. Impacts to current waste management at Y-12 from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. There would be no change to current waste generation from the operation of Alternative 3, Pump Stations Feed Loop.

4.12.4 Alternative 4 – Local Pumping Stations

Construction. Impacts to current waste management at Y-12 from construction would be similar to those described for Alternative 1, the Proposed Action.

Operation. There would be no change to current waste generation from the operation of Alternative 4, Local Pumping Stations.

4.12.5 Alternative 5 – No Action

Under the No Action alternative, there would be no change to waste generation from that of current operations.

4.13 VISUAL RESOURCES

The visual resources analysis considers a ROI which includes those lands from which the Y-12 Complex is visible (viewshed). Impacts to the ROI include those associated with changes in the existing landscape character resulting from construction activities and operations under the No Action and the action alternatives.

4.13.1 Alternative 1 – New Elevated Water Tanks on Bear Creek Road (Proposed Action)

Construction. Under the Proposed Action, two new elevated water tanks would be installed on Bear Creek Road. The new elevated water tanks would exceed the height of the two meteorological towers, which are currently the tallest structures on Y-12. Construction staging and lay-down areas would be located at the proposed project site along Bear Creek Road, and existing roads would be used to support construction needs. Temporary construction fencing would also be installed during construction activities.

Short-term visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be limited to the construction staging and lay-down areas and the immediate

construction site of the new elevated water tanks. Construction activities would be visible from Bear Creek Road, Chestnut Ridge, and Pine Ridge. However, since the portion of Bear Creek Road in the project area is not a public thoroughfare and both Chestnut Ridge and Pine Ridge are restricted within the ORR boundary and accessible only by dirt road or by foot, short-term visual impacts to the public would be minimal. Following construction activities, the construction lay-down areas would be revegetated and incorporated into the landscape design of Y-12.

Operation. The proposed elevated water tanks would exceed the height of the two meteorological towers and would be the tallest structures located within the Y-12 Complex. The proposed potable water tanks would appreciably modify the visual quality of the existing landscape of the Y-12 Complex. The water tanks would be approximately 30 m (100 ft) in diameter and the top of the tanks would be approximately 76 m (250 ft) above grade. Figures 4.13-1 through 4.13-3 show visual renderings the proposed elevated water tanks, across from the proposed Production Interface Facility and the North Portal parking area. The elevated water tanks would be visible from Bear Creek Road and Chestnut Ridge.

Figure 4.13-1. Visual Rendering of Elevated Water Tanks at Y-12 – Looking Northwest.

Figure 4.13-2. Visual Rendering of Elevated Water Tanks at Y-12 – Looking West.

Figure 4.13-3. Visual Rendering of Elevated Water Tanks at Y-12 – Looking North.

The Y-12 Complex is consistent with VRM Class IV which is used to describe a highly developed area. Most of the land surrounding the Y-12 site would be consistent with VRM Class II and III (i.e., left to its natural state with little to moderate changes). The viewpoints from public access roadways such as Bear Creek Road and Scarboro Road would be altered by

the elevated water tanks, which would be the dominant structure on the landscape. The fluted pillar supporting the elevated water tanks would be partially shielded by vegetation from the densely wooded area on Pine Ridge however, part of the elevated water tanks would be slightly visible in the City of Oak Ridge.

4.13.2 Alternative 2 – New Water Tanks on Pine Ridge

Construction. Visual impacts from the construction of the two water tanks on Pine Ridge would be similar to those described for Alternative 1, the Proposed Action.

Operation. As shown in Figure 4.13-4, the tanks would be partially shielded by vegetation on Pine Ridge and partially visible within the viewshed. The tanks would be visible from Bear Creek and Scarboro roads and slightly more visible in the City of Oak Ridge than the elevated water tanks since vegetation in the project area would be removed to install these tanks. However, the tanks would not be as dominant a feature on the landscape as the elevated tanks in the Proposed Action.

Figure 4.13-4. Visual Rendering of Water Tank on Pine Ridge – Looking Northwest.

4.13.3 Alternative 3 – Pump Stations Feed Loop

Construction. Under Alternative 3, two pumping stations would be installed, one on either end of the Y-12 Complex and connected to the existing Y-12 potable water system. New distribution

and supply lines would be installed to ensure that all areas of the Y-12 Complex receive adequate pressure and flow. Construction activities (dust, equipment exhaust, etc.) would occur on previously disturbed areas and would be short-term and limited to the construction lay-down area and the immediate construction site of the new pumping stations, therefore construction activities would not alter the visual character of the Y-12 Complex.

Operation. Due to its industrial surroundings, the operation of the two pumping stations would not alter the visual character of the Y-12 Complex, and long-range views would not be adversely affected.

4.13.4 Alternative 4 – Local Pumping Stations

Construction. Under Alternative 4, pumping station would be installed at six to eight locations for high pressure, safety basis fire systems. Construction impacts would be similar to those described under Alternative 3, Pump Stations Feed Loop.

Operation. Impacts due to operation of the local pumping stations would be similar to those described under Alternative 3, Pump Stations Feed Loop.

4.13.5 Alternative 5 – No Action

Under the No Action alternative, no new construction or other activities that would disturb the viewshed of the Y-12 Complex would occur beyond those previously assessed in the Y-12 SWEIS (DOE 2001a) and subsequent NEPA documents. Therefore, no impacts to visual resources are anticipated.

5.0 CUMULATIVE IMPACTS

Under all the alternatives analyzed in this EA, cumulative impacts would be minor or insignificant for all resource areas assessed. Impacts to land use would range from "no change to continued operations" (No Action alternative) to more than 0.4 ha (1 acre) for the installation of the two water tanks on Pine Ridge. This would involve significantly less than one 1 percent of the available land at Y-12. Repair and/or replacement of existing potable water infrastructure, and the installation of the water tanks would have no cumulative impact to geology and soils because of the stability of soils at Y-12, and because all facilities would comply with regulatory requirements. Air quality at Y-12 is generally good. With the exception of the 8-hour O_3 (ozone) and $PM_{2.5}$ standards, the greater Knoxville and Oak Ridge areas are in attainment with the NAAQS for all other criteria pollutants for which EPA has made attainment designations. The alternatives analyzed in this EA would not have an adverse cumulative impact on air quality or regional climatic conditions.

All the alternatives analyzed, except for the No Action alternative, would have a beneficial effect on the existing Y-12 potable water system by repairing or replacing original water distribution and supply lines, and maintaining proper chlorine residuals in the system. There would be no negative effects on the groundwater and surface water resources. Because there are no critical habitats for threatened or endangered species, and because of the absence of any significant ecological resources at any of the locations potentially affected by the alternatives, no cumulative impacts to ecological resources are expected. This conclusion is also true for cultural resources. Socioeconomics would be relatively unchanged by any of the alternatives because the alternatives would not create a significant number of jobs, and would not exceed housing demands, community services, or transportation capabilities. With respect to human health, improvements to the potable water system would ensure water circulation in all distribution lines to maintain chlorine residuals and provide adequate pressure and capacity to address abnormal system circumstances. Waste management activities would be unaffected by the alternatives. All wastes generated would be managed and disposed of in accordance with the project-specific waste management plan and in compliance with all regulatory requirements. Although viewscape impact would be affected by the proposed elevated water tanks, the overall visual classification of Y-12 would not change as a highly developed site.

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7.0 LIST OF AGENCIES AND ENTITIES CONTACTED

Tennessee Department of Environment and Conservation

Tennessee Historical Commission

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APPENDIX A

A PHASE I ARCHAEOLOGICAL SURVEY OF THE PROPOSED POTABLE WATER STORAGE AND FORCE MAIN FACILITIES
Y-12 NATIONAL SECURITY COMPLEX SITE ANDERSON COUNTY, TENNESSEE

A PHASE I ARCHAEOLOGICAL SURVEY OF PROPOSED POTABLE WATER STORAGE AND FORCE MAIN FACILITIES Y-12 NATIONAL SECURITY COMPLEX SITE ANDERSON COUNTY, TENNESSEE

Negative Findings Report

Prepared by

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Lead Agency: United States Department of Energy

August 2005

MANAGEMENT SUMMARY

A Phase I archaeological survey of the area of potential effect of the proposed project was conducted on August 17, 2005. The impact area of the project is limited to the steep side slopes north of Bear Creek Road and the Y-12 National Security Complex. The project consists of the location of two 2.5 million gallon water storage tanks and approximately 8,000 linear feet of force main. The purpose of the project is to provide potable water and additional fire protection to the complex.

The survey to assess adverse impacts to cultural resources located within the area of potential effect (APE) of Federally-licensed, permitted, funded or assisted projects was conducted in compliance with the National Historic Preservation Act of 1966 (Public Law 89-665; 16 USC 470; 80 Stat. 915), National Environmental Policy Act of 1969 (Public Law 91-190; 91 Stat. 852; 42 USC 4321-4347) and Executive Order 11593 (May 13, 1971).

Based upon the survey, a search of the site files at the Tennessee Division of Archaeology and a search of the National Register of Historic Places, no historic properties included in or eligible for inclusion in the National Register of Historic Places, pursuant to 36 CFR 60.4, will be affected by construction on the site. The entire project lies on slopes in excess of 15% eliminating the potential for significant archaeological sites.

Additionally, a large number of non-specific utilities (above and below ground) cross the area. No undisturbed areas were observed during the survey due to the maintenance of the slopes in the cleared state.

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A PHASE I ARCHAEOLOGICAL SURVEY OF PROPOSED POTABLE WATER STORAGE AND FORCE MAIN FACILITIES Y-12 NATIONAL SECURITY COMPLEX SITE ANDERSON COUNTY, TENNESSEE

INTRODUCTION

At the request of the U.S. Department of Energy and Spectra Tech, Inc., Oak Ridge, Tennessee, a Phase I archaeological survey of the area of potential effect of the project was conducted on August 17, 2005. The impact area of the project is limited to the steep side slopes north of Bear Creek Road and the Y-12 National Security Complex (Figure 1). The project was conducted by Glyn D. DuVall, Principal Investigator, Mr. Robb Unger, Spectra Tech, Inc., and Mike Watkins, Y-12 photographer.

The survey to assess adverse impacts to cultural resources located within the area of potential effect (APE) of Federally-licensed, permitted, funded or assisted projects was conducted in compliance with the National Historic Preservation Act of 1966 (Public Law 89-665; 16 USC 470; 80 Stat. 915), National Environmental Policy Act of 1969 (Public Law 91-190; 91 Stat. 852; 42 USC 4321-4347) and Executive Order 11593 (May 13, 1971).

PROJECT DESCRIPTION

The project consists of the location of two 2.5 million gallon water storage tanks and approximately 8,000 linear feet of force main. The purpose of the project is to provide potable water and additional fire protection to the complex.

ENVIRONMENTAL SETTING

Due to the size of the Oak Ridge Reservation and its location in portions of two counties, all descriptions will incorporate the sections of those counties and treat them as a single entity. Anderson and Roane Counties (Figure 2) are located in the Great Valley of East Tennessee, a part of the Ridge and Valley Physiographic Province that extends from New York State to Central Alabama (Fenneman 1938). The Great Valley is characterized by numerous elongate, parallel ridges and intervening valleys created by severe faulting and folding. The trend of these valleys is northeast to southwest. Relief in the Ridge and Valley will vary as much as 300 feet (Hubbard, et al, 1956:5). The terrain is rugged and ranges from moderately steep to very steep.

The underlying rocks are almost wholly sedimentary (mainly limestones and dolomites) of Ordovician age. Also present are some harder shales, sandstones and siltstones. Cherty gravel deposited from eroded limestone and dolomite is present along many of the ridge tops.

The climate classification of the area is the mesothermal (Cfa) hot summer (Koeppe and DeLong 1958: 247-254). Regionally, the general air movement in the summer is from the southwest which results in strong convection currents and locally intense thunderstorms.

Although heavy thunderstorms are frequent, the maximum rainfall occurs in the winter and spring months. Precipitation records for the area indicate that about 55 inches occur annually with a mean annual temperature of 57^{o} F. Temperatures below 0^{o} F and above 100^{o} F are rare and periods of prolonged very hot or very cold temperatures are unusual.

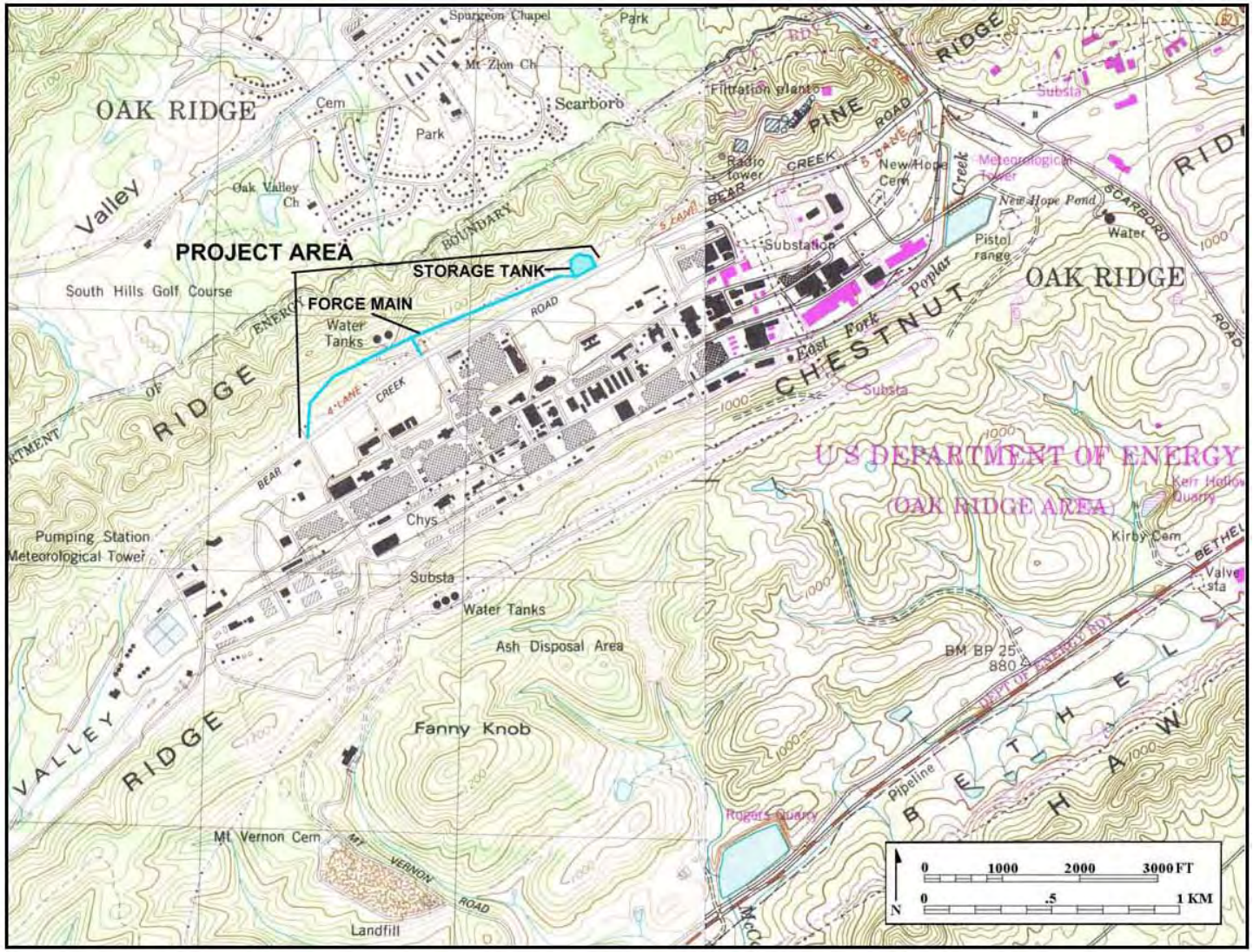

FIGURE 1: PROJECT LOCATION MAP.

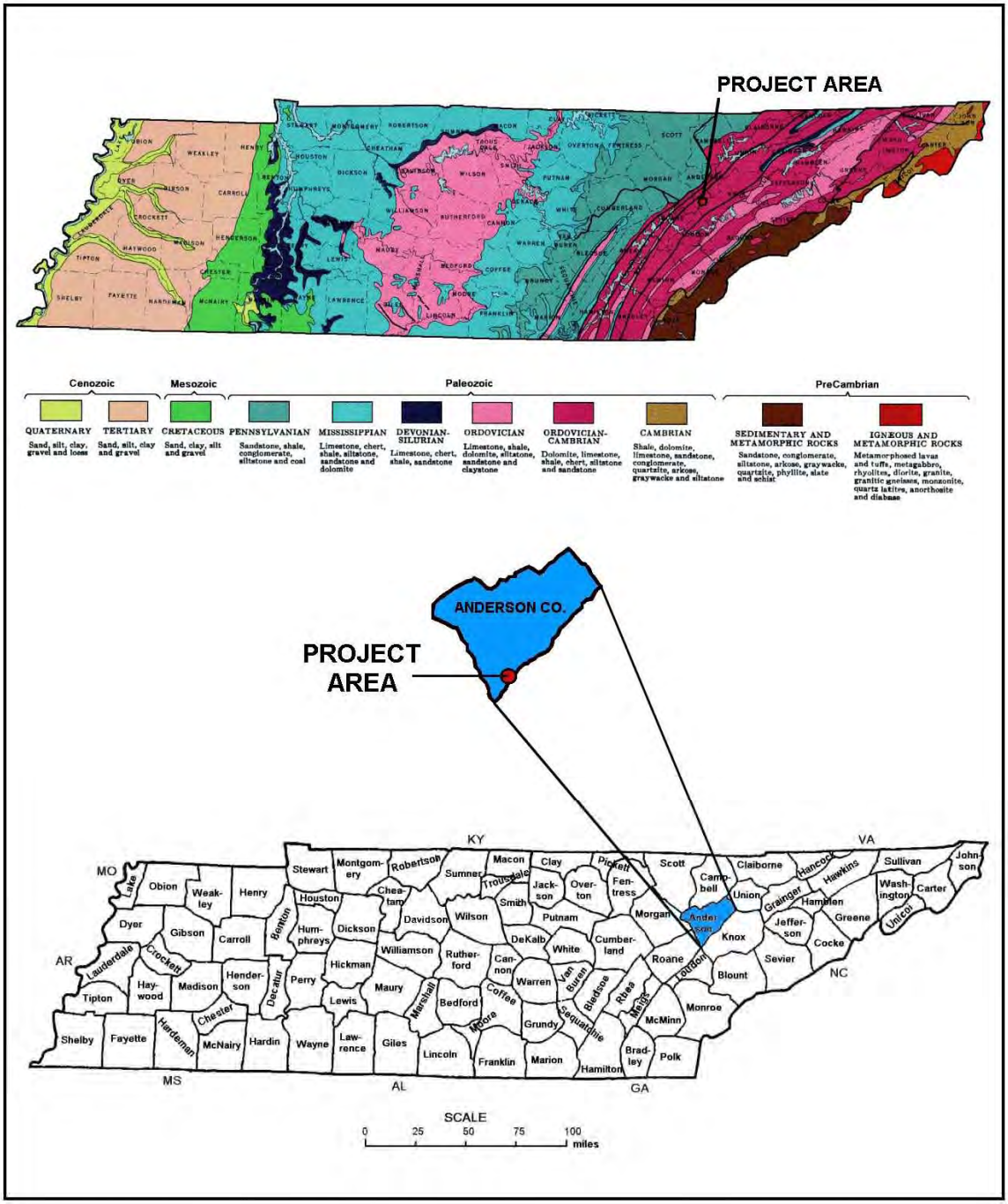

FIGURE 2: PHYSIOGRAPHIC AND POLITICAL MAP OF TENNESSEE SHOWING ANDERSON COUNTY.

ARCHAEOLOGICAL BACKGROUND

A minimum of ten major reconnaissance level surveys have been conducted on the reservation with many sufficiently documented in a management plan prepared by the Department of Energy (1983).

The first reported reconnaissance of the area was conducted along portions of the Clinch River by Cyrus Thomas (1894) and reported in the Bureau of American Ethnology. He reported a visit to the Lee Farm Site (40RE27) and a visit to Jones Island (40RE28).

Two Woodland mound sites, the Crawford Farm Mounds (40AN21) and the Freels Farm Mounds (40AN22), located on the reservation were excavated by Webb (1938) during the construction of the Norris Dam.

Construction of the Watts Bar Reservoir resulted in a survey of portions of the Clinch River, mainly in the narrow bench areas and terraces along the main channel. Numerous sites along the course were identified facilitated by almost ideal survey conditions (Nash 1941).

Construction of the Melton Hill Dam resulted in several investigations by the University of Tennessee (McNutt and Graham 1961; McNutt and Fisher 1960): sites 40AN2 (UT Farm Site), 40AN8 (Freels Bend Site) and 40AN20 (Bull Bluff Site). The most extensively occupied of these appeared to be 40AN20 which contained Woodland, Mississippian and Euro-American artifacts.

During 1972, archaeological investigations were initiated on the proposed site of the Clinch River Breeder Reactor Project (CRBRP). Schroedl (1972) relocated sites 40RE104-40RE108 originally recorded during Nash's 1941 survey. Additionally, four historic Euro-American farmsteads and a cemetery were recorded.

A follow-up study of the CRBRP site was conducted by Schroedl (1974) following the acquisition of 1940 survey maps from the Tennessee Valley Authority. The major emphasis of the survey was the relocation of the structural areas and comparison of current conditions to those present at the time of the acquisition of the ORR by the Corps of Engineers in 1942. The findings indicated that some of the original locations were intact with all structures present while others contained no evidence of former structure locations.

Fielder's 1974 and 1977 surveys of specific areas of the ORR focused on the prehistoric and historic sites, respectively. The 1974 survey relocated and identified 45 sites dating from the Paleoindian through the Historic Euroamerican Period with no conclusive evidence for any historic Native American occupations within the ORR. The 1977 survey focused on the numerous structures and former structure areas partially noted in previous surveys. A total of 415 structures ranging from houses to barns and sheds was identified. Of these, one structure (The Freels Cabin) was considered eligible for inclusion in the National Register of Historic Places (Fielder, et al, 1974:41).

A survey of approximately 1400 acres for the proposed Tennessee Synfuels Associates site was conducted by GAI, Inc. during the summer of 1981. The survey and testing program relocated and evaluated five previously recorded sites. The overall results included the identification of three cemeteries and associated residential areas and one house complex. Prehistoric site 40RE86 produced undisturbed cultural features and was recommended for inclusion in the National Register of Historic Places (GAI 1981:7).

Jolley (1982) conducted a second survey of the CRBRP site of those areas not evaluated in Schroedl's 1972 survey. The utilization of a thorough shoreline survey, deep testing program along the floodplain and terraces and a shovel test strategy resulted in the identification of seventeen additional sites.

An archaeological assessment of two historic house sites for the purpose of National Register eligibility evaluation was conducted on the Jenkins House Site (40RE188) and the Jones House Site (40RE189) (Faulkner 1988). The assessment utilized subsurface testing to determine if artifact concentrations were present on the sites. The Jones House Site and support structures were recommended for inclusion in the National Register of Historic Places due to the relatively intact nature of the site and its early occupation date (ca. 1820). On the other hand, the Jenkins House had been severely effected by modern intrusions and was not considered eligible for inclusion in the National Register of Historic Places.

Several surveys associated with borrow areas and minor projects on the reservation have recently been conducted. They include the approximately 425 acre HPPR-DOSAR and Tower Shielding Borrow area (DuVall 1991), the approximately 78 acre Advanced Neutron Source (ANS) Project (DuVall 1991a), the approximately 6500 linear feet Liquid Low Level Waste Collection and Transfer (LLW-CAT) System (DuVall 1991b), the one acre Melton Valley Recontour Site (DuVall 1991c), a reconnaissance of the M.K. Ferguson Lay-Down Area/West End Treatment Facility (DuVall 1992), and the Pond Waste Management Project on the K-25 Complex (DuVall 1992a). No archaeological sites were identified on any of the project areas due to large areas of prior disturbance, in most cases.

An approximately 40 acre reconnaissance of the Remote Handled Transuranic (RH TRU) Waste Storage Area site contained the Jenkins House site (40RE188) within the boundaries of the project DuVall 1992b). However, the house site area was scheduled to be excluded from the project area.

A survey of the Solid Waste Storage Area (SWSA 7) encompassed approximately 220 acres of extremely steep and deflated uplands and the low floodplain of Melton Branch (DuVall 1992c). Site 40RE194 was identified by shovel testing a low terrace along Melton Branch. Based on the shovel tests, the site was determined to be an ephemeral encampment of unknown cultural origin.

A negative survey of the impact area of the Environmental Management Waste Management Facility (EMWMF) project was confined to approximately 125 acres of dry slopes and ridgetops on Pine Ridge in the Bear Creek Valley (DuVall 1998). This survey area was noncontiguous due to previous survey on three sections of the adjacent study area. Bentz (1992) excavated a total of 257 shovel tests within this area. Two flakes were recovered from 2 shovel tests in Area C. The survey was considered negative for archaeological sites due to the highly deflated nature of the area.

A survey of an approximately 100 acre tract at the intersection of Scarboro and Bear Creek Roads was conducted by the author in 2004 (DuVall 2004). One site, 40AN68, had been previously recorded near the project area but was determined to be a low density lithic scatter which had been destroyed by prior demolition efforts. Two cemeteries, New Hope and Jackson, are located in the vicinity of the project area. These cemeteries are highly visible and maintained appropriately by the Department of Energy.

METHODOLOGY

The Phase I survey of the project consisted of a pedestrian survey of the entire area. Due to the steep slopes, narrow survey corridor and extremely disturbed nature of the survey area, no formal transects were utilized. The pedestrian survey focused on determining that no suitable habitation area existed within the project area.

Notes were taken on all sections and depicted terrain features, vegetation patterns, soil conditions, prior disturbance and the probability for archaeological sites. No cultural material was identified or collected.

No screened shovel tests were excavated due to the extreme slope and extreme disturbance.

All field notes and photographs are on file at DuVall & Associates, Inc., 137-A Alpha Drive, Franklin, Tennessee 37064.

COORDINATION WITH STATE AGENCIES

A search of the site files and coordination with the Tennessee Division of Archaeology, Nashville, indicated that no site had been previously recorded within the project boundaries.

The ORR is a closed system with all studies centrally controlled. An ongoing record of recorded sites and surveys on the reservation is maintained by the individual plants in the ORR complex.

A search of the National Register of Historic Places and a review of the site files at the Tennessee Historical Commission, Nashville, indicated that no properties included in the National Register of Historic Places lie within 1000 feet of the tract.

SURVEY RESULTS

The project area is located north of Bear Creek Road and the Y-12 National Security Complex (Figure 3). The project area lies between Bear Creek Road and the vegetated slopes. Mr. Mick Wiest, Environmental Engineer, Environmental Compliance Department, BWXT Y-12, disclosed that the area is constantly cleared of vegetation.

The entire project area exceeds 15% slope. Disturbance to the area includes above ground transmission lines, guard towers, existing water storage tanks, paved parking lots, gravel parking lots, gravel roads, and nonspecific underground utilities. The parking lots had been cut into the slope with the spoil utilized to level the grade. Sparse grass cover on the slopes revealed C Horizon soils throughout the project. No shovel tests were excavated due to the slope and extreme disturbance.

Photographs of the project are presented in Plates 1-6.

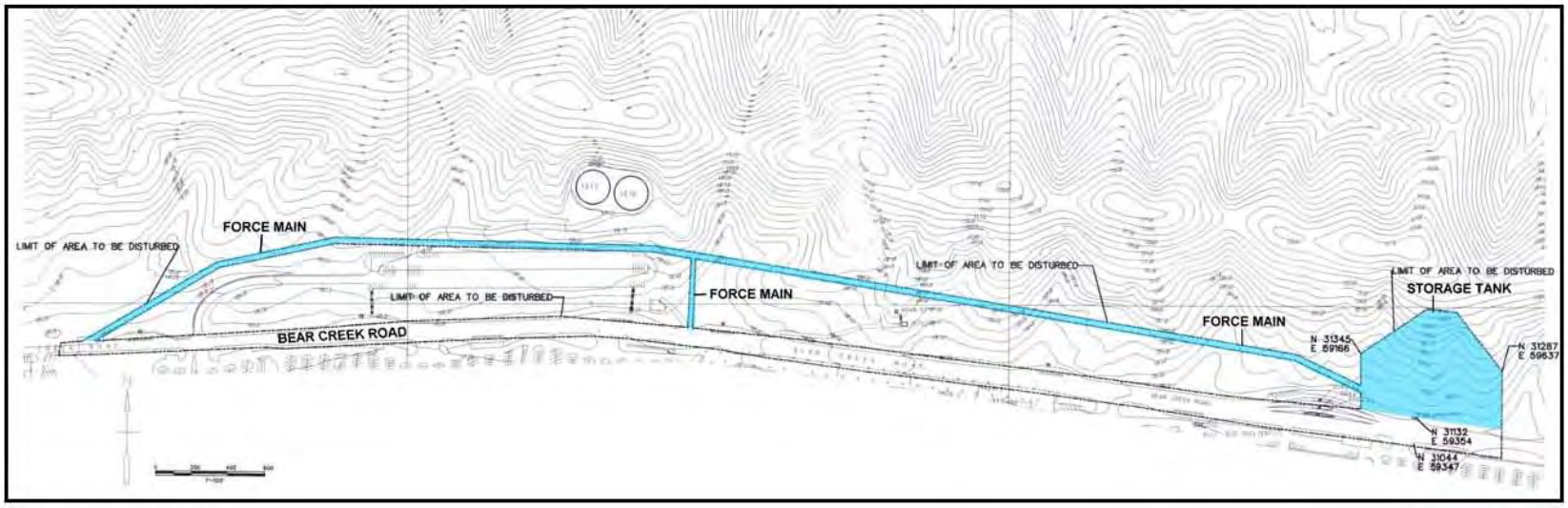

FIGURE 3: PROJECT PLAN.

Plate 1. View South (downslope) of the Storage Tank Location.

Plate 2. View East of the Force Main Location Exiting the Storage Tanks.

Plate 3. View East of Force Main Location Along Slopes.

Plate 4. General View of Force Main Location Along Slopes.

Plate 5. General View East of Force Main Location From Existing Storage Tanks.

Plate 6. General View East of Force Main From Terminus of Project.

CONCLUSIONS

Based upon the survey, a search of the site files at the Tennessee Division of Archaeology and a search of the National Register of Historic Places, no historic properties included in or eligible for inclusion in the National Register of Historic Places, pursuant to 36 CFR 60.4, will be affected by construction on the site. The entire project lies on slopes in excess of 15% eliminating the potential for significant archaeological sites.

Additionally, a large number of non-specific utilities (above and below ground) cross the area. No undisturbed areas were observed during the survey due to the maintenance of the slopes in the cleared state.

The contractors should be made aware of the present Tennessee burial law (TCA Title 46) which protects both marked and unmarked, historic and prehistoric interments. In the event that human skeletal material is unearthed during construction activities, construction in the vicinity should cease and the Tennessee Division of Archaeology notified immediately.

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APPENDIX B

COMMENT RESOLUTION MATRIX

COMMENT RESPONSE MATRIX
PWSU ENVIRONMENTAL ASSESSMENT
DRAFT COMMENTS

Comment #	Page #	Section/Figure/ Table/Appendix	Line Number	Commentor	Comment	Response (Contractor)
1	2-3	2.1		TDEC	Text states, "The tanks would be approximately 381 m (1,250 ft) in height." Is this correct?	The top of the tanks are 381m above Mean Sea Level (MSL). The EA will be revised to indicate that the top of the tanks will be approximately 250 ft above grade.
2	3-13	3.5.2		TDEC	At the top of the page, the text refers to "Station 16." Should this be "Station 17"?	Yes. The EA will be revised to indicate Station 17.
3	3-27	3.11.1		TDEC	The text states, "The Y-12 Complex also has cross connection prevention programs to prevent contamination of potable water." The Y-12 Complex does not have a State Approved cross connection control program. The Y-12 Complex was issued a Notice of Violation in 2004 due to the inadequacy of the program that was in place. At the time of this review, the Y-12 Complex does not have a State approved program.	The Y-12 Complex Utilities department does have cross connection prevention programs that have not been approved by TDEC. They are currently working with TDEC Division of Water Supply to obtain approval of a new integrated cross connection program. A draft of this new program was submitted to TDEC on December 13, 2005, and a meeting to review this program with TDEC is scheduled for January 31, 2006. The EA will be revised to state: "The Y-12 Complex also has cross connection prevention programs and is working with Tennessee Department of Environment and Conservation (TDEC) to obtain approval."
4	4-25	4.13.1		TDEC	The text again refers to the height of the tanks as 381 m. Same comment as Page 2-3.	The EA will be revised to indicate that the top of the tanks will be approximately 250 ft above grade.

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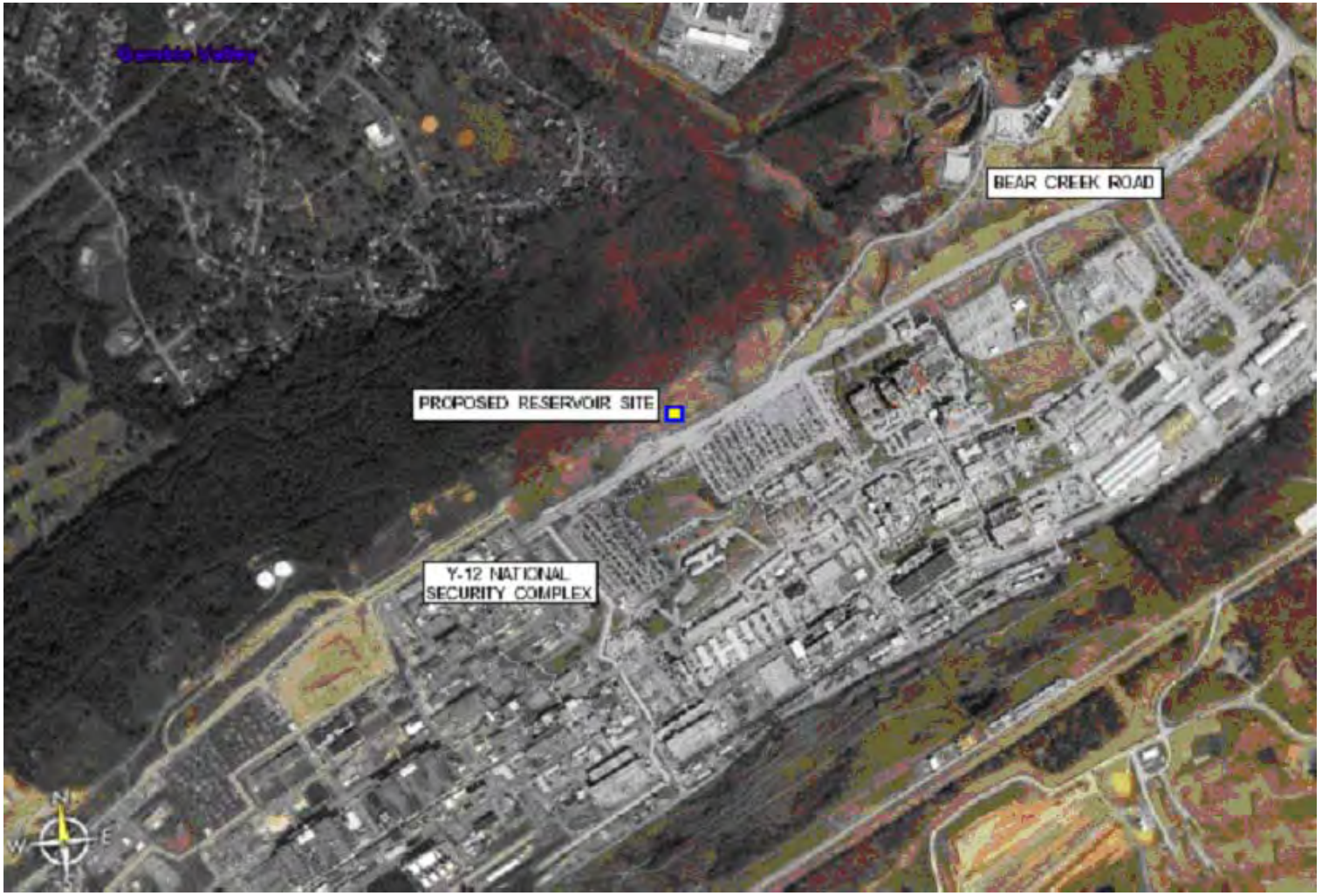


Figure 2.1–1. Project Location.

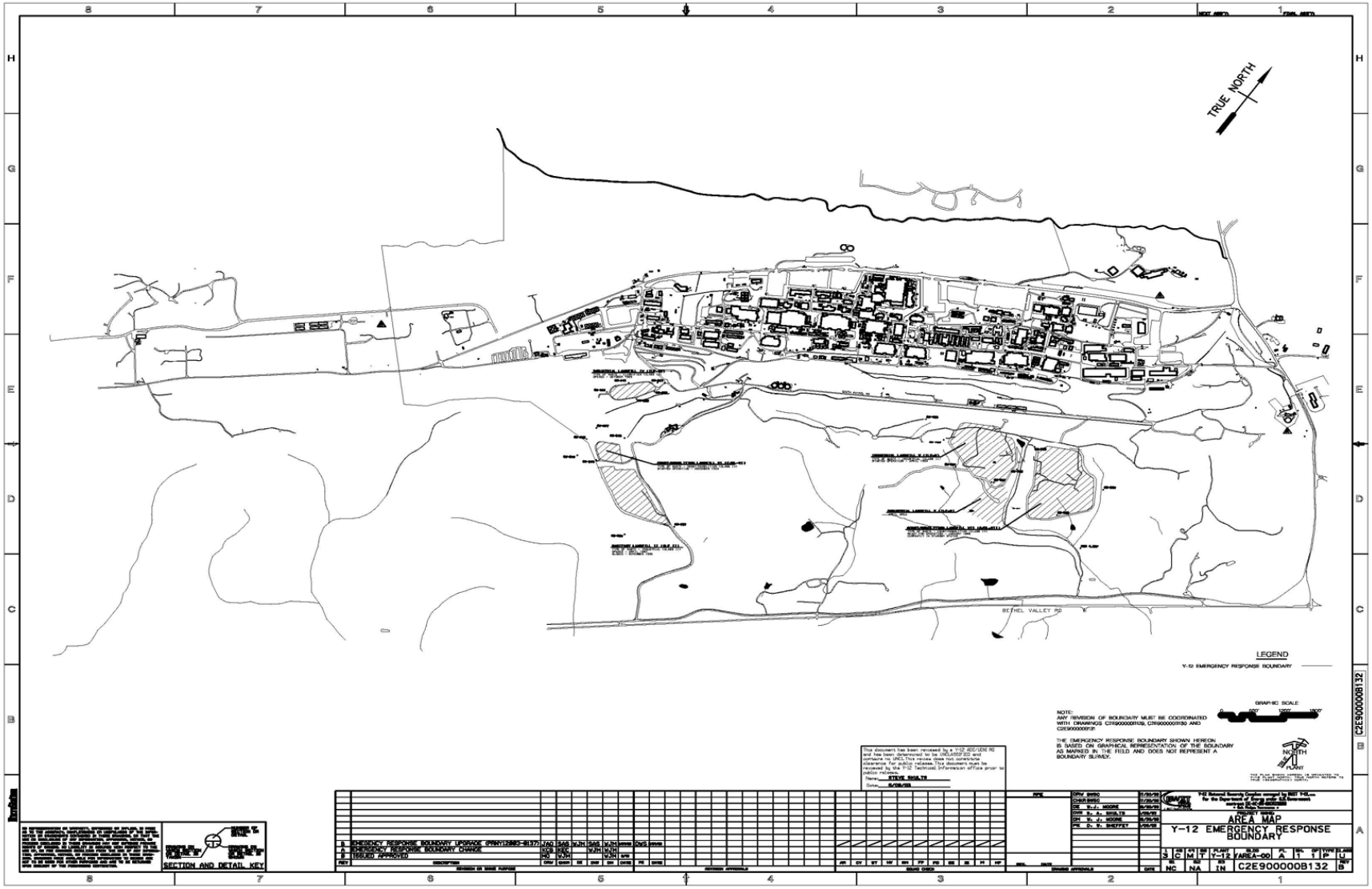


Figure 3.1–1. Y-12 Site Boundary Map.

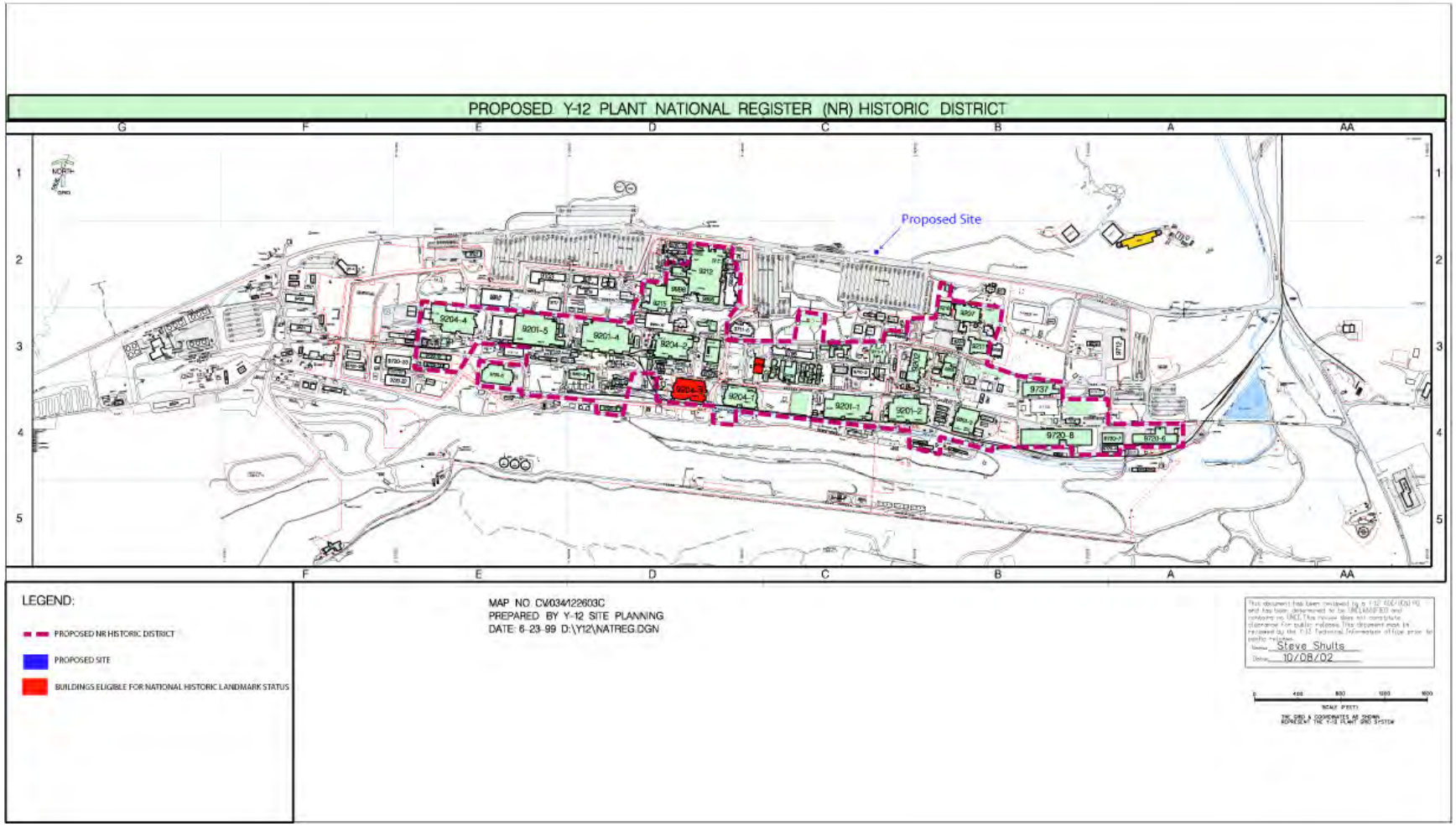
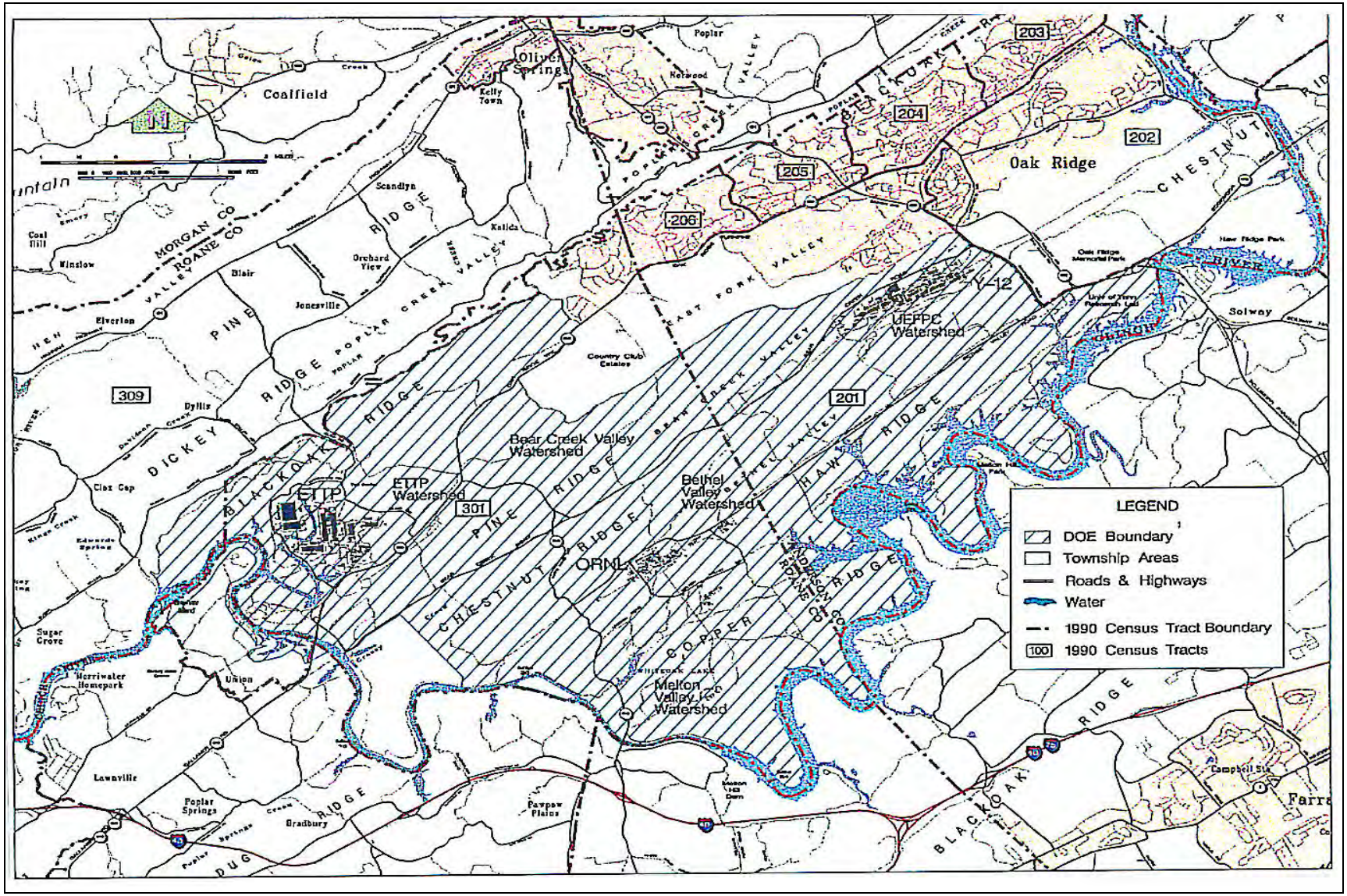


Figure 3.7–1. Location of the Historic District at Y-12 in Relation to the Proposed Site.



Source: DOE 2001a.

Figure 3.9–1. City of Oak Ridge Census Tracts.