DOE/EA-2136

Draft
Environmental Assessment
Construction and Operation of the
Stable Isotope Production and Research Center
Oak Ridge National Laboratory
Oak Ridge, Tennessee

April 2022

U. S. Department of Energy
Office of Science
Oak Ridge National Laboratory Site Office

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ACRONYMS, SYMBOLS AND ABBREVIATIONS

$\mu g/m^3$	micrograms per cubic meter
ALARA	as low as reasonably achievable
amsl	above mean sea level
BMP	best management practice
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CO	carbon monoxide
dB	decibel
dBA	A-weighted decibel
DOE	Department of Energy
DOE IP	DOE Isotope Program
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EMIS	electromagnetic isotope separators
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ESH&Q	Environment, Safety, Health, and Quality
ESIPP	Enriched Stable Isotope Prototype Plant
ETTP	East Tennessee Technology Park
FONSI	Finding of No Significant Impact
GCIS	gas centrifuge isotope separators
GHG	greenhouse gases
IFDP	Integrated Facility Disposition Project
INL	Idaho National Laboratory
ISM	Integrated Safety Management
kV	kilovolt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NO_2	nitrogen dioxide
NOx	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORSTP	Oak Ridge Science and Technology Project
OSHA	Occupational Safety and Health Administration
Pb	lead
PM	particulate matter
PM_{10}	particulate matter with a diameter of less than or equal to 10 microns
$PM_{2.5}$	particulate matter with a diameter of less than or equal to 2.5 microns
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act of 1976

ROD	Record of Decision
RPF	Radioisotope Processing Facility
ROI	region-of-influence
SIP	State Implementation Plan
SIPF	Stable Isotope Production Facility
SIPRC	Stable Isotope Production and Research Center
SO_2	sulfur oxides
SR	State Route
SWPPP	Stormwater Water Pollution Prevention Plan
TDEC	Tennessee Department of Environment and Conservation
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TN SHPO	Tennessee State Historic Preservation Office
TSDF	treatment, storage, and disposal facilities
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
UPF	Uranium Processing Facility
U.S.	United States
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UT-B	UT-Battelle, LLC
VOC	volatile organic compound
VTR	Versatile Test Reactor

1. INTRODUCTION

1.1 PURPOSE AND NEED FOR ACTION

The Department of Energy (DOE) Office of Science, Office of Isotope Research and Development and Production, Isotope Program (DOE IP) mission includes producing and distributing radioactive and stable isotopes[1] that are in short supply and providing related technical isotope products and services. The DOE IP also maintains the infrastructure required to produce and supply isotope products and services. In addition, it supports research and development on new and improved isotope production and processing techniques, resulting in new isotopes becoming available for research and various application.

The demand for enriched stable isotopes over the last decade has increased significantly for medical, national security, and fundamental research projects and DOE's supply of certain key enriched stable isotopes has been depleted or exhausted. Therefore, the United States is becoming increasingly dependent on foreign suppliers for enriched stable isotopes.

The Oak Ridge National Laboratory (ORNL) stable isotope program is advancing electromagnetic separation and centrifuge technologies. This suite of technologies has been developed at ORNL with support from the DOE IP to address the need for increased domestic stable isotope production. The current production afforded by prototype capabilities developed through DOE IP supported research do not provide adequate production capabilities to meet the growing United States demand for stable isotopes.

The purpose and need for the proposed Stable Isotope Production and Research Center (SIPRC) would be to expand current stable isotope production capabilities at ORNL, facilitate efficient operations, help meet demand, and reduce dependencies for obtaining stable isotopes from foreign suppliers.

1.2 BACKGROUND

ORNL, located on the DOE Oak Ridge Reservation (ORR), is one of 10 DOE Office of Science Laboratories and 17 DOE National Laboratories total. ORNL is managed for DOE by UT-Battelle, LLC (UT-B), a partnership between the University of Tennessee and Battelle Memorial Institute (Figure 1.1). UT-B conducts basic and applied research at ORNL to deliver transformative solutions to compelling problems in energy and security. Formerly known as X-10, ORNL was established in 1943 to support the Manhattan Project. During the 1950s and 1960s, ORNL became an international center for the study of nuclear energy and related research in the physical and life sciences. With the creation of DOE in the 1970s, the research and development portfolio at ORNL broadened to include programs supporting DOE missions in scientific discovery and innovation, clean energy, and nuclear security. DOE supports these missions at ORNL through leadership in four major areas of science and technology: neutron science, high-performance computing, materials science, and nuclear science.

[1] Stable nuclides are nuclides that are not radioactive and so (unlike radionuclides) do not spontaneously undergo radioactive decay. When such nuclides are referred to in relation to specific elements, they are usually termed stable isotopes. Although they do not emit radiation, their unique properties enable them to be used in a broad variety of applications.

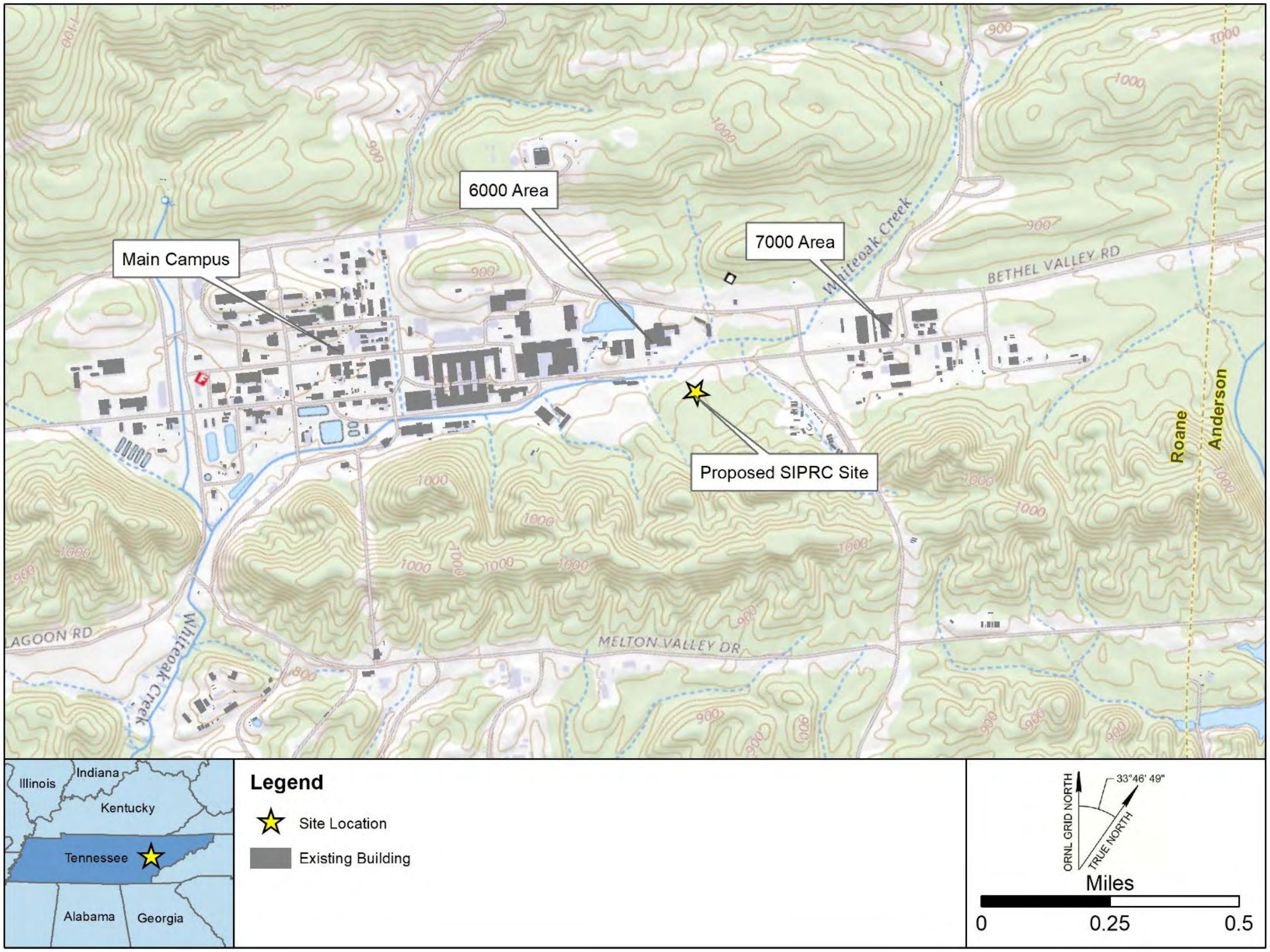


Figure 1.1. Oak Ridge National Laboratory and Proposed Location of the SIPRC

Over the past several years, DOE has invested in upgrades of the 6000 Area of ORNL (Figure 1.1) in support of continued stable isotope research, development, and operations.

Presently, the stable isotope program is dispersed across various refurbished/repurposed facilities on the ORNL campus and DOE IP has used the Enriched Stable Isotope Prototype Plant (ESIPP) to reestablish a national capability for stable isotope production for the first time since the late 1990s. Prior to that, DOE produced a legacy inventory of enriched stable isotopes using calutrons at the Y-12 National Security Complex from the 1940s to 1990s. The ESIPP, located in the 6000 Area, produces research quantities of enriched stable isotopes using electromagnetic and gas centrifuge isotope separators (GCIS). Electromagnetic isotope separators (EMIS) can separate isotopes for many elements to very high purity and at lower production rates while gas centrifuge production cascades can produce much larger quantities of isotopes but is limited to those isotopes that have compatible feedstock chemicals. The Stable Isotope Production Facility (SIPF) project is focused on expanding stable isotope enrichment capability by producing the Xe-129 isotope and will be installed in the ESIPP. This project, initiated in FY 2017, has received approval to start construction, and is expected to transition to full-time operation in 2025.

Most of the DOE stable isotope inventory, consisting of approximately 58 periodic table elements and 252 individual isotopes, is stored in a secure location at ORNL. Isotopes are stored in their most stable chemical form, which is typically carbonate, oxide or metal powder. ORNL also maintains advanced technical services capabilities that are utilized to convert isotopic material into specific physical or chemical forms requested by customers.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This Environmental Assessment (EA) presents information on the potential impacts associated with the construction and operation of the SIPRC at ORNL. DOE has prepared this EA to assess the potential consequences of its activities on the human environment in accordance with the Council on Environmental Quality (CEQ) regulations [40 *Code of Federal Regulations* (CFR) Parts 1500–1508] implementing National Environmental Policy Act of 1969 (NEPA) and DOE NEPA Implementing Procedures (10 CFR 1021). If the impacts associated with the proposed action are not identified as significant, DOE shall issue a Finding of No Significant Impact and will proceed with the action. If impacts are identified as potentially significant, an Environmental Impact Statement would be prepared.

In addition to identifying the purpose and need and scope of the action this EA: (1) describes the affected environment relevant to potential impacts of the proposed action and alternatives; (2) analyzes potential environmental impacts that could result from the proposed action; (3) identifies and characterizes cumulative impacts that could result from the proposed action in relation to other ongoing or proposed activities within the surrounding area; and (4) provides DOE with environmental information for use in prescribing restrictions to protect, preserve, and enhance the human environment and natural ecosystems.

The proposed action does not include changes to the existing research missions or process operations. Therefore, process operations for other research missions are not the focus of this evaluation and are only discussed if potentially affected. Potential actions that would be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), such as environmental restoration and decontamination and decommissioning, as well as actions that have already been reviewed or will be reviewed under separate NEPA documentation, are not within the scope of this EA.

Certain aspects of the proposed action have a greater potential for creating adverse environmental impacts than others. For this reason, CEQ regulations (40 CFR 1502.1 and 1502.2) recommend a "sliding-scale" approach so that those actions with greater potential effect can be discussed in greater detail in NEPA documents than those that have little potential for impact. Additionally, conservative estimates were used to bound the analysis of potential impacts. For instance, water resources and ecological resources are areas where a possibility for significant impacts exists. Those areas accordingly receive more attention in this EA.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE proposes to construct and operate the SIPRC in a forested area south of White Oak Avenue in the 6000 Area of the ORNL campus (Figure 2.1). The new facility would expand DOE's ability to perform multiple stable isotope production campaigns at ORNL.

The conceptual design (approximately 54,000 square feet) of the current project (referred to as Phase 1) would meet current programmatic needs and has a strategy for future expansion (Phase 2). The conceptual site plan (Figure 2.2) defines the footprint limits of Phase 1 and a potential future Phase 2. The potential Phase 2 expansion (approximately 40,000 square feet) would be to the east and the west portions of the SIPRC site.

Prior to the implementation of Phase 2, DOE would review if any changes or additions to the project fall outside of the bounds of the analysis conducted in this EA. DOE would then decide if Phase 2 falls within the bounding analysis in this EA or they would determine the appropriate level of additional review that would be required prior to implementation. Since the Phase 2 expansion would be located within the area that would be disturbed for the Phase 1 facility, it is expected that any new construction would be bounded by this existing EA. However, since the operational specifics of the potential Phase 2 expansion are presently not known, the potential for new operational impacts would likely be the focus of any additional review (e.g., emissions, waste management, accidents).

The SIPRC has been designed to meet the strategic goals set forth by the DOE IP program requirements. Specific objectives have been developed during the conceptual design process, including:

- Provide a facility with the capability to increase isotope production capacity.
- Consider as part of the facility design future expansion of the facility.
- Maintain adjacency to the 6000 Area facilities.

The major construction parts of the project include:

- Site preparation activities that include clearing and grading the area, and installation of site utilities. Stormwater pollution controls would be installed and inspected prior to site grading, excavation, and other construction activities.
- Construction of an approximately 54,000 gross square foot, single-story structure that includes approximately 49,700 net square feet of assignable space to support the required stable isotope research and production capability.
- Construction of an asphalt parking lot adjacent to the SIPRC building with approximately 20 parking spaces.
- Fabrication, installation, and initial testing of isotope enriching equipment.

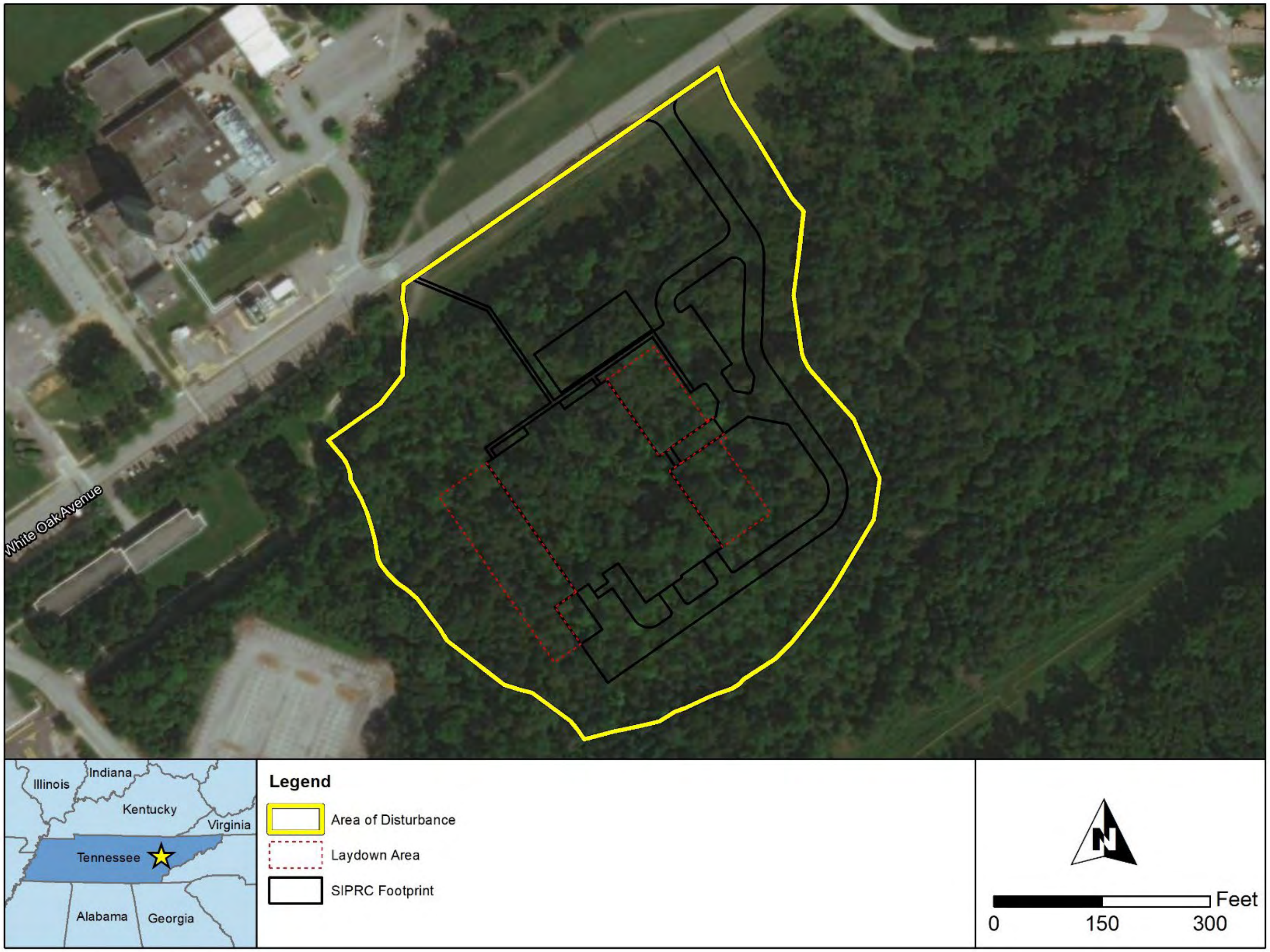


Figure 2.1. Proposed SIPRC Site – South White Oak Area

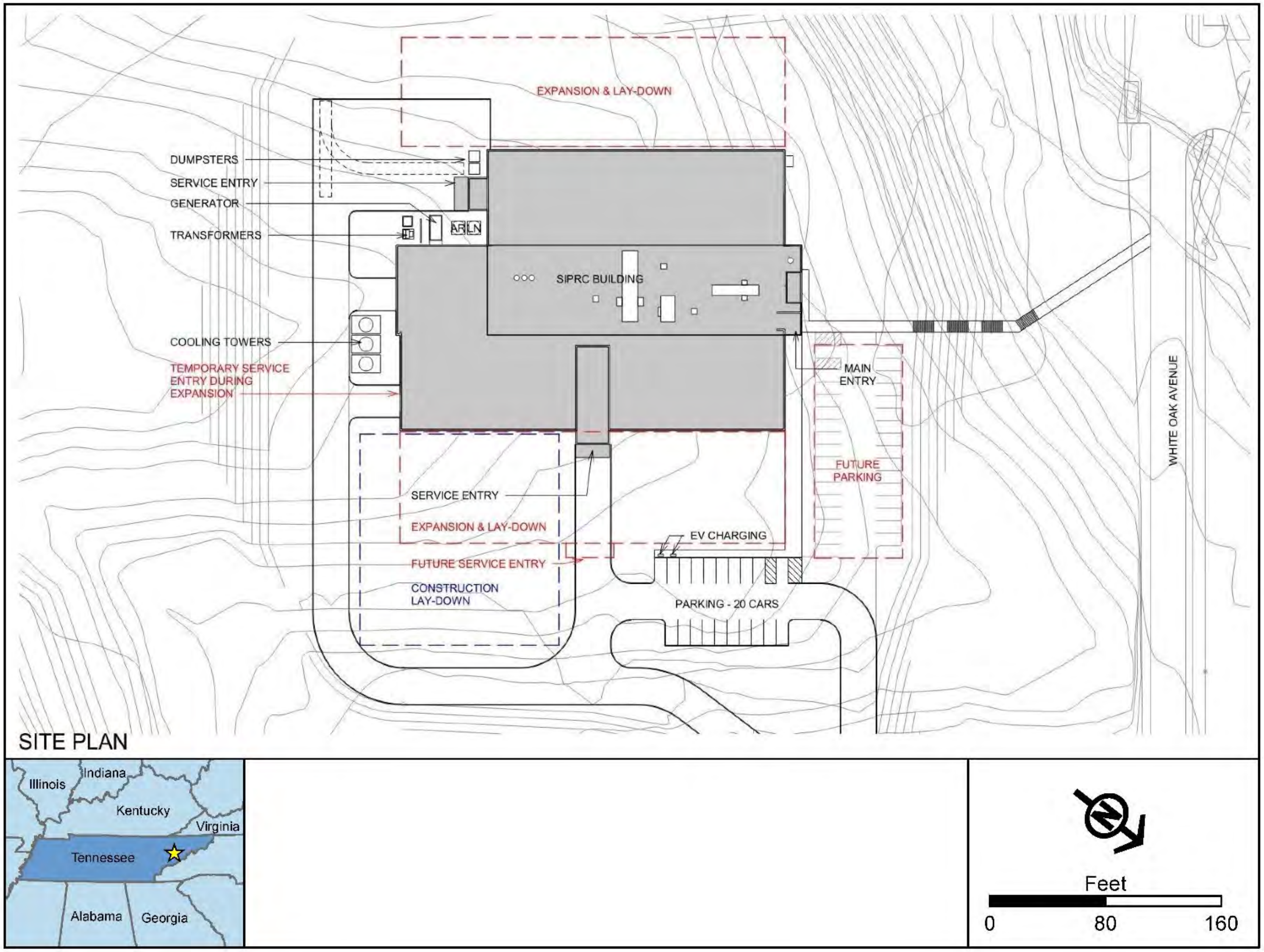


Figure 2.2. Proposed SIPRC Site Plan

SIPRC operations include:

- Research and testing in addition to stable isotope production.
- Production area that would be operated continuously.
- Both EMIS and GCIS would be used for stable isotope production (See Section 2.1.3 for description).
- SIPRC generated stable isotope products would be harvested and transported to other existing ORNL stable isotope facilities where they would be converted to the desired form required by the end user.

2.1.1 SIPRC Site Preparation

The proposed project site consists of approximately 10 heavily vegetated acres on the eastern edge of ORNL's main campus. The site is directly south of White Oak Avenue and is within proximity to the 6000 Area. White Oak Avenue is a two-lane road and is expected to be the primary pedestrian and vehicular means of access to the site. An existing parking lot is located to the west, and a creek with an associated 60-foot riparian buffer zone is directly east and west of the project site.

Underground utilities would be identified prior to any site preparation activities. Removal of site utilities would be performed on an as-required basis; however, this is not expected based on current information. Any utilities abandoned in place would be capped at the end point of removal and would be filled with flowable fill before final capping.

Substantial clearing and grubbing within the area of disturbance (Figure 2.1) would be required to accommodate the proposed building and site development and would be performed only in the areas approved on the construction plans. All trees, brush, grass, and other organic materials would be removed from the site and disposed of in an approved location on ORNL property. As an alternate erosion control option, trees could be mulched and used as perimeter sediment control barriers. Topsoil would be removed to full depth (6-inch minimum) and stockpiled in an approved location on the site. If any material to be disposed of is found to contain hazardous, toxic, or radiological substances, they would be handled according to the applicable ORNL waste management procedures. Rubbish and debris would be removed from the site as needed and transported to the ORR Industrial Landfill V for disposal to avoid accumulation at the project site.

A Stormwater Water Pollution Prevention Plan (SWPPP) would be developed to provide direction and instruction for maintaining appropriate erosion controls in accordance with the Tennessee Department of Environment and Conservation (TDEC) requirements. During construction, measures would be taken to prevent unnecessary erosion of exposed soil and to prevent sediment from leaving the site. Erosion and sediment prevention and other protective measures would be maintained on-site. Unless designed to remain in place, temporary structural practices would be removed once the corresponding disturbed drainage area has been permanently stabilized.

Storm drainage structures (catch basin, area drains, headwalls, etc.) would be installed in the apron, parking areas, driveways, and lawn on all sides of the building. The building drainage would be combined with a new stormwater system in the egress apron areas for the building and carried west to an existing culvert along White Oak Avenue. The project would comply with requirements of the Tennessee National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit.

2.1.2 SIPRC Site Design

Under Phase 1 the proposed SIPRC would be an approximately 54,000 gross square foot, single-story structure that includes approximately 49,700 net square feet of assignable space. The building would be divided into two distinct areas to handle the different types of isotope production equipment. One area would be for EMIS and the other GCIS. The SIPRC building design and construction would employ sustainable approaches in accordance with the 2016 Guiding Principles for Sustainable Federal Buildings including energy efficiency measures.

Space types for the SIPRC include:

- Production Rooms
- Control Rooms
- Production Support
- Offices and Storage Room
- Mechanical, Electrical, Plumbing
- Building and Program Support

New utility connections (i.e., power, water sewer, steam, air, fire water, etc.) would tie-in to the closest existing lines and be connected to the SIPRC building. A heating, ventilation, and air conditioning system would control the temperature inside the building. The building would also have an exhaust system to ventilate gases and heat generated during operations. Roof mounted heat exhaust would exhaust excess heat from ovens, furnaces, soldering stations and provide exhaust from a chemical washroom. Roof mounted toxic exhaust would provide exhaust primarily from chemical fume hoods and gas cabinets. The building would also have small utility exhaust fans for toilet rooms, janitor’s closets, and other rooms requiring ventilation.

An independent chilled water generating system for the building would be provided to serve air handling units, supplementary cooling units, and provide process cooling water via heat exchangers and tertiary loops. The chillers would reject heat to a three-cell induced draft cooling tower located outside of the building. Cooling tower condensate/blowdown would be chemically treated as needed and discharged into the new site stormwater system.

The primary entrance and driveway would access the site from the east and connect with White Oak Avenue. There would also be a parking lot on the east side of the building consisting of approximately 20 parking spaces. Another parking lot for approximately 30 additional vehicles could be added for Phase 2. On-grade loading areas on the south and east sides of the building would accommodate deliveries from box-truck style vehicles. The site would also have sidewalks to provide access from the building to various parking lots and other nearby facilities.

2.1.3 Operations

Once construction of the SIPRC building is completed and the isotope enriching equipment has successfully passed the testing phase, SIPRC operations would begin. Operations at SIPRC would be primarily focused on stable isotope production but would also include research and testing. Production area operations are expected to run continuously with approximately 20 workers occupying the building at any given time. In addition to SIPRC, the current stable isotope production capabilities at ORNL would continue to be utilized.

Figure 2.3 provides a high-level flow chart of the process for enriching stable isotopes at the SIPRC. Feed material would be procured and processed into the desired physical or chemical form, which includes both solid and gas feedstock forms. The feedstock would be delivered to SIPRC and used by the enrichment systems to generate the stable isotopes.

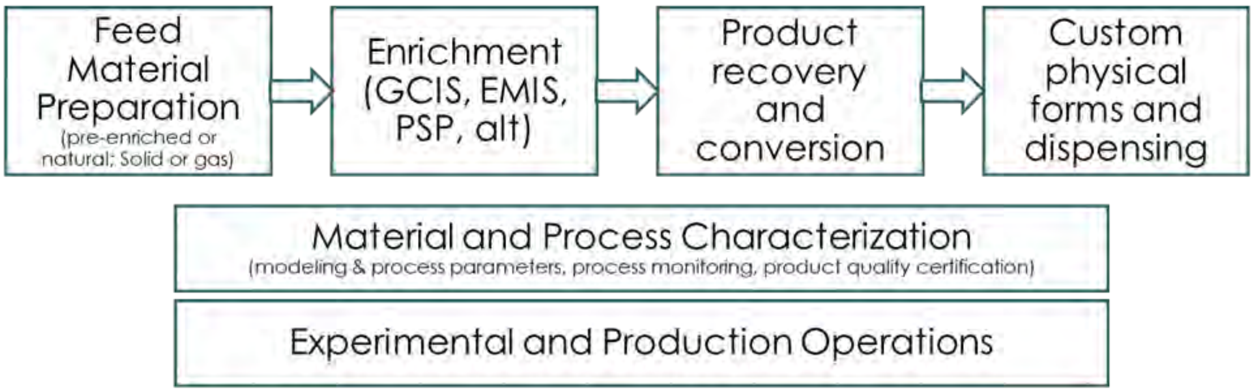


Figure 2.3. SIPRC Stable Isotope Enrichment Process Flow

The process used by the EMIS relies on each isotope of an element having a different mass. First, the element is converted into a gas that is then ionized. Because ions are electrically charged, a stream of ions bends as it passes through a magnetic field, but not all the ions bend by the same amount. The isotopes have different masses, and the lighter ones change direction more than the heavier ones. The result is multiple beams, each containing a single isotope pointed at a collection pocket lined with graphite. EMIS is effective at separating isotopes to very high assay or purity, but the yields are relatively small (typically gram quantities) in any given year (ORNL 2019).

GCIS also rely on the fact that different isotopes have different masses. A gas is sent past a spinning rotor, which changes the direction of the ions based on the mass of the isotope, with heavier atoms moving to the wall and lighter ones staying close to the center. Unlike in the EMIS, however, the result is two streams—with one made up primarily of the heaviest isotopes—instead of a separate stream for each isotope. As a result, the process involves sending the gas through a series of centrifuges, known as a cascade, to enrich the isotope incrementally. GCIS offers milligrams-per-second throughput (dependent on the number of machines, cascade design, and individual machine performance) and can produce large amounts of an isotope (i.e., kilograms rather than grams) (ORNL 2019).

The SIPRC generated stable isotope products would be harvested and transported to the other existing ORNL stable isotope facilities where they would be converted to the desired form required by the end user. The converted material would then be put into the Sales Inventory for dispensing in response to orders placed through the National Isotope Development Center.

An unbiased, qualitative evaluation was performed to identify the preferred alternative to satisfy the approved mission need. The analysis of alternatives used a stepwise approach to: (1) identify potential sites across the nation that possess “isotope enrichment” expertise or capability, (2) evaluate those sites against a set of essential capability criteria to determine if the site could satisfy the SIPRC mission need, (3) identify any existing facilities at the sites that could be renovated that meet the SIPRC criteria, and (4) eliminate alternatives that do not meet the SIPRC mission need. The analysis of alternatives concluded that the most effective alternative for meeting the objectives identified in the mission need statement was to construct a new facility with EMIS and GCIS equipment at ORNL.

While other laboratories have core competencies in EMIS technology, only ORNL has an active centrifuge development program with associated core competencies. Only ORNL has the existing capability to construct gas centrifuges. The results of the alternatives analysis concluded that ORNL is the preferred site and that a new facility should be constructed to support the SIPRC mission. This approach consolidates and expands the nation’s ability to perform multiple isotope production campaigns, which will support the mission need and fill the current gap of isotopes required while taking advantage of the unique stable isotope production experience at ORNL.

The other options were highly undesirable because they would not result in addressing the capability gap in the foreseeable future. As a result, the United States (U.S.) would remain dependent on foreign sources for critical isotopes, adding risk to application and research that are important to the nation.

Once it was decided that ORNL was the preferred site for the SIPRC, a site analysis was conducted to evaluate alternative sites at ORNL for construction of the new facility using the following parameters:

- Building operations
- Future consolidation of isotopes facilities
- Proximity to existing operational facilities
- ORNL Campus infrastructure and utilities
- Available project budget
- Stable isotope long-term development plan at ORNL

Current stable isotope production capabilities at ORNL are housed in several refurbished facilities; however, given the need for continued expansion of production capacity, the use of refurbished facilities is not optimal. First, none of the existing facilities have an adequate footprint to accommodate the full suite of needed production capabilities. This results in a “fragmented approach” locating similar capabilities in geographically separate locations, increasing operating complexity and operating costs. Second, refurbishment of existing facilities is expensive. Some of the facilities that could be utilized are radioactively contaminated, almost all have asbestos, and some are contaminated with beryllium. The existence of these legacy hazards considerably increases refurbishment costs.

Five site options were evaluated (Figure 2.4) to determine the optimum location to meet the current stable isotope production needs and provide enough space for future expansion. Sites A and B were determined to have substantial prohibitive environmental, utility, and access constraints. Site C was considered nonviable due to the need to replace approximately 500 parking spaces that would be eliminated. Site E was rejected due to the lack of proximity to key adjacencies and the cost of environmental mitigation required at this location. Site D was ultimately chosen due to proximity to exiting stable isotope research and operations in the 6000 Area, its ability to facilitate expansion, and relatively clear site conditions (no major utility conflicts, relatively clean soils, etc.).

Figure 2.4. Locations Evaluated for Siting the SIPRC at ORNL

2.3 NO ACTION ALTERNATIVE

The No Action Alternative provides an environmental baseline with which impacts of the proposed action and alternatives can be compared and is required by the DOE NEPA Regulations. Under the No Action Alternative, the SIPRC would not be established and operated at ORNL. Ongoing stable isotope research and production activities at ORNL could continue, but the full mission of the SIPRC to expand domestic production of enriched stable isotopes would not be realized and reliance on foreign vendors would continue.

2.4 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Table 2.1 provides a comparative summary of the potential environmental consequences that could result from implementing the Proposed Action or the No Action Alternative.

Table 2.1. Summary of Environmental Consequences

Environmental Impact	Proposed Action	No Action Alternative
Land Use	Construction of the SIPRC would change about 10 acres of the existing undeveloped land use to an institutional/research designation. The change would be minor and would be within the context of and compatible with the surrounding institutional/research and mixed industrial land uses in the 6000 Area and 7000 Area.	Construction of the SIPRC would not occur and there would be no change to the existing land use of the area.
Geology and Soils	Adverse impacts to site geology are not expected and the affected soil is generally stable and acceptable for standard construction requirements. Erosion prevention and sedimentation control management practices would be implemented, and adverse impacts would be negligible.	Construction and operation of the SIPRC would not take place and there would be no impacts to the existing geology and soils present on and in the vicinity of the SIPRC site.
Water Resources	Erosion and sedimentation controls would limit potential impacts to surface water and groundwater during site preparation activities. There would be no impacts to surface water or groundwater from normal facility operations and decommissioning activities.	Current stable isotope production at ORNL would continue within existing facilities and there would be no additional impacts to water resources beyond those associated with other ongoing and planned activities.

Environmental Impact	Proposed Action	No Action Alternative
Ecological Resources	Construction of the SIPRC would directly impact approximately 10 acres of mixed deciduous forest and herbaceous utility right-of-way. Temporarily disturbed areas would be revegetated post construction. Impacts to wildlife could include direct mortality or injury and displacement. Migratory birds are also known to frequent and possibly nest within the SIPRC site. The state-listed four-toed salamander and wood thrush could be potentially impacted. The site also contains suitable foraging habitat for threatened and endangered bat species. Consultation is ongoing with the USFWS, Tennessee Wildlife Resources Agency (TWRA), and TDEC to identify measures to minimize and/or mitigate potential adverse impacts to the rare species and habitat.	Current stable isotope production at ORNL would continue within existing facilities and there would be no additional impacts to ecological resources beyond those associated with other ongoing and planned activities.
Cultural Resources	Construction of the SIPRC would result in an adverse impact to remains associated with a pre-WWII homesite barn. Consultation between DOE and the Tennessee State Historic Office is ongoing to determine what, if any mitigation would be required for the SIPRC. DOE will complete a Phase I Archaeological Survey of the site prior to the completion of this EA.	No additional impacts to cultural resources would occur beyond those associated with other ongoing and planned activities at ORNL.
Air Quality	Negligible, short-term, sporadic, and localized emissions of criteria air pollutants would be produced during site preparation activities on the SIPRC site. Specific details about atmospheric pollutants including emissions of hazardous air pollutants that may be emitted by the SIPRC during operation are not available. However, any emissions would be expected to be minimal and would be mostly controlled within the facility. External effects would be negligible. DOE would obtain any required air quality construction and operation permits from TDEC. Greenhouse gas emissions would be minimal and not contribute substantially to adverse impacts.	Air pollutants would continue to be emitted at current rates at ORNL. Adverse effects to air quality are minor assuming that existing emission control systems are efficiently maintained.

Environmental Impact	Proposed Action	No Action Alternative
Noise	Construction noise associated with the SIPRC would cause a temporary and short-term increase to the ambient sound environment in the immediate vicinity of the site. There would be no adverse effects from noise during operation of the SIPRC.	There would be no noise impacts beyond those presently occurring from other construction activities and normal facility operations at ORNL.
Socioeconomics and Environmental Justice	Construction of the SIPRC would have a short-term and temporary positive impact on the local economy. Operation of the SIPRC would have a minor long-term beneficial impact to the local economy from the small number of estimated new jobs (approximately 40-60) that would be created. There would be no measurable change in anticipated population, employment, income, or fiscal characteristics in the ORNL area from the operation of the SIPRC. The SIPRC would occur within the established ORNL and would not adversely affect communities outside of the ORR. There would be no impacts associated with environmental justice.	No project related changes to population and job growth would occur. Current employment trends in the area would likely continue. There would not be any disproportionately high and adverse direct or indirect impacts on any minority or low-income populations.
Waste Management	None of the activities associated with the SIPRC should result in unacceptable adverse impacts related to waste generation, treatment, or disposal. Characterization activities would meet all applicable quality assurance and other waste management requirements. Only existing permitted and licensed and/or permitted treatment, storage, and disposal facilities would be used.	There would be no change to current waste generation and handling from routine operations at ORNL. No additional impacts would occur.
Human Health and Safety	The SIPRC would follow all applicable DOE regulations, along with any other applicable regulations required to protect human health and safety. Construction workers would be subject to the typical hazards and occupational exposures faced at other industrial construction sites. No unique occupational health and safety hazards would be expected from the normal operation of the SIPRC. Individuals not employed by DOE working at the SIPRC would be considered co-located workers.	Current facility operations supporting stable isotope work at ORNL would continue and no major changes in worker and public exposures would be expected.

Environmental Impact	Proposed Action	No Action Alternative
Accidents	Construction and operation of the SIPRC could potentially result in hazards identified as low risk, such as non-routine accidents, fires, and a release of hazardous materials. There is also the low probability of an accident caused by a severe storm or earthquake. Because of facility design measures and existing safety programs, there is no reasonably foreseeable accident scenario that would result in severe impacts.	Current stable isotope production would continue within existing facilities. There would be no accident scenarios that would result in the uncontrolled release of radioactive materials and exposures to on-site or off-site individuals or other environmental impacts.
Utilities	Construction and operation of the SIPRC would require new connections to the existing ORNL utility infrastructure. There is enough existing utility capacity to meet the need of the SIPRC without disrupting other ORNL operations and local needs. The net impact on utility systems and demand would be minimal.	Current stable isotope production at ORNL would continue within existing facilities and there would be no additional impacts to existing utilities beyond those associated with other ongoing and planned activities.
Transportation	Site preparation and construction activities would be minimal and would have a negligible effect on existing traffic in the vicinity of the SIPRC. Since only a small number of SIPRC employees would be new hires (about 40-60) and operations would be conducted in shifts each day, the transportation impact from new commuters to ORNL would be negligible.	The exiting transportation network and traffic would likely continue to remain close to current levels and no additional transportation impacts are expected.
Cumulative Impacts	The incremental impact from the construction and operation of the SIPRC, when added to impacts from other past, present, and reasonably foreseeable future actions would not be substantial.	No additional cumulative impacts would occur beyond those that would already result from ongoing activities and projects.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter provides background information for evaluating the potential environmental impacts of the Proposed Action and No Action Alternative (Affected Environment). It also includes the impact analysis and discussion of project attributes that could have the potential for significant impacts (Environmental Consequences).

3.1 LAND USE

3.1.1 Affected Environment

DOE classifies land use on the ORR into five categories: institutional/research, industrial, mixed industrial, institutional/environmental laboratory, and mixed research/future initiatives. The main ORNL site encompasses facilities in two valleys (Bethel Valley and Melton Valley) on 1,100 acres of land within the ORR. The main ORNL campus is generally divided into three research campuses, each of which contains a mix of facilities by research type. The west campus primarily contains facilities dedicated to biological and environmental sciences. The heavily industrialized central campus contains a mix of facilities used for administration and support, energy and engineering sciences, physical sciences, and management and integration. The east campus also contains a mix of research facilities along with support facilities.

The proposed site for the SIPRC is located within the East Campus. This campus area is located east of Sixth Street and in general consists of buildings in the 5505, 5510/10A, 6000, and 7000 areas. The 10-acre SIPRC site is presently a heavily wooded, greenfield area located on the south side of White Oak Avenue (Figure 1.1 and Figure 2.1). The existing land use to the north is a mix of institutional/research facilities associated with the 6000 Area. A large, developed parking area also on the south side of White Oak Avenue is located to the west. The Melton Valley Access Road and the 7000 Area is located to the east of the proposed SIPRC site. North of the site is additional undeveloped forest area that is part of Haw Ridge.

3.1.2 Environmental Consequences

3.1.2.1 Proposed Action

Construction of the SIPRC would change about 10 acres of the existing undeveloped land use to the institutional/research designation. The change to the existing land use for the SIPRC site would be minor since the new designation would be within the context of and compatible with the surrounding institutional/research and mixed industrial land uses in the 6000 Area and 7000 Area. The SIPRC would also have a minor visual impact since the existing visual landscape of the site would change from a wooded undeveloped area to a new facility. However, the SIPRC design and construction would blend in with the existing facilities in the vicinity and much of the existing undeveloped area would remain.

3.1.2.2 No Action Alternative

Construction of the SIPRC would not occur under the No Action Alternative. There would no change to the existing land use of the area.

3.2 GEOLOGY AND SOILS

3.2.1 Affected Environment

Part of the Valley and Ridge Physiographic province of East Tennessee, the ORR area is characterized by a series of narrow, parallel valleys and ridges. Valleys are typically underlain by Chickamauga limestones or by Conasauga Group shale and shaley limestones. Ridges are capped with the more resistant sandstones and siltstones of the Rome and the post-Chickamauga rocks or by Knox Group dolostones (Hatcher 1992, ORNL 2006).

The main campus of ORNL is in Bethel Valley to the south and east of White Oak Creek. The subsurface geology of Bethel Valley in the ORNL area is underlain primarily by Ordovician Chickamauga limestones and siltstones along with Mascot Dolomite (Knox Group) at the base of Chestnut Ridge and with Lower Cambrian Rome Formations south of the Copper Creek Fault. From north to south, bedrock in Bethel Valley prescribes roughly horizontal bands between the ridges, transitioning from oldest to youngest Chickamauga members.

Characterization of the SIPRC site was provided by Shield Engineering, Inc. (Shield). Geotechnical activities to characterize subsurface conditions at the site included field activities and laboratory testing along with report preparation. Information from this May 2021 report are considered in the design and construction of the SIPRC site from site preparation through building construction (Shield 2021).

The SIPRC site ranges from almost 800 feet above mean sea level (amsl) in the northwest near White Oak Creek up to nearly 900 feet amsl in the southeast (Shield 2021). The Shield survey of the SIPRC site found an irregular bedrock surface with numerous outcrops. Bedrock at the SIPRC site is Witten Formation in the north with Moccasin Formation in the south (Shield 2021). The bedrock surface is highly irregular and numerous limestone outcrops are visible in the cut areas around the site (Shield 2021).

Topsoil at the SIPRC site ranges from 3 to 12 inches thick. Beneath the organic topsoil, residual soils from weathering of the bedrock were encountered to depths of 1.3 to 19.9 feet during the Shield survey (Shield 2021). Residual soils from the Witten and Moccasin bedrock are primarily clayey soils with some reddish clayey soils (Hatcher 1992, Shield 2021). Residual soils from the Moccasin are generally very shallow, providing a veneer of limy soil with reddish chips over the bedrock (USGS 1953). During the Shield survey, partially weathered bedrock was encountered beneath the residual soil to depths ranging from 1.3 to 19.8 feet in some of the borings (Shield 2021). Auger refusal occurred from 1.3 to 19.9 feet below grade for all borings during the Shield survey (Shield 2021).

3.2.1.1 Karst

Carbonate rocks, like limestone and dolomite, are subject to dissolution and the formation of karst features including voids, fissures, caves, and springs. Karst terrain is formed by water percolating down along the joints, fractures, and bedding planes dissolving the carbonate rock; thus, enlarging the opening. Over time, dissolution of carbonate rock, especially fractured limestone and dolomite, produces sinkholes, underground streams, enlarged fissures, and even caverns. The prevalence of near surface limestone and dolomite in East Tennessee along with humid conditions and variable water table levels provide optimal conditions for the development of karst features (USGS 2014, USGS 2018).

Within the ORR, karst is evident in both the Knox and Chickamauga Groups. While common, karst in the Chickamauga is isolated and poorly developed. Conversely, karst in the Knox Group is well developed and connected. Large springs often occur along the base of ridges underlain by the Knox

Group adjacent to the aquitard of the Maynardville limestone (Conasauga Group). And, thus, the potential for karst collapse is greatest at the base of these Knox Group ridges (ORNL 2006).

A natural resource survey performed as part of the 2019 Site Analysis, noted the presence of numerous springs and seeps over the SIPRC site (ORNL 2019). Although the surface of the SIPRC site does not exhibit large karst terrain features, the 2021 Geotechnical Report by Shield recognized the Witten Formation as a Karst limestone; advising the adoption of practices to reduce the potential for sinkhole formation during preparation and management of the SIPRC site (Shield 2021).

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action

Site preparation and construction on the SIPRC site would involve grubbing and extensive grading resulting in an 839-foot amsl finished elevation for the SIPRC building on a level site. The building footprint along with parking areas, laydown areas, building expansion areas, and utility access areas would be grubbed and graded with all surface materials removed, topsoil stockpiled on-site, low areas properly filled, and bedrock excavated to facilitate foundation activities. Boulders and stumps would be removed to a depth of two feet below grade surface. In addition, because the finished site would avoid the use of retaining walls, buffer zones allowing the proper slope from the finished grade to the undeveloped areas would also require complete grubbing and grading; resulting in a total of approximately 10 disturbed acres.

Impacts to site geology and soils would be minimized through implementation of the following measures. Potential impacts from erosion would be minimized through the development and implementation of a SWPPP in accordance with TDEC. A system of underdrains is recommended to drain away waters from springs and seeps encountered during grading to minimize continued erosion by the water feature (Shield 2021). In addition, implementation of erosion and sediment control measures and implementation of revegetation plans for disturbed areas would minimize permanent impacts. Site topsoil would be stripped and stock-piled on site prior to grading activities to allow application post-construction to facilitate revegetation. Potentially compacted soils in staging areas could be mechanically de-compacted prior to the revegetation phase of the project to facilitate re-growth.

During construction, stormwater control measures would be implemented to protect the exposed subsurface from surface water runoff or sediment transport during construction. Based on available survey data, it does not appear that sinkholes and void spaces are prevalent across the site. However, based on a review of the site’s topography there is the potential for seeps and springs being encountered during site grading. If new seeps or springs are identified during site grading the recommendation would be to install a system of underdrains to allow for drainage and prevent risk the risk of saturating newly placed fill (Shield 2021).

Once construction is complete, laydown areas and other open areas around the SIPRC building would be cleaned up, restored, and revegetated. Although erosion from stormwater runoff and wind action could occur occasionally during SIPRC operations, it is anticipated to be minimal.

Hazards posed by geological conditions are expected to be minor. Although historic thrust faults in the region continue to release energy, these frequent seismic events are relatively minor in magnitude. Potential hazards from earthquakes would be minimized through adherence to current International Building Code guidelines for facilities in seismic zones. Due to the clay content and shallow depth to bedrock, the subsurface conditions are not susceptible to liquefaction from a seismic event. Similarly, gentle to moderate slopes in the region reduce the incident rate of landslides, making landslide risk low.

Karst features were not discovered in the vicinity of the site making subsidence from karst a low risk. However, the continued formation and development of sinkholes on the site cannot be eliminated (Shield 2021). During site development, practices could be utilized to reduce the potential for sinkhole formation. These include: (1) in areas of cut, scarify and recompact the exposed upper nine inches of soil to develop a less permeable layer of material; (2) in suspect areas, utilize a liner system for ditches and water collection systems such as asphalt, concrete, or geo-membranes; (3) prior to slab placement, pressure test all under-slab piping before beginning service; (4) route roof drains away from structure and specifically not beneath the structure.

Although impacts to the existing geology and soils in the immediate vicinity of the SIPRC building would be major and permanent, adherence to regulations and best management practices (BMPs) would minimize the spatial extent of these permanent impacts. Continued utilization of SWPPP would minimize permanent impacts over the life of the project. Long-term, adverse impacts to the geology and soils in the region would be negligible.

3.2.2.2 No Action Alternative

The construction and operation of the SIPRC would not take place under the No Action Alternative. There would be no impacts to the existing geology and soils present on and in the vicinity of the SIPRC site.

3.3 WATER RESOURCES

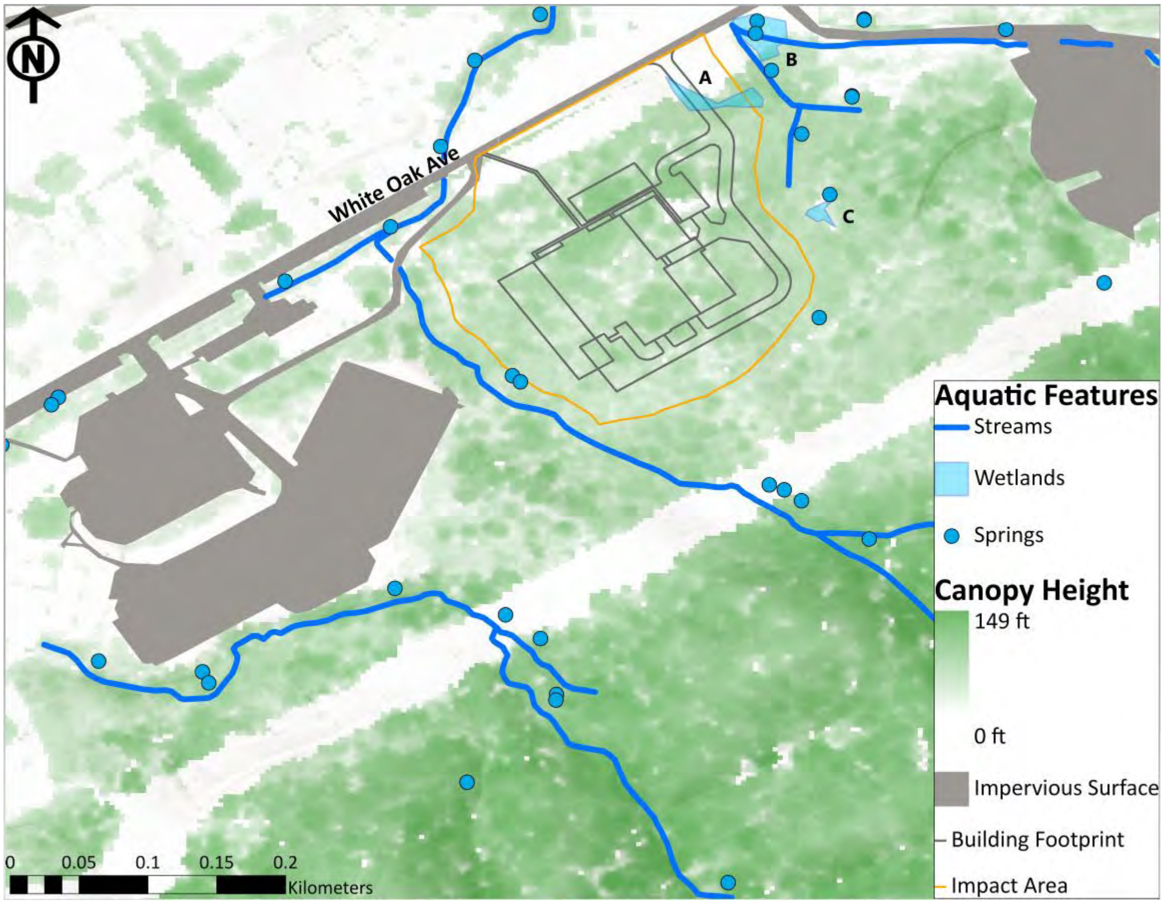
3.3.1 Affected Environment

3.3.1.1 Surface Water

ORNL occupies portions of two watersheds of tributaries to the Clinch River. Most of the area, including the West, Central, and East Campus areas of Bethel Valley, and the Melton Valley area, are in the White Oak Creek watershed. Surface water drainage from the ORNL area eventually reaches the Tennessee River via the Clinch River, which is located to the south and west. Surface water in this area is in hydraulic communication with the upper portion of the aquifer underlying ORNL. Water levels and flow rates in the tributaries and other surface water bodies are influenced by the position of the water table (Bonine and Ketelle 2001). Under natural conditions, flow in the Clinch River, White Oak Creek (which drains most of the main area of ORNL), and their tributaries is derived from groundwater discharge and surface water runoff.

Surface water at ORNL is classified by the state of Tennessee to support fish, aquatic life, and recreation as well as livestock and wildlife under Use Classification for Surface Water (1200-4-4). Surface water is not used for human consumption within the boundaries of ORNL. Water used at ORNL for drinking and cooling is supplied by the city of Oak Ridge. The city of Oak Ridge’s water intake is located on the Clinch River upstream of ORNL. The ORNL stormwater collection system consists of drainage ditches, catch basins, manholes, and collection pipes conveying stormwater, condensate, and cooling water flows to receiving streams. Rainfall, snowmelt, and other authorized flows are directed to the gravity-drainage system conveying the water from buildings, parking lots, streets, and roofs to outfalls. Each of these outfalls is periodically sampled and characterized to determine the makeup of the discharge stream and to ensure that it complies with NPDES permit requirements.

As part of the Natural Resources Assessment conducted for the SIPRC (ORNL 2021), an aquatic assessment was made of the SIPRC study area (approximately 30 acres). The area is prone to flooding, receiving large amounts of runoff from the ridge and gas line but it is not located within a floodplain. Several streams are located within the SIPRC study area, but none are located within the proposed limit of disturbance (Figure 3.1). These streams are tributaries to White Oak Creek, and they have been previously mapped and are in the ORNL databases. Wet weather conveyances, ditches, and seeps/springs also occur within the study area. In addition, the karst geology allows for fluctuating water levels that create temporary pools of water (ORNL 2021).



Source: ORNL 2021

Figure 3.1. Location of Aquatic Resources Found Within the SIPRC Study Area

3.3.1.2 Groundwater

Groundwater monitoring is conducted at selected areas of ORNL for various purposes, including DOE environmental surveillance, Water Resources Restoration Program, plume monitoring, and research projects. No groundwater monitoring wells are present in the immediate vicinity of the proposed SIPRC site.

As part of the geotechnical exploration of the SIPRC site (Shield 2021), groundwater measurements were taken after the completion of test borings performed across the site. Groundwater measurements were taken after 24 hours in all borings. Water levels were recorded in four borings at depths ranging from 18.2 feet to 23.2 feet below the ground surface near the rock core termination depths (Shield 2021). Shield noted that fluctuations in the elevations of the static groundwater table may occur seasonally and are also influenced by variations in precipitation, evaporation, surface water runoff and/or the presence of surface water features. In their report, Shield did not anticipate that groundwater would be an issue during construction of the SIPRC.

3.3.1.3 Wetlands and Floodplain

Three wetlands were delineated within the SIPRC study area investigated as part of the 2019 and 2021 SIPRC Natural Resources Assessment (ORNL 2021). These wetlands are labeled A, B, and C (Figure 3.1). Wetland A is almost entirely within the current disturbance limits for the project. The other two wetlands, Wetland B and Wetland C, are both located within 100 feet of the SIPRC area of disturbance.

Wetland A is a 0.123-acre wetland located along the tree line on the northeast side of the SIPRC area of disturbance. Hydrology characteristics come from a seasonally high-water table, flow from adjacent stream and low topography. The wetland contains both palustrine emergent and palustrine forested wetland communities. The emergent plant community occurs in the periodically mown right-of-way adjacent to White Oak Avenue. Dominant species with the mown sections are various wetland carex and grass species. As the soil becomes more saturated, species such as jewelweed, false-nettle, fox sedge, leafy bulrush and cattails grow within the wettest portion of the emergent wetland. The forested wetland portion contains species such as green ash, willow, and privet. The wetland nearly abuts the tributary contributes to the wet hydrology. A small drainage from the creek to an inundated portion of the forested wetland flows most of the year (ORNL 2021).

Wetland B is a 0.171-acre wetland just to the east of Wetland A. It lies within the riparian area of the two tributary streams that split at White Oak Creek Road near the existing access road to the 6556 Area. Hydrology is due to topography and proximity to the two streams. Wetland B contains palustrine emergent and palustrine forested communities. Unlike Wetland A, the emergent vegetation is not mown and is predominantly cattails, with some other wetland species including monkeyflower and wetland sedges. The forested community is predominantly made up of black willow and green ash (ORNL 2021).

Wetland C is a 0.032-acre wetland located just outside the southeast corner of the area of disturbance. This wetland contains predominantly emergent vegetation and saplings and is located within a dirt trail surrounded by forest. There are multiple pools of standing water along this dirt trail, but Wetland C is the only inundated area that contains hydrophytic vegetation such as green ash seedlings and bearded beggartick. A spring to the west of the wetland feeds a wet weather conveyance that flows through this wetland and toward the eastern stream (ORNL 2021).

No portion of the SIPRC site is located within any 100- or 500-year floodplain.

3.3.2 Environmental Consequences

3.3.2.1 Proposed Action

Surface Water

No perennial streams, seeps, or springs are located within the proposed construction and operational footprint (area of disturbance) for the SIPRC. None of these surface water features would be directly impacted by construction. During construction, soil erosion and sedimentation would increase due to increased soil exposure. However, the implementation of erosion prevention and sediment control measures such as silt fencing, filter socks, and temporary slope breakers, would reduce impacts to adjacent surface waters. Installing and maintaining erosion controls around the perimeter of the construction footprint especially along sloped areas would help minimize the potential for sediment transport into nearby streams. Temporary slope breakers terminating in sumps could help to trap sediment, and reduce water velocity prior to drainage into stream channels, thereby reducing erosion potential from storm events. In addition, a 60-foot riparian buffer on each side of the nearby perennial streams would be marked in the field prior to the start of construction to protect sensitive resources and minimize the potential for direct impacts. The potential for adverse impacts to surface water would exist until disturbed areas are stabilized, and revegetation is established.

Prior to the start of construction, it would be necessary to obtain a construction stormwater NPDES permit for discharges of stormwater associated with the construction activities. As part of the NPDES permit, the development and implementation of a SWPPP would be required to help minimize any pollution that might leave the site by stormwater. The SWPPP would contain a detailed site plan and schematics for the installation of temporary and permanent stormwater and erosions control devices to effectively manage the site during construction and SIPRC operation. Unless designed to remain in place, temporary erosion and sedimentation practices would be removed once the corresponding disturbed drainage area has been permanently stabilized.

The SIPRC building stormwater drainage system would be connected to each primary roof drain and be routed by gravity to a new site storm sewer. Storm drainage structures (catch basin, area drains, headwalls, etc.) would be installed in the apron, parking areas, driveways, and lawn on all sides of the building. The building drainage would be combined with a new stormwater system in the egress apron areas for the building and carried offsite to an existing drainage ditch/culvert located along White Oak Avenue. Cooling tower condensate/blowdown would be chemically treated as needed and also discharged into the new site stormwater system. No NPDES permit (new or modified) would be required for the stormwater from the SIPRC site.

The Technical Guidance on Implementing the Storm Water Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (EISA) is incorporated into processes and procedures at DOE sites. The intent of the Section 438 is to maintain or restore the pre-development site hydrology during the development process. In an effort to meet these requirements, the design of the proposed SIPRC site would include contouring the land to minimize the potential impact on existing surface waters. The clayey soils severely limit the infiltration of stormwater, and the introduction of additional groundwater to the underlying karst geology could accelerate the formation of sink holes. Instead of using subsurface infiltration to meet the requirements of Section 438 of the EISA, DOE would likely pursue mitigation of streams and associated buffer zone and the installation of devices and systems to improve water quality and allow for additional evapotranspiration.

Groundwater

No groundwater would be utilized by the SIPRC. During construction activities equipment washing would generate routine wastewater. Construction equipment could either be taken to an established maintenance area or washed in a temporary wash area that would prevent greases, oils, or material residues from contacting the ground surface and migrating to the subsurface. Uncontrolled spills of chemicals or petroleum products are also potential pathways of groundwater contamination. Spill prevention and clean-up programs, a wastewater discharge management plan, and waste management procedures would help to control potential impacts.

Stormwater runoff from impervious surfaces associated with the facilities would not have an adverse impact on groundwater because it would continue to be collected and discharged into the existing stormwater collection system and discharged under the applicable NPDES permit. The SIPRC would not require the use of groundwater for operations. Therefore, no impacts to groundwater are anticipated from normal facility operations.

Wetlands

As part of its NEPA review, DOE must determine whether the proposed action is in accord with the wetland protection requirements of Executive Order (E.O.) 11990 – Protection of Wetlands. A wetland assessment has been prepared for the Proposed Action in accordance with 10 CFR Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements," for the purpose of fulfilling DOE's responsibilities under E.O. 11990. A copy of the wetland assessment is included in Appendix A.

Construction of the SIPRC would have a long-term direct adverse impact on Wetland A, which would result in its permanent elimination. Wetland B and Wetland C are both located outside of the SIPRC area of disturbance and would not be directly impacted by construction. However, construction activities within the SIPRC area of disturbance could cause changes in the site hydrology, which could indirectly impact both Wetland B and C. Other potential indirect impacts could include siltation from soil erosion on the construction area, spills or leaks of oil or other chemicals from construction equipment, and allowing invasive, exotic plant pest species to colonize the wetlands thereby diminishing the diversity and quality of wetland impact.

Prior to the start of any construction, DOE would coordinate with the TDEC regarding the disturbance to Wetland A and potential indirect impacts to Wetland B and Wetland C. A TDEC Aquatic Resource Alteration Permit/Section 401 Water Quality Certification, and U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 Permit would be obtained. The implementation of stream and wetland buffer zones, spill prevention and response plans, and NPDES permit requirements would help to minimize the potential indirect impacts from spills, increased sedimentation and stormwater runoff.

Since Wetland A is over one tenth of an acre, compensatory mitigation could also be required. Guidelines of compensatory measures include a minimum ratio of 2:1 for restoration, 4:1 for creation and enhancement, and 10:1 for preservation, or at best professional judgement ration agreed to by the state (ORNL 2021). A potential mitigation option would be the preservation, enhancement, or restoration of Wetland C since it is located outside of the SIPRC area of disturbance. Preservation, enhancement, or restoration of Wetland C could also mitigate potential impacts to the state-listed four-toed salamanders (*Hemidactylium scutatum*) that occur within the wetland (see Section 3.4.1.3).

3.3.2.2 No Action Alternative

The construction and operation of the SIPRC at ORNL would not take place under the No Action Alternative. Current stable isotope production at ORNL would continue within existing facilities and there would be no additional impacts to water resources beyond those associated with other ongoing and planned activities.

3.4 ECOLOGICAL RESOURCES

3.4.1 Affected Environment

3.4.1.1 Vegetation

As part of the SIPRC Natural Resources Assessment (ORNL 2021), forest inventories and plant surveys were initially conducted in 2019 and completed during the 2021 growing season. Forest inventory data was collected to calculate estimates of basal area, tree density, species dominance and wood volume. The plant surveys were focused on areas with habitat most suitable for rare plant species. The 30-acre

SIPRC study area is approximately 14.5 acres conifer dominated forest and 12 acres hardwood dominated forest, with the remaining edge acreage being non-forested (maintained grass, kudzu, and gravel surface).

The forest inventory identified 26 species among live trees within the SIPRC study area. Table 3.1 presents a list of these species and live tree basal area statistics. Additional forest inventory data including the basal area by genus, tree number and density, along with the estimated volume of merchantable timber can be found in the Natural Resources Survey report presented in Appendix B.

Table 3.1. Live Basal Area by Species

Scientific Name	Common Name	Basal Area (ft^2)			
		Trees (dbh > 10 in.)	**Saplings (2 > dbh < 10 in.)**	**All tally trees (dbh > 2 in.)**	**Merchantable**
Juniperus virginiana	red cedar	660.5	575.3	1235.8	617.9
Liriodendron tulipifera	tulip poplar	319.6	21.3	340.9	234.4
Acer rubrum	red maple	170.5	149.2	319.6	149.2
Pinus echinata	short-leaf pine	127.8	0.0	127.8	127.8
Quercus shumardii	Shumard oak	106.5	0.0	106.5	85.2
Pinus virginiana	Virginia pine	85.2	63.9	149.2	85.2
Oxydendron arboreum	sourwood	42.6	63.9	106.5	0.0
Prunus serotina	black cherry	42.6	21.3	63.9	0.0
Quercus alba	white oak	42.6	21.3	63.9	42.6
Quercus stellata	post oak	42.6	0.0	42.6	42.6
Ulmus rubra	slippery elm	42.6	21.3	63.9	21.3
Carya cordiformis	bitternut hickory	21.3	0.0	21.3	21.3
Carya glabra	pignut hickory	21.3	0.0	21.3	21.3
Cercis canadensis	redbud	21.3	170.5	191.8	0.0
Quercus muehlenbergii	chinquapin oak	21.3	21.3	42.6	0.0
Quercus velutina	black oak	21.3	21.3	42.6	21.3
Ulmus alata	winged elm	21.3	21.3	42.6	21.3
Acer saccharum	sugar maple	0.0	127.8	127.8	0.0
Carya tomentosa	mockernut hickory	0.0	21.3	21.3	0.0
Cornus florida	flowering dogwood	0.0	63.9	63.9	0.0
Diospyros virginiana	persimmon	0.0	42.6	42.6	0.0
Fagus grandifolia	American beech	0.0	42.6	42.6	0.0
Juglans nigra	black walnut	0.0	21.3	21.3	0.0
Liquidambar styraciflua	sweetgum	0.0	85.2	85.2	0.0
Quercus falcata	southern red oak	0.0	42.6	42.6	0.0
Robinia pseudoacacia	black locust	0.0	21.3	21.3	0.0
	Totals	**1811.11**	**1640.62**	**3451.73**	**1491.51**

3.4.1.2 Wildlife

The SIPRC study area contains a largely unfragmented forest with shallow to exposed karsts, relic cedar barrens, grassy forest gaps, spring and seeps, and wetlands that host potential habitat for numerous wildlife species. The resulting diversity of wildlife species ranges from species commonly found in urban and suburban areas of East Tennessee to species that have more restrictive habitat preferences such as interior forest birds and rare amphibians and reptiles.

Wildlife surveys of the SIPRC study area were conducted in 2020 and 2021 as part of the SIPRC Natural Resources Assessment (ORNL 2021). These included bat acoustic surveys, visual encounter surveys, avian point counts, small mammal trapping, funnel trap surveys (small vertebrates and invertebrates), a nocturnal species survey, and camera-trap surveys.

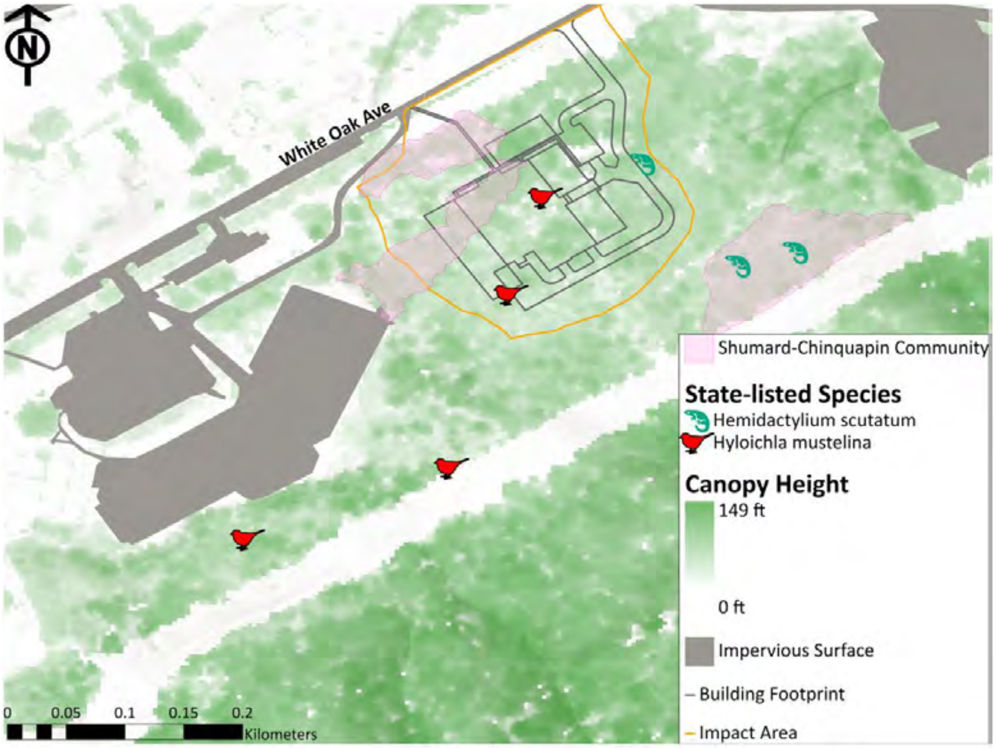
A list of all vertebrate wildlife known from the SIPRC study area is included in the SIPRC Natural Resources Assessment report (Appendix B). In total, greater than 105 vertebrate animals are known from the study area in the spring/summer of 2021. This includes 10 amphibians, 54 birds, 25 mammals, 15 reptiles, and 1 fish (37 invertebrates were also identified).

3.4.1.3 Rare Species and Habitat

Of all species known from the SIPRC study area, at least 60 are afforded special legal protection under state or federal law (ORNL 2021). Information on these species from the SIPRC Natural Resources Assessment report (Appendix B) is summarized below.

All the 54 bird species identified are protected under the Migratory Bird Treaty Act. Of the 54 species, 3 are assigned as common birds in steep decline, 4 designated to be in need of management action, and 2 that are on the yellow watch list; designations that are created by Partners in Flight. Additionally, 4 birds are considered by U.S. Fish and Wildlife Service (USFWS) to be birds of management concern, and 4 species are deemed by USFWS to be Birds of Conservation Concern. The wood thrush (*Hylocichla mustelina*), a species identified with the survey area, is one of ORNL's focal species. ORNL focal species are species of research or conservation interest for ORNL. The Wood thrush is also state listed In Need of Management, in addition to being on the yellow watch list and Birds of Conservation Concern list. The wood thrush was identified as occurring within the SIPRC area of disturbance and within the larger SIPRC study area (Figure 3.2).

No status small mammal species were detected during the spring/summer surveys conducted in 2021. However, historical data from ORNL and TDEC indicate the presence of southern bog lemmings (*Synaptomys cooperi*) near the vicinity of the SIPRC project area. This species is state listed as In Need of Management by both the Tennessee Wildlife Resources Agency (TWRA) and TDEC. Its current presence is possible but unconfirmed (ORNL 2021). Gravid females and nests of state-listed four-toed salamanders occur in the southeastern portion of the SIPRC study area near springs and wetlands. This species was also identified within the area of disturbance (Figure 3.2).



Source: ORNL 2021

Figure 3.2. Location of State Listed Species Within the SIPRC Study Area

Visual surveys of the SIPRC study area found trees with peeling bark and dead snags with peeling bark or crevices to serve as suitable roosting habitat for forest dwelling bat species, and foraging habitat was found throughout the study area (ORNL 2021). Bat acoustic surveys were conducted a total of 104 survey nights. In total, 12 native bat species were detected in the spring/summer of 2021. Of these, detection frequencies provided strong evidence for ten species, including the federally endangered gray bat (*Myotis grisescens*), state threatened little brown bat (*Myotis lucifugus*), and state threatened tricolored bat (*Perimyotis subflavus*). The latter two species are currently under petition for federal listing. Evidence is weak that the federally endangered Indiana bat and federally threatened northern long-eared bat would roost within the SIPRC study area, though a small number of calls were recorded. Four of the 10 bat monitoring sites that indicated the presence of federal and state listed bats were located within the proposed SIPRC area of disturbance.

Few rare plant species occur within the SIPRC study area and there are no records of plant species in this area that are on the state or federal protections lists (ORNL 2021). A population of blueflag iris (*Iris virginica*), an ORNL focal species, is located outside of the proposed area of disturbance. This species is uncommon in East Tennessee. Three areas within the SIPRC study area are dominated by Shumard oak (*Quercus shumardii*) and chinquapin oak (*Quercus muehlenbergii*). Two of these areas preside mainly in the current area of disturbance. These areas have been identified as Shumard oak and chinquapin oak communities of conservation concern (Figure 3.2). Dry sites with shallow soils over limestone dominated by oak trees (found chiefly on limestone) are uncommon plant communities.

3.4.2 Environmental Consequences

3.4.2.1 Proposed Action

Vegetation and Wildlife

Construction of the SIPRC would directly impact approximately 10 acres of mixed deciduous forest and herbaceous utility right-of-way adjacent to White Oak Avenue. Clearing and grading within the proposed area of disturbance would be necessary for construction of the SIPRC building, driveways/access road, and parking and loading areas. The construction would result in the permanent loss of forest area. Portions of the right-of-way would be temporarily impacted, while minor parts of it would be permanently impacted by the installation of new impervious surface (i.e., sidewalks and driveways). Temporarily disturbed areas would be revegetated post construction. While adverse, the loss of approximately 10 acres of forest would not be significant due to the extensive amount of heavily forested area adjacent to proposed area of disturbance.

Construction impacts could include direct mortality or injury to wildlife. Indirect impacts to wildlife would potentially include specialized interior forest species directly outside the area of disturbance that would be affected by forest fragmentation. Normal facility operations would not have any adverse impacts to wildlife or aquatic habitat or pose any unacceptable ecological risk. To minimize the potential for adverse impacts, soil disturbance would be minimized to the maximum extent possible to limit potential impacts to ground-dwelling species (e.g., reptiles, amphibians, and small mammals). Also, ORNL Natural Resources staff would be on-site during site development activities to ensure that clearing limits are adhered to and to limit potential encroachment into sensitive areas (e.g., stream riparian zones, wetlands, sensitive species habitat). These measures would ensure that wildlife impacts would be minimal. Additionally, many of the species that likely occur in the affected area are common in the Oak Ridge area and some species could relocate to similar habitats located immediately adjacent to the area of disturbance.

Rare Species and Habitat

No federally or state listed threatened or endangered plant species were identified within the SIPRC area of disturbance. While not listed, two Shumard-chinquapin oak communities within the area of disturbance would be permanently impacted under the proposed action. To minimize the loss of these two communities of conservation concern, efforts could be made to expand the Shumard-chinquapin oak community that is within the SIPRC study area but outside of the area of disturbance (Figure 3.2). This could be accomplished with proper management tools such as invasive species control and prescribed burns. The wetland area where the blue flag iris would not be impacted.

The state-listed four-toed salamander, which has been identified as occurring within the SIPRC area of disturbance could be directly impacted during clearing and grading of the site. The state-listed wood thrush, which was also identified within the area of disturbance would be indirectly impacted due to the loss of habitat. However, the wood thrush was also identified in the surrounding forest area and this provides suitable habitat for the species to relocate to.

Based on the results of on-site surveys conducted in 2019 and 2021, most migratory birds known to frequent the proposed SIPRC site would nest between April 1 and October 30 (ORNL 2021). To protect these species, surveys would be conducted for early nesters (February 1 thru March 31) prior to any proposed clearing within the SIPRC area of disturbance and clearing would be conducted outside the nesting season for most bird species that frequent the area.

Clearing and grading activities would result in the loss of suitable roosting and foraging habitat for forest dwelling bat species including the federally endangered gray bat, state threatened little brown bat, and state threatened tricolored bat. Since the gray bat is cave obligate, it would only use the SIPRC area to forage. It is also possible that federally endangered Indiana bats and federally threatened northern long-eared bats could roost and forage within the SIPRC study area. However, based on the bat acoustic surveys, evidence for these species is weak (ORNL 2021). DOE determined that removal of trees within the proposed SIPRC area of disturbance may affect but is not likely to adversely affect federally listed bat species.

Given that the proposed construction area for the SIPRC contains suitable foraging habitat for federally listed bats, and federally listed bats were detected via acoustic survey, informal consultation with the USFWS was initiated (Appendix C). Informal consultation between DOE and USFWS was also initiated for migratory birds under existing agreements between the two agencies. The USFWS Cookeville Field Office provided an initial response indicating that there could be an effect on bats because of the project, which might require some type of mitigation in compensation for project impacts. The USFWS will provide a formal letter outlining their determination. This may lead to a negotiated mitigation of impacts. The results of additional consultation with between DOE and the USFWS will be updated prior to the completion of the Final EA.

Additionally, TDEC and the TWRA have been notified concerning potential impacts to state-listed fauna and sensitive or rare habitat within or directly adjacent to the SIPRC area of disturbance. Initial responses from these agencies have been provided (Appendix C) and the results of any additional consultation will be updated prior to the completion of the Final EA. Additional consultations with TDEC and TWRA would be conducted during the process of applying for required Aquatic Resource Alteration Permit and Construction Stormwater Permits. These consultations would take place following submittal of completed and ongoing detailed sensitive resources assessment reports, which would provide more detailed information on the site.

3.4.2.2 No Action Alternative

The construction and operation of the SIPRC at ORNL would not take place under the No Action Alternative. Current stable isotope production at ORNL would continue within existing facilities and there would be no additional impacts to ecological resources beyond those associated with other ongoing and planned activities.

3.5 CULTURAL RESOURCES

3.5.1 Affected Environment

Cultural resources include “historic properties” as defined in the National Historic Preservation Act of 1966 (NHPA), “archaeological resources” as defined in the Archaeological Resources Protection Act, and “cultural items” as defined in the Native American Graves Protection and Repatriation Act. Cultural resources thus include, but are not limited to, the following broad range of items and locations:

- Archaeological materials (i.e., artifacts) and sites that date to the prehistoric, historic, and ethnohistoric periods that are currently located on, or are buried beneath, the ground surface.

- Standing structures and/or their component parts that are over 50 years of age or are important because they represent a major historical theme or era (e.g., the Manhattan Project and the Cold War).

- Structures that have an important technological, architectural, or local significance.
- Cultural and natural places, select natural resources, and sacred objects that have importance for Native Americans.
- American folk life traditions and arts.

An extensive discussion of cultural resources of the ORR region can be found in the DOE Oak Ridge Office Cultural Resource Management Plan (DOE 2001). In 2017, Cultural Resource Analysts, Inc. completed a historic architectural resources survey of the ORNL (ORNL 2018). The survey included the entirety of ORNL's main campus. The findings of the survey built on the conclusions of the 1994 survey by DuVall & Associates, Inc. as well as the survey updates completed by Thomason and Associates in 2004 and 2015.

Based on the previous fieldwork and research, several properties at ORNL have been determined to be eligible for inclusion in the National Register of Historic Places (NRHP). The NRHP eligible sites that are located nearest to the proposed SIPRC site include two historic sites within two miles. The first site being less than 0.5-miles away from the SIPRC site is New Bethel Baptist, and the second site just over 0.5-miles away is the X-10 reactor, both respectively described in Table 3.2.

Table 3.2. NRHP Properties within Two Miles of the SIPRC Site

Site	NRHP number	Date listed	Description	Approximate distance to SIPRC site (miles)
New Bethel Baptist Church	92000409	5/6/1992	No style listed. Area of significance is art, military, architecture, and social history	0.13
X-10 Reactor, Oak Ridge National Library	66000720	10/15/1966	Area of significance is science and invention.	0.66

A 2021 desktop review compiled information about the proposed SIPRC site from the ORNL Natural Resources geographic information system databases and aerial photography archives, as well as the 1942-43 USACE scans of archived photography taken during acquisition of land for the Manhattan Project in Oak Ridge. The SIPRC site is located partially within two of the original acquisition parcels: Parcel A-12, encompassing 360-acres, and Parcel A-13, encompassing 292-acres of undeveloped land. No pre-WWII structures were evident on the 1942 aerial photography for the portions of parcel A-13 located within the SIPRC site area, though fence rows and large edge trees that define the parcel boundaries were observed during a field survey in February 2021 (Byrd 2021).

For the portion of the SIPRC located within parcel A-12, the 1942 aerial photography was compared to the 1941 USGS-TVA Bethel Valley topographic map. Mapped features were overlain and compared to allow structures to be georeferenced with global positioning system coordinates. In February of 2021 a reconnaissance survey, which lacked invasive excavations, was conducted to identify any remaining ground evidence of the previously existing structures within parcel A-12 using the georeferenced locations. A total of 26 improvements (constructed features) were identified within parcel A-12, six of which are located within the SIPRC study area. The six improvements are all likely associated and include a tenant house, smoke house, spring house, crib/shed, barn, and privy (outdoor toilet), and additional features such as fence rows, large edge trees (Byrd 2021).

3.5.2 Environmental Consequences

3.5.2.1 Proposed Action

Construction of the SIPRC would result in an adverse effect to the foundation rock piers associated with the pre-WWII homesite barn. The barn was a board box structure with a metal roof and rock piers. This is the least disturbed foundation located within parcel A-12 the SIPRC Site. At least seven rock piers were identified at this location. The remaining five improvements associated with the homesite are located outside of the area of disturbance and would be protected during the construction of the SIPRC.

As part of the Section 106 review process under the NHPA, DOE contacted the Tennessee State Historic Preservation Office (TN SHPO) regarding the potential significance of the pre-WWII homesite structures and the adverse effect on the remains of the barn. In response to the DOE request, the TN SHPO stated that the undertaking would not adversely affect the ORNL Historic District but to complete their review, a detailed archaeological survey report (Phase I Archaeological Survey) on the area of potential effect was requested. Copies of the correspondence between DOE and the TN SHPO are included in Appendix C. DOE will complete the Phase I Archaeological Survey and the results will be incorporated in the Final EA once the survey and any additional consultation with the TN SHPO is completed.

If during construction activities, an unanticipated discovery of cultural materials (e.g., human remains, pottery, weapon projectiles, and tools) or sites is made, the DOE Oak Ridge Historic Preservation Manager would be notified immediately, and all excavation would cease in the immediate vicinity. A further determination would be made and appropriate consultation requirements with the TN SHPO would be initiated and completed prior to any further disturbance of the discovery-site area.

Once constructed, operation of the SIPRC would involve access to and use of the facility, maintenance, and landscaping. Because these activities would not require ground disturbance, operation of the SIPRC would have no impact on cultural resources.

3.5.2.2 No Action Alternative

Under the No Action Alternative, the construction and operation of the SIPRC at ORNL would not take place. Current stable isotope production at ORNL would continue within existing facilities and there would be no additional impacts to cultural resources beyond those associated with other ongoing and planned activities.

3.6 AIR QUALITY

3.6.1 Affected Environment

3.6.1.1 Air Quality Standards

Ambient air quality is determined by the type and amount (concentration) of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. Through the passage of the Clean Air Act of 1970, which was last amended in 1990, the U.S. Environmental Protection Agency (EPA) has established the National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The EPA has set NAAQS for six criteria pollutants [carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone, sulfur oxides (SO_2), particulate matter (PM) with a diameter of less than or equal to 10 microns (PM_{10}), and particulate matter with a diameter of less than or equal to 2.5 microns ($PM_{2.5}$)].

The primary NAAQS were promulgated to protect public health, and the secondary NAAQS were promulgated to protect public welfare (e.g., visibility, crops, forests, soils, and materials) from any known or anticipated adverse effects of air pollutants. Primary and secondary standards are listed in Table 3.3 (EPA 2021a).

Table 3.3. National Ambient Air Quality Standards

Criteria Pollutant		Primary/Secondary	Averaging Time	Level [a]	Form
Carbon Monoxide (CO)		Primary	1-hour	35.0 ppm	Not to be exceeded more than once per year
			8-hour	9.0 ppm	
Lead (Pb)		Primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)		Primary	1-hour	100 ppb	98[th] percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1-year	53 ppb	Annual mean
Ozone (O_3)		Primary and secondary	8-hour	70 ppb[b]	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
Particulate Matter	$PM_{2.5}$	Primary and secondary	24 hours	35.0 µg/m^3	98[th] percentile, averaged over 3 years
		Primary	1 year	12.0 µg/m^3	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years
	PM_{10}	Primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year
Sulfur Dioxide (SO_2)		Primary	1-hour	75 ppb	99[th] percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Notes:
[a] Units of measure are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter (µg/m3) of air.
[b] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards remain in effect in some areas. Some areas may have certain continuing implementation obligations under the prior 1-hour (1979) O_3 standards. Source: EPA 2021a

Areas in compliance with the NAAQS are designated "attainment" areas. Non-attainment areas have pollutant concentrations that are greater than acceptable levels established by NAAQS, which indicates poor air quality. A nonattainment designation requires that a region submit a State Implementation Plan

(SIP) that addresses how the NAAQS will be met. The EPA would determine whether the region has met the SIP goals, and if so, the designation is changed from a nonattainment area to “maintenance” area. The Clean Air Act General Conformity Rule requires that Federal actions taking place in nonattainment areas conform to the region’s SIP for reducing airborne concentrations of the nonattainment pollutant(s).

The state of Tennessee has adopted NAAQS [TDEC 1200-3-3].

3.6.1.2 Regional Air Quality

The proposed SIPRC site is in Roane County. As of July 7, 2021, Roane County was designated as an attainment area for the NAAQS (EPA 2021b). Roane County is only in maintenance status for $PM_{2.5}$ levels (redesignated from nonattainment to maintenance in September 2017). The surrounding counties are also in attainment or in maintenance status for all NAAQS. Anderson County was redesignated to maintenance status for ozone in August 2015 and for $PM_{2.5}$ in August 2017. Blount and Knox Counties were redesignated to maintenance status for ozone in August 2015 and for $PM_{2.5}$ in September 2017; Loudon County was redesignated to maintenance status for $PM_{2.5}$ in September 2017. The average emission levels from the most recent EPA inventory data for NAAQS pollutants in Roane County (2017) are presented in Table 3.4.

Table 3.4. Average Emissions of NAAQS Pollutants in Roane County for 2017

Pollutant	Emissions (tons per year)
Carbon Monoxide	12,361
Lead	0.159
Nitrogen Oxides (NOx)	3,606
$PM_{2.5}$ Primary	920
PM_{10} Primary	1,449
Sulfur Dioxide	2,026
Volatile Organic Compounds (VOC)	10,332

Source: EPA 2017

Emissions that would be generated were compared with Roane County emissions obtained from EPA’s 2017 National Emissions Inventory. The latest available National Emissions Inventory data for Roane County are presented in Table 3.4. The county data include emissions amounts from stationary sources (point and nonpoint sources), mobile sources, fires, and biogenics (naturally occurring emissions). Point sources are stationary sources that can be identified by name and location. Non-point sources are point sources from which emissions are too low to track individually, such as a home or small office building, or a diffuse stationary source, such as wildfires or agricultural tilling. Mobile sources are any kind of vehicle or equipment with gasoline or diesel engine. Two types of mobile sources are considered: on-road and non-road. On-road sources consist of vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Non-road sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles (EPA 2017).

Ten meteorological towers are located on the ORR to provide data on meteorological conditions and on the transport and diffusion qualities of the atmosphere. Data collected at the towers are used in routine dispersion modeling to predict impacts from facility operations and as input to emergency response atmospheric models, which are used for simulated and actual accidental releases from a facility (DOE 2021a). Three of the towers are located at ORNL. A fourth tower supports meteorological measurement for releases close to the Spallation Neutron Source, north of the SIPRC site. Pursuant to 40 CFR Part 61, Subpart H, the DOE ORNL Site Office has published the Air Emissions Annual Report for Calendar Year 2020 (DOE 2021b). The report includes ORR facility information, air emissions data, and dose assessments to document compliance with all requirements 40 CFR Part 61.

3.6.1.3 Greenhouse Gases (GHGs)

GHGs are compounds found naturally within the earth's atmosphere. These compounds trap and convert sunlight into infrared heat. In this way, GHGs act as insulation in the stratosphere and contribute to the maintenance of global temperatures. As the levels of GHGs increase at ground level, the result is an increase in temperature on earth, commonly known as global warming. The climate change associated with global warming is predicted to produce negative economic and social consequences across the globe through changes in weather (e.g., more intense hurricanes, greater risk of forest fires, flooding).

The most common GHG emitted from natural processes and human activities include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. The primary GHG emitted by human activities in the US is CO_2, representing approximately 80 percent of total GHG emissions in 2019. The largest source of CO_2 and of overall GHG emissions is fossil fuel combustion. CH_4 emissions, which have declined from 1990 levels, result primarily from production and transport of fossil fuels; livestock and other agricultural practices; and decomposition of wastes in landfills. Agricultural soil management and mobile source fuel combustion are the major sources of N_2O emissions in the US are agriculture, land use, and combustion of fossil fuels and solid waste. Major sources of fluorinated gases are industrial processes. (EPA 2021c).

GHG emissions for Tennessee and Roane County from 2019 reported as carbon dioxide equivalents (CO_2e), obtained from EPA's Facility Level Information on Greenhouse Gases Tool (FLIGHT; EPA 2020) are summarized in Table 3.5.

Table 3.5. Greenhouse Gas Emissions Inventory for Roane County, TN

Area	Greenhouse gases (million metric tons/year)
	Carbon dioxide equivalent (CO_2e)
Roane County	4.1
Tennessee	40
United States	2,850

Source: EPA 2020

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action

Construction Emissions

During site preparation and construction, the use of heavy equipment (e.g., bulldozers, dump trucks, pile drivers, etc.) would generate engine exhaust containing air pollutants associated with diesel combustion. Similar air emissions would be generated from delivery vehicles bringing supplies and equipment to the construction site and from construction workers commuting in their personal vehicles.

Emissions associated with the combustion of gas and diesel fuels by internal combustion engines would generate local emissions of particulate matter, nitrogen oxide (NOx), CO, volatile organic compounds (VOCs), and SO_2 during the construction period. Air quality impacts from construction activities would depend on both man-made factors (intensity of activity, control measures, etc.) and natural factors such as wind speed and direction, soil moisture, and other factors. However, even under unusually adverse conditions, these emissions would have, at most, a minor transient impact on air quality, which would remain well below the applicable ambient air quality standard.

Construction of the SIPRC would include clearing, grading and ground-disturbing activities. Therefore, construction activities could also generate fugitive dust (i.e., airborne particulate matter that escapes from a construction site) from earthmoving and other construction vehicle operation, resulting in negative impacts on air quality. In addition, grading activities result in soil disturbance that can make soils vulnerable to wind erosion. Increases in fugitive dust concentrations would probably be noticeable on the site and in the immediate vicinity, and ambient concentrations of particulate matter could rise in the short-term. However, control measures for lowering fugitive dust emissions (i.e., covers and water or chemical dust suppressants) would minimize these emissions. Properly implemented control and suppression measures, as well as BMPs (such as covered loads and wet suppression), greatly minimize fugitive dust emissions. In addition, standard erosion control measures, such as redistribution of removed topsoil and reseeding, would minimize the potential for wind erosion.

Construction and preconstruction activities, such as operation of on-road construction vehicles, commuter vehicles, nonroad construction equipment, and marine engines, would also result in GHG emissions, principally CO_2. However, based on the relatively small construction equipment GHG footprint compared to total Tennessee and United States annual GHG emissions, the atmospheric impacts of GHGs from construction and preconstruction activities would not be noticeable and additional mitigation would not be warranted.

Overall, with adherence to regulations and BMPs, air emissions associated with the construction of SIPRC, including GHG emissions, are expected to be minor. Emissions from construction would have, at most, a minor transient impact on air quality, which would remain well below the applicable ambient air quality standards.

Operational Emissions

Specific details about atmospheric pollutants including emissions of hazardous air pollutants that may be emitted by the SIPRC during operation are not available. However, any emissions would be expected to be minimal and would be controlled within the facility using conventional treatment technologies like scrubber systems and particulate filters, and external effects would be negligible. New facility operations that have minor air contaminant sources would be required to obtain air quality construction and operating permits (non-Title V) from TDEC. The terms and conditions of the permits would include emission limits and outline specific monitoring, operating conditions, and recordkeeping requirements for the source. An air emissions review and permit evaluation would be conducted prior to starting stable isotope production and any required permits would be obtained.

Gases and heat generated during operations would be ventilated from the SIPRC via an exhaust system. Roof mounted heat exhaust would exhaust excess heat from ovens, furnaces, soldering stations and provide exhaust from a chemical washroom. Roof mounted toxic exhaust would provide exhaust primarily from chemical fume hoods and gas cabinets.

The SIPRC would include three natural gas fired hot water boilers (two active; one standby) and a diesel generator, which could require a modification to the ORNL Title V Clean Air Act Operating

Permit. A permit evaluation would be conducted prior to the purchase and installation of the boilers and generator. Emissions are expected to be minor, and any boiler installed must use a low NOx burner.

Overall, the operation of the SIPRC would not constitute a major source of air pollutants. No adverse impacts to air quality or GHG emissions are anticipated.

3.6.2.2 No Action Alternative

Under the No-Action Alternative, the SIPRC would not be constructed, and no additional air emissions would occur. Air quality would be unaffected compared to baseline levels discussed in Section 3.6.1.

3.7 NOISE

3.7.1 Affected Environment

Noise is unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. Noise is any sound that impacts the resource being considered in this section—a sound environment that is quiet and/or desirable to the sound receptor (i.e., a person or animal hearing the sound). Responses to noise vary widely according to the characteristics of the sound source, the distance between the noise source and the receptor, and the time of day as well as the sensitivity and expectations of the receptor.

Sound varies by both intensity and frequency. Various units are used to measure sound and noise levels, including decibel (dB), A-weighted decibel scale (dBA), sound level equivalents (Leq), day-night average sound levels (Ldn), and percentile. While the dB scale is an unweighted logarithmic unit of measure based on sound pressure or intensity, the dBA scale is based on intensity and weighted for frequency because the human ear does not perceive all frequencies in the same way. As dBA increases, hearing is more likely to be damaged. The most common measurement of sound and environmental noise is the dBA, a logarithmic scale that ranges from 0 dBA to about 140 dBA and approximates the range of human hearing. Approximate noise levels measured in dBA of common activities/events are provided below.

- 0 dBA - the softest sound a person can hear with normal hearing
- 10 dBA - normal breathing
- 20 dBA - whispering at 5 feet
- 30 dBA - soft whisper
- 50 dBA - rainfall
- 60 dBA - normal conversation
- 110 dBA - shouting in ear
- 120 dBA - thunder

The dBA noise metric describes steady noise levels, although very few noises are constant. Therefore, A-weighted Day-night Sound Level has been developed. To adjust for nighttime annoyances, noise levels are computed over a 24-hour period and noise level measurements between the hours of 10 pm and 7 am are artificially increased by 10 dB. This results in the day-night-sound level measured in units of Ldn. In the United States, Ldn is the metric recommended by the EPA and has been adopted by most Federal agencies. An Ldn of 65 dBA is commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like construction. An Ldn of 55 dBA was identified by the EPA as a level below which there is no adverse impact (EPA 1974).

The Noise Control Act of 1972, as amended, delegates authority to the states to regulate environmental noise and directs State and local government agencies to comply with Federal, State, and local noise requirements. However, neither the state of Tennessee, nor Roane County, maintain noise ordinances that set strict not-to-exceed levels.

Noise sources within the ORNL can be categorized into two major groups: transportation and stationary. Transportation noise sources are associated with moving vehicles that generally result in fluctuating noise levels above ambient noise levels for a short period of time. Stationary noise sources are those that do not move or that move relatively short distances. Stationary noise sources include ventilation systems, air compressors, generators, power transformers, and construction equipment. These stationary sources are primarily associated with the ongoing activities within the industrialized central portion of ORNL. During peak hours, traffic along White Oak Avenue is a major contributor to traffic noise levels in the area. Background noise levels at the ORNL are mostly from local traffic and are comparable to noise levels in an urban residential area.

The proposed SIPRC site is a heavily vegetated area on the eastern edge of ORNL's main campus. The only sensitive noise receptors (i.e., schools, churches, daycare facilities, etc.) within 1 mile of the proposed SIPRC site is New Bethel Baptist Church which approximately 0.2 miles north of the site. However, this church is rarely used or accessed. No sensitive receptor sites such as picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, or hotels are presently located in the immediate ORNL vicinity.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action

Construction of SIPRC would generate a range of noises from the operation of construction equipment on-site and the movement of construction-related vehicles (i.e., worker trips, and material and equipment trips). Noise levels associated with construction activities will increase ambient noise levels adjacent to the construction site and along roadways used by construction-related vehicles; however, the level of construction noise would vary depending on the phase of construction. The activity likely to make the most noise would be the pile drivers used during the construction of the building foundation. Standard construction pile drivers are estimated to produce between 90 to 95 dBA at 50 feet (DOT 2006). Noisy construction equipment, such as delivery trucks, dump trucks, water trucks, service trucks, bulldozers, chain saws, bush hogs, or other large mowers for tree clearing, produce maximum noise levels at 50 feet of approximately 84 to 85 dBA. These types of equipment may be used for approximately 2 months (approximately 60 days) in the project area. Examples of possible construction equipment and associated noise levels are presented in Table 3.6.

Table 3.6. Examples of Possible Construction Equipment and Noise Emission Criteria Limits

Equipment Description	Lmax Noise Limit at 50 feet, dB	Equipment Description	Lmax Noise Limit at 50 feet, dB
Backhoe	80	Flat Bed Truck	84
Chain Saw	85	Front End Loader	80
Clam Shovel	93	Grader	85
Compressor (air)	80	Jackhammer	85
Concrete mixer truck	85	Paver	85
Crane (mobile or stationary)	85	Pickup Truck	55
Dozer	85	Pile Driver	95
Dump Truck	84	Vibratory Concrete mixer	80
Excavator	85	Welder	73

Source: Adapted from DOT 2006

The overall noise levels generated by construction-related traffic would be consistent with customary construction noise levels and temporary. During operation of SIPRC, the ambient sound environment would be expected to return to existing levels. No long-term increases in the overall noise environment (e.g., Leq) would be expected with the operation of the SIPRC. Further, the area surrounding the proposed SIPRC is generally used for industrial purposes and is not considered to be noise sensitive.

3.7.2.2 No Action Alternative

Under the No Action Alternative, the SIPRC would not be constructed. There would be no noise impacts beyond those presently occurring from other construction activities and normal facility operations at ORNL.

3.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

3.8.1 Affected Environment

The proposed SIPRC is in Roane County, TN. approximately 6.4 miles southwest of the city of Oak Ridge, TN and 23 miles west of Knoxville, TN. Located centrally in the eastern portion of Tennessee, Roane and adjacent counties of Anderson, Knox and Loudon comprise the region-of-influence (ROI) for socioeconomic resources.

3.8.1.1 Population

In 2019, Knox County had the largest population (461,104) followed by Anderson County (76,061), Roane county (53,075), and lastly Loudon County (52,340). As shown in Table 3.7, population increased in each county between 2000 and 2019. Population increase was greatest in Loudon County (20.7 percent), and smallest in Roane County (2.2 percent). Population in the state of Tennessee and the United States increased by 17.9 percent and 15.4 percent respectively during the same time period (USCB 2000, USCB 2019a). Population is projected to increase in each county by 2030. Loudon County projects the greatest population increase (15.2 percent); while growth in Roane County is projected to be flat (0.1 percent) (TNSDC 2019). Population is projected to increase in Tennessee (17.9 percent) and the United States (9.4 percent) (TNSDC 2019, USCB 2020). The proposed SIPRC site is located in Roane County in Block Group 1, Census Tract 9801, which indicates a population of 0 (USCB 2019b).

Table 3.7. 2000 – 2030 Population Data

	2000	2010	2019	Projected 2030	Percent Change 2000 - 2019	Percent Change 2019 - 2030
Anderson County	71,330	75,129	76,061	79,454	6.6%	4.5%
Knox County	382,032	432,226	461,104	513,318	20.7%	11.3%
Loudon County	39,086	48,556	52,340	60,311	33.9%	15.2%
Roane County	51,910	54,181	53,075	53,111	2.2%	0.1%
Tennessee	5,689,283	6,346,105	6,709,356	7,393,069	17.9%	10.2%
United States	281,421,906	308,745,538	324,697,795	355,101,000	15.4%	9.4%

Sources: TNSDC 2019, USCB 2000, USCB 2010, USCB 2019, USCB 2020a

3.8.1.2 Employment and Income

Employment and industry trends are presented in Table 3.8. In 2019 Anderson County had a total employment of 50,998 jobs. Manufacturing comprised the largest percentage of jobs (23.2 percent), greater than the state (8.8 percent) and nation (6.7 percent) (BEA 2019). The unemployment rate for Anderson County was 6.1 percent, greater than the state (5.3 percent) and nation (5.3 percent) (USCB 2019c).

In 2019 Knox County had a total employment of 328,096 jobs. Health care and social assistance comprised the largest percentage of jobs (12.4 percent), greater than the state (10.4 percent) and nation (11.3 percent) (BEA 2019). The unemployment rate was 4.3 percent, less than the state and nation (USCB 2019c).

In 2019 Loudon County had a total employment of 24,095 jobs. Manufacturing comprised the largest percentage of jobs (15.7 percent), greater than the state (8.8 percent) and the nation (6.7 percent) (BEA 2019). The unemployment rate was 4.7 percent, lower than the state and nation (USCB 2019c).

In 2019 Roane County had a total employment of 26,015 jobs. Government comprised the largest percentage of jobs (15.2 percent), greater than the state (10.8 percent) and the nation (12.1 percent) (BEA 2019). The unemployment rate was 6.1 percent, higher than the state and nation (USCB 2019c).

Table 3.8. Employment Data

	Anderson	Knox	Loudon	Roane	Tennessee	United States
Total Employment (Number of Jobs)	50,998	328,096	24,095	26,015	4,205,777	203,809,500
Industry	**Percentage of Employment (%)**					
Farm	0.9	0.3	4.3	2.1	1.8	1.3
Construction	4.3	5.7	7.4	(D[1])	5.6	5.5
Manufacturing	23.2	4.2	15.7	4.5	8.8	6.7
Retail Trade	8.6	11.4	11.1	9.4	9.9	9.4
Health care and Social Assistance	10.0	12.4	7.1	8.2	10.4	11.3

	Anderson	Knox	Loudon	Roane	Tennessee	United States
Accommodation and Food Services	6.9	8.6	7.7	5.6	8.0	7.5
Services (other)	5.0	5.7	7.0	5.0	6.2	5.8
Government	10.5	10.7	9.9	15.2	10.8	12.1
Unemployment Rate	6.1	4.3	4.7	6.1	5.3	5.3

Sources: USCB 2019b, BEA 2019

[1] (D) Not shown to avoid disclosure of confidential information; estimates are included in higher-level totals.

Table 3.9 presents 2019 per capita personal income. Of the four counties, Knox had the highest per capita income ($51,758), which was 95.1 percent of the national average ($54,446) and higher than the state average ($48,684). Roane County had the lowest per capita income ($41,917), which was 77 percent of the national average (USCB 2019c).

Table 3.9. 2019 Per Capita Personal Income Data

Area	Per Capita Personal Income	Percent of US
Anderson County	$43,045	79.1
Knox County	$51,758	95.1
Loudon County	$50,154	92.1
Roane County	$41,917	77.0
Tennessee	$48,684	89.4
United States	$54,446	100.0

Source: USCB 2019c

3.8.1.3 Environmental Justice

E.O. 12898 directs federal agencies to identify and address, as appropriate, potential disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The CEQ has provided guidance for addressing environmental justice in *Environmental Justice: Guidance under the National Environmental Policy Act* (CEQ 1997).

In identifying minority and low-income populations, the following CEQ definitions of minority individuals and populations and low-income populations were used:

- *Minority individuals.* Individuals who identify themselves as members of the following population groups: American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Black, Hispanic, or two or more races.

- *Minority populations.* Minority populations are identified where (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. For the purposes of this analysis, "meaningfully greater" is defined as greater than 20 percent of the minority population percentage in the general population of the larger geographical region within which the affected area is located.

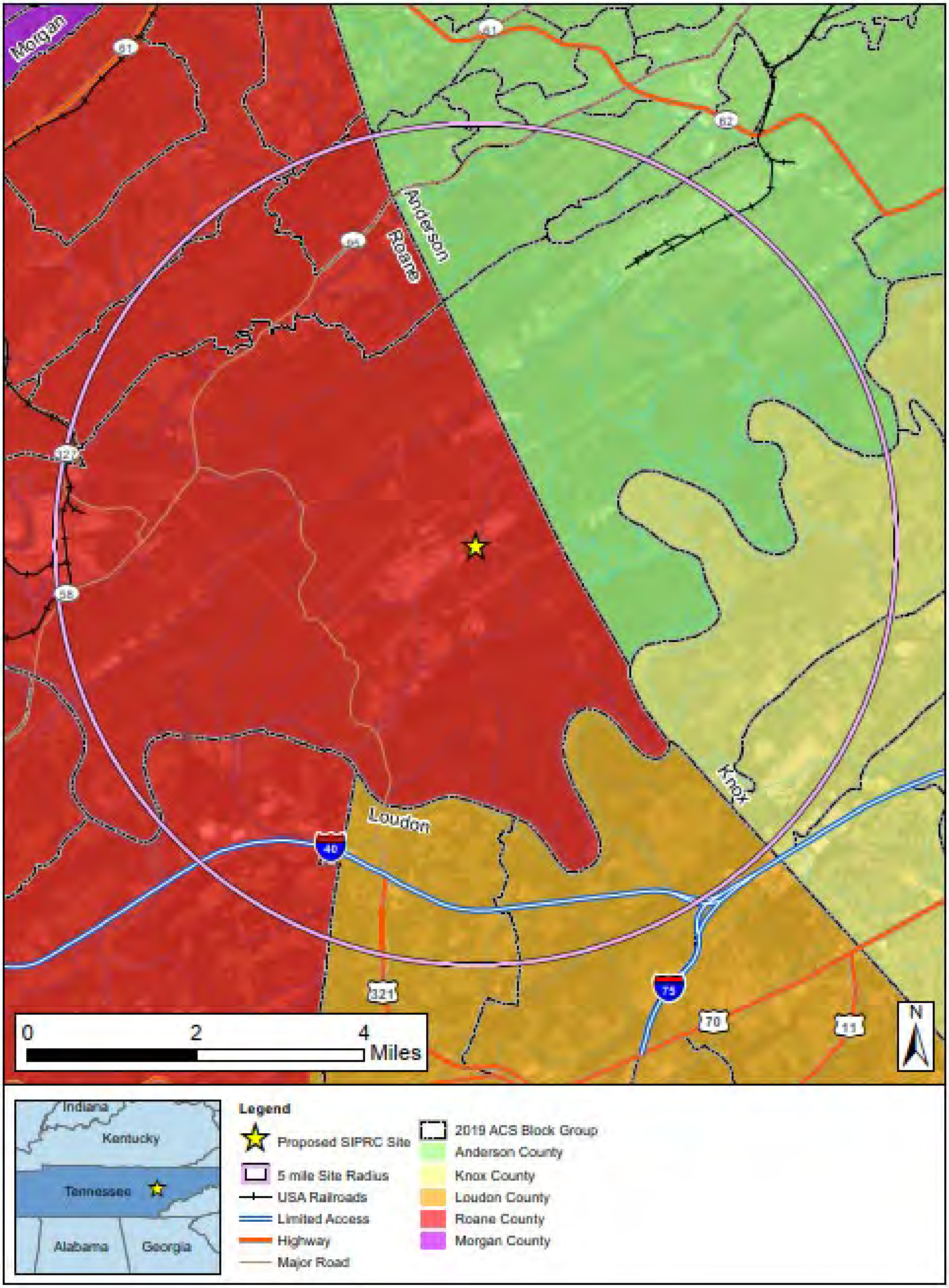
- *Low-income populations.* Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the U.S. Census Bureau's Current Population Reports, Series P-60, on Income and Poverty. In this analysis, low-income populations are identified where (1) the population of an affected area exceeds 50 percent low-income based on the Census data or (2) the percentage of low-income population in the affected area is greater than 20 percent of the low-income population percentage in the larger geographical region within which the affected area is located.

According to CEQ guidance, U.S. Census data are typically used to determine minority and low-income population percentages in the affected area of a project to identify populations subject to consideration as a potential environmental justice community of concern. The geographic unit used in the analysis is the census block group. For the purposes of this analysis, a census block group with one of the two criteria described above for either minority or low-income populations as compared to the surrounding county average constitutes a potential environmental justice population (CEQ 1997).

As the location for the proposed project, Roane County would experience most environmental impacts as compared to other ROI counties. Block Group 1, Census Tract 9801 encompasses the proposed project site; however, no one resides there. Therefore, a total of 14 census block groups located within a 5-mile radius of the project site were evaluated for potential environmental justice impacts. As shown in Figure 3.3, the area of interest encompasses block groups in parts of ROI counties of Anderson, Knox, Loudon, and Roane counties. Table 3.10 identifies thresholds for each county for the identification of minority and low-income communities within the 5 mile radius traversing the counties (USCB 2019d).

Table 3.10. 2019 Thresholds for Identification of Minority and Low-income Environmental Justice Communities in ROI Counties

	Minority Population (percentage)	Low-Income Population (percentage)
Anderson County	30.9	36.7
Knox County	37.7	34.5
Loudon County	32.3	31.3
Roane County	27.3	33.8



1
2 **Figure 3.3 Counties within a 5-mile Radius of the Proposed SIPRC**

Minority Population

Table 3.11 presents the results of the analysis for potential minority populations. None of the 14 block groups within the 5-mile radius encompassing the 4 ROI counties had minority populations exceeding 50 percent. Therefore, no block groups met the “greater than 50 percent” minority population threshold indicating potential environmental justice populations.

Table 3.11. 2014-2019 American Community Survey Minority Population Data

Area	Total Population	Minority Population	Percent Minority Population (%)
Block Group 1, Census Tract 201, Anderson County, Tennessee	1,678	602	35.9
Block Group 2, Census Tract 201, Anderson County, Tennessee	1,518	486	32.0
Block Group 1, Census Tract 206, Anderson County, Tennessee	1,453	263	18.1
Block Group 1, Census Tract 9801, Anderson County, Tennessee	0	0	0
Anderson County, Tennessee	76,061	8,284	10.9
Block Group 1, Census Tract 59.06, Knox County, Tennessee	2,077	72	3.5
Block Group 1, Census Tract 59.05, Knox County, Tennessee	2,081	589	21.0
Knox County, Tennessee	461,104	81,775	17.7
Block Group 1, Census Tract 601, Loudon County, Tennessee	1,168	12	1.0
Block Group 3, Census Tract 601, Loudon County, Tennessee	1,327	80	6.0
Loudon County, Tennessee	52,340	6,441	12.3
Block Group 1, Census Tract 301, Roane County, Tennessee	1,544	204	13.2
Block Group 1, Census Tract 302.01, Roane County, Tennessee	1,431	40	2.8
Block Group 4, Census Tract 302.01, Roane County, Tennessee	918	41	4.5
Block Group 5, Census Tract 302.01, Roane County, Tennessee	1,192	132	11.1
Block Group 2, Census Tract 309, Roane County, Tennessee	870	16	1.8
Block Group 1, Census Tract 9801, Roane County, Tennessee	0	0	0
Roane County, Tennessee	53,075	3,855	7.3

Source: USCB 2019d

Only two of the 14 block groups exceeded the “20 percent greater” threshold indicating the presence of minority populations subject to consideration as potential environmental justice communities of concern. Those two block groups are in Anderson County, which has a threshold of 30.9 percent as shown in Table 1.1-4. They are Block Group 1, Census Tract 201 (35.9 percent minority population) and Block Group 2, Census Tract 201 (32.0 percent minority population) (USCB 2019d).

Low-Income Populations

Table 3.12 presents the results of the analysis for potential low-income populations. The highest rates of poverty were found in Block Group 3, Census Tract 9602, Anderson County, Tennessee (26.5 percent), Block Group 1 and Census Tract 302.01, Roane County, Tennessee (24.9 percent). However, none of the 14 block groups within the 5-mile radius encompassing the 4 ROI counties had low-income populations exceeding 50 percent. Therefore, no block groups met the “greater than 50 percent” threshold indicating potential environmental justice populations.

None of the 14 block groups exceeded the "20 percent greater" threshold as shown in Table 3.9 indicating the presence of low-income populations subject to consideration as potential environmental justice communities of concern.

Table 3.12. 2019 Poverty Level Data

Area	Total Population	Persons Below Poverty Level	Percent of Persons Below Poverty Level (%)
Block Group 1, Census Tract 201, Anderson County, Tennessee	1,678	445	26.5
Block Group 2, Census Tract 201, Anderson County, Tennessee	1,518	181	11.9
Block Group 1, Census Tract 206, Anderson County, Tennessee	1,453	118	8.1
Block Group 1, Census Tract 9801, Anderson County, Tennessee	0	0	0
Anderson County, Tennessee	74,552	12,481	16.7
Block Group 1, Census Tract 59.06, Knox County, Tennessee	2,801	218	7.8
Block Group 1, Census Tract 59.05, Knox County, Tennessee	2,077	152	7.3
Knox County, Tennessee	450,053	65,448	14.5
Block Group 1, Census Tract 601, Loudon County, Tennessee	1,052	97	9.2
Block Group 3, Census Tract 601, Loudon County, Tennessee	1,327	141	10.6
Loudon County, Tennessee	51,857	5,845	11.3
Block Group 2, Census Tract 301, Roane County, Tennessee	1,715	26	1.5
Block Group 1, Census Tract 302.01, Roane County, Tennessee	1,431	356	24.9
Block Group 4, Census Tract 302.01, Roane County, Tennessee	892	0	0
Block Group 5, Census Tract 302.01, Roane County, Tennessee	1,192	28	2.3
Block Group 2, Census Tract 309, Roane County, Tennessee	870	15	1.7
Block Group 1, Census Tract 9801, Roane County, Tennessee	0	0	0
Roane County, Tennessee	52,262	7,237	13.8

Source: USCB 2019e

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action

Socioeconomics

Implementation of the proposed action would entail a variety of operation and maintenance related activities and would directly affect employment, industry, and commerce in the ROI. The direct impact to the economy associated with construction activities is expected to be short-term and beneficial to the local economy. The implementation of the SIPRC with respect to construction activities would directly cause the creation of approximately 40 full time equivalent construction jobs for approximately 16 months. Benefits include the purchase of materials, equipment, and services and a temporary increase in employment and income. This increase would be local or regional, depending on where the goods, services, and workers were obtained. It is likely some construction materials and services would be purchased locally in the four counties comprising the ROI as well as in adjacent counties and cities. Most of the construction workforce would likely be from local or regional sources, mostly from construction contractors, with a small portion of the workforce potentially coming from out of state.

Indirect employment and income impacts would result from expenditure of the wages earned by the workforce involved in construction activities, as well as the local workforce used to provide materials and services. Materials, equipment, and services may be purchased locally in the ROI, as well as in adjacent counties and the Knoxville metropolitan area. Revenue generated by income tax and sales tax from new workers associated with the construction activities would benefit the local economy. However, given the relatively small magnitude of the anticipated workforce, this impact is considered to be negligible relative to the size of the local economy.

The direct impact to the economy associated with operations is expected to be long-term and beneficial to the local economy. As a result of the implementation of the proposed action, approximately 75-100 workers would be employed, representing 60 full time positions. Of the 75 jobs, approximately 40-60 would be new hires. The production area is expected to run operations continuously with approximately 20 workers occupying the building at any given time. The local tax base would increase as a result; this impact would be most beneficial to Roane County.

Overall, socioeconomic impacts for the operation of the SIPRC are anticipated to be positive and long-term, although small relative to the total economy of the region.

Environmental Justice

According to the CEQ, adverse health effects to be evaluated within the context of environmental justice impacts may include bodily impairment, infirmity, illness, or death. Environmental effects may include ecological, cultural, human health, economic, or social impacts. Disproportionately high and adverse human health or environmental effects occur when the risk or rate of exposure to an environmental hazard or an impact or risk of an impact on the natural or physical environment for a minority or low-income population is high and appreciably exceeds the impact level for the general population or for another appropriate comparison group (CEQ 1997).

The area of interest contains two minority populations subject to consideration as potential environmental justice communities of concern. No potential low-income populations have been identified. Based on the analysis of impacts for all resource areas presented in this EA, it is determined that environmental, health, and occupational safety impacts would be minimal, temporary, and confined primarily to the immediate project site. Thus, there would be no significant adverse health impacts on members of the public or significant adverse environmental impacts on the physical environment (water, air, aquatic, and terrestrial resources) and socioeconomic conditions. Therefore, there would not be any disproportionately high and adverse environmental or economic effects on minority or low-income populations.

3.8.2.2 No Action Alternative

Under the No Action Alternative, the SIPRC would not be constructed; therefore, no project related changes to population and job growth would occur. Current employment trends in the area would likely continue with most of the employment in the existing economic sectors of government and manufacturing. Therefore, no beneficial socioeconomic impacts from a change in population, employment, or expenditures would occur under the No Action Alternative. There also would not be any disproportionately high and adverse direct or indirect impacts on any minority or low-income populations.

3.9 WASTE MANAGEMENT

3.9.1 Affected Environment

Conventional (i.e., sanitary/industrial waste) along with small quantities of hazardous wastes are expected to be generated by the proposed action. These categories are briefly described below.

3.9.1.1 Sanitary/Industrial

Sanitary/industrial wastes consist of both liquid and solid forms, and include paper, garbage, wood, metal, glass, plastic, demolition and construction debris, sanitary and food wastes from cafeteria operations, sludge from water and air treatment, and other special wastes. Liquid wastes cannot be sent to a solid waste landfill for disposal.

The Solid Waste Management Program in Tennessee operates under the authority of the Solid Waste Management Act of 1991 (Tennessee Code Annotated § 68-211-101). Within the state of Tennessee there are four distinct classes of solid waste landfills that are permitted by TDEC for disposal of various types of solid waste generated within the state. The four classes of landfills and wastes that may be disposed of within the various classes of landfills include:

- Class I landfills – non-hazardous municipal solid waste, household waste, commercial wastes, shredded/waste tires, approved special wastes.
- Class II landfills – non-hazardous industrial, manufacturing, and commercial wastes.
- Class III landfills – farming wastes, landscaping, and land clearing wastes.
- Class IV landfills – construction/demolition waste, shredded tires, and waste with similar characteristics.

Solid waste landfills are governed by federal and state environmental regulations that are found at 40 CFR Part 258, *Criteria for Municipal Solid Waste Landfills*, and Rules of the TDEC Chapter 0400-11-01, *Solid Waste Processing and Disposal* (previously numbered 1200-01-07). These provisions specify the operational and permit requirements for disposal of solid waste within the state of Tennessee. Sanitary/industrial wastes generated from the proposed action would be acceptable for a Class I landfill. The nearest commercial Class I landfills to the ORR are the Chestnut Ridge Landfill and Recycling Center in Anderson County operated by Waste Management, Inc. of Tennessee and Loudon County Landfill in Loudon County operated by Santek Waste Services (TDEC 2021a).

DOE operates two Class II industrial solid waste disposal landfills and one Class IV construction demolition landfill near the Y-12 National Security Complex. These facilities are permitted by TDEC and accept solid waste from DOE operations on the ORR. Should sanitary/industrial waste remain on the ORR, the Y-12 Industrial Landfill V and VII are used for disposal of non-hazardous materials such as construction debris and other solid sanitary wastes. The ORNL Recycling Program also recycles a wide variety of materials such as office-related materials, batteries, computer electronic equipment, scrap metal, tires, used oils, plastic products, aluminum cans, corrugated cardboard, lamps, paper, and wood/pallets.

3.9.1.2 Hazardous Waste

Hazardous waste is a waste or surplus material with negligible value that may cause or contribute to an increase in mortality or to an increase in serious irreversible illness or pose a substantial present or potential hazard to human health or the environment when improperly stored, treated, disposed of, or transported. These wastes are regulated pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA). Hazardous wastes are defined and regulated by RCRA regulations by specific source lists, non-specific source lists, characteristic hazards, and discarded commercial chemical product lists. The regulations generally divide hazardous wastes into two categories: characteristic hazardous wastes and listed hazardous wastes. Characteristic hazardous wastes are those that exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined in 40 CFR 261 Subpart C. Listed hazardous wastes are those found within the specific waste listings provided at 40 CFR Part 261 Subpart D.

Tennessee has been authorized by EPA to administer most of the federal program and receives a grant in support of this effort. The Tennessee Hazardous Waste Management Program operates under the authority of the Hazardous Waste Management Act of 1977 and various Hazardous Waste Management rules (TDEC 2021b). Tennessee has detailed regulations (Tennessee Rule Chapter 0400-12-01-.06 and .07) to ensure that treatment, storage, and disposal facilities (TSDFs) operate safely and protect human health and the environment. There are 19 hazardous waste TSDFs in Tennessee (EPA 2021d). Additional hazardous waste TSDFs operate within the region.

Hazardous wastes are generated throughout ORNL and are stored in generator satellite accumulation areas or in (90-day) accumulation areas operated by the generator or the Transportation and Waste Management Division pending pickup. Based on the characteristics and certification of the waste, the waste may be: (1) transported to an off-site commercial facility for treatment and/or disposal, (2) stored in one of several storage facilities permitted for hazardous waste, or (3) utilized for other on-site treatment. Most of the permitted storage of hazardous waste at ORNL is consolidated in the 7650 series buildings on Melton Valley Access Road.

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action

It is expected that activities associated with the SIPRC would not result in adverse impacts related to waste generation, treatment, or disposal. All waste generated would be characterized to allow proper segregation, treatment, repurposing, and disposal. Characterization activities would meet all applicable quality assurance and other waste management requirements. Only existing permitted and licensed TSDFs would be used, and those facilities are expected to have enough existing capacity for the quantities of waste to be generated assuming all the applicable waste acceptance criteria are met.

Waste minimization measures would also be used to the extent practicable to reduce the amount of process and secondary wastes generated and to minimize the overall volume of waste sent to disposal. ORNL's Environmental Management System's subject areas and procedures including its Waste Certification Program would be utilized to ensure that all waste streams would meet the required DOE, U.S. Nuclear Regulatory Commission (NRC), and U.S. Department of Transportation (DOT) waste-packaging requirements and applicable TSDF waste acceptance criteria. Qualified transportation subcontractors would be used for the shipment of waste to off-site treatment and disposal facilities in full compliance with NRC and DOT.

Although the exact volume of waste generated under the proposed action has not been determined, quantities would not be anticipated to exceed the management or disposal capacities of the involved personnel and TSDFs.

Construction Waste

Construction waste includes materials such as construction materials for buildings, concrete and asphalt rubble, and land-clearing debris. SIPRC site preparation activities would generate minimal construction waste. However, substantial clearing and grubbing would be required to accommodate the proposed building and site development. All trees, brush, grass, and other organic materials would be removed from the site and disposed of in an approved location on ORNL property. As an alternate erosion control option, trees could be mulched and used as perimeter sediment control barriers. Topsoil would be removed to full depth (6-inch minimum) and stockpiled in an approved location on the site. Although not anticipated, if any material to be disposed of is found to contain hazardous, toxic, biological, or radiological substances, they would be handled according to the applicable ORNL waste management procedures. Rubbish and debris would be removed from the site as needed and transported to the ORR Industrial Landfill V (or other approved landfill) for disposal to avoid accumulation at the project site.

The SIPRC would be constructed utilizing standard construction methods, which would limit, to the extent possible, the use of hazardous materials. The quantity of hazardous materials is expected to be limited and would comprise products routinely used during construction, such as fuels, paints, adhesives, etc. These materials would be stored in proper containers, employing secondary containment as necessary, to prevent releases. No radioactive waste, mixed waste, asbestos waste, or polychlorinated biphenyl waste are expected to be generated. All other waste and debris generated from construction would be acceptable to be disposed of as sanitary industrial waste at the ORR Industrial Landfill V. Therefore, the impacts from construction waste generated from the proposed action are considered insignificant.

Operational Waste

During operations, municipal solid waste (generally paper waste) would be generated. Quantities of solid, non-hazardous waste generated would most likely be recycled or transported to the ORR Landfill V for disposal. No adverse impacts are expected as sufficient landfill capacity exists to accommodate the additional nonhazardous solid waste generated from the operational activities of the SIPRC.

Hazardous wastes (e.g., residual hazardous gas in cylinders) may also be generated from operational activities. The SIPRC accumulate hazardous waste in satellite accumulation areas or in 90-day accumulation areas, and no RCRA-permitted storage and/or treatment facilities would be operated at the SIPRC. It is not possible at this time to estimate the quantity of hazardous wastes that would be generated, but it is anticipated that most of the hazardous waste would be associated with recyclable materials, such as used oil, used batteries, absorbents with oil, etc. Wastes that cannot be recycled would be handled under the ORNL Waste Management Program and transported to licensed off-site facilities for further treatment and/or disposal. Therefore, implementation of the above management requirements would minimize and/or mitigate any potential adverse impacts resulting from the generation of hazardous wastes. Impacts from accidental spills would be addressed through safety procedures and spill prevention plans. No RCRA permits or permit modifications would be required.

3.9.2.2 No Action Alternative

Under the No Action Alternative, the SIPRC would not be constructed or operated and there would be no change to current waste generation and handling from routine operations at ORNL. Waste storage, transport, and disposal activities would continue to be handled under the ORNL Waste Management Program. No additional impacts would occur.

3.10 HUMAN HEALTH AND SAFETY

3.10.1 Affected Environment

Past activities at ORNL have resulted in releases of radionuclides and chemicals to the environment. Such releases combine with natural sources and can augment the exposure to humans both on- and off-site. Natural background sources include cosmic radiation and uranium and thorium in native soils. Inorganic elements, such as arsenic, beryllium, and manganese, are also found in native soils on the ORR, including ORNL (DOE 2021a). These naturally existing sources of radiological and chemical exposures become the background exposure to which the effects of the any man-made releases would be added. The proposed location for the SIPRC is an undisturbed site and no known radiological or chemical releases are known to have occurred within the area.

Workers at some ORNL facilities near the proposed SIPRC site are potentially exposed to radioactive hazards. Some facilities contain out-of-date, service-contaminated equipment remaining from former operations and other work involving spent fuel, plutonium, uranium, thorium, and other radionuclides. Other facilities include on-going operations that involve the use of radioactive materials. ORNL operates an extensive health physics program to control worker exposures and uncontrolled releases of radioactive materials (DOE 2021a).

Potential chemical hazards to personnel working at ORNL are addressed under DOE Order 420.1C, *Facility Safety*, which requires that facility design protect against chemical hazards and toxicological hazards. Oversight for control of occupational chemical exposures at existing facilities is under the responsibility of the UT-B Environment, Safety, Health, and Quality (ESH&Q) organization or UCOR. Both UT-B and UCOR ensure compliance with the provisions of 10 CFR 851, *Worker Safety and Health Program*. 10 CFR 851 also includes a requirement that contractors comply with Federal Occupational Safety and Health Administration (OSHA) regulations.

The ORNL Chemical Safety Subject Area provides ORNL-wide methods for purchasing, inventorying, and managing hazardous chemicals and hazardous chemical products. The Hazardous Materials Management Information System provides the mechanism for inventorying and tracking hazardous chemicals and ensures that safety and health information for each chemical is readily available. Line managers are responsible for implementing the Chemical Safety Management Program in their facilities.

3.10.2 Environmental Consequences

The following sections look at the human health effects for the Proposed Action and the No Action Alternative for the construction and operation of the SIPRC for the facility workers.

3.10.2.1 Proposed Action

In accordance with DOE Order 413.3B, Appendix C, a Preliminary Hazard Analysis was prepared for the SIPRC before the DOE Critical Decision-1 (i.e., approve alternative selection and cost range) to "identify and evaluate all potential hazards and establish a preliminary set of safety controls. The proposed SIPRC would not utilize releasable quantities of radiological materials, nor any significant quantities of hazardous materials. Consequently, the potential for impacts related to human health and safety expected to occur is low and would be limited to on-site SIPRC workers and personnel. The potentially affected construction workforce for the SIPRC is estimated to be 40 workers and during operations approximately 20 workers would occupy the building at any given time.

Construction Safety

DOE minimizes standard construction hazards through strict adherence to DOE and ORNL environment, health and safety policies and procedures. ORNL staff would follow a Standard-Based Management System and 10 CFR 851 (*Worker Safety and Health Program*) during all activities. The ORNL Construction Safety Program supports line management actions to provide workers with a safe and healthful work environment and maintain compliance with applicable worker safety and health requirements including 29 CFR 1926 (*Safety and Health Regulations for Construction*).

For DOE-funded construction subcontracts, the environmental, safety, and health expectations are formally communicated to construction subcontractors in contract terms, conditions and specifications. Health and safety requirements are determined from the scope of work to be performed, the identification of hazards and controls to be implemented are reviewed by an organization-specified health and safety reviewer to ensure appropriate requirements are included. The construction subcontractor may be required to submit a health and safety program for approval or adopt a project-specific health and safety program already approved.

Construction subcontractor requirements for activity-level hazard analysis, making employees aware of hazards and protective measures prior to beginning work, worker acknowledgement of awareness and disciplinary process are implemented through the contract requirements. If unanticipated hazards are encountered during the construction process and immediate corrective actions are not possible, the construction contractor must immediately notify affected workers, post appropriate warning signs, implement needed interim control measures, and notify the construction manager of the action taken. Technical support for the development of activity or job hazard analysis is provided by the Worker Safety and Health Management System. The analysis of operations and procedures that include assessment and documentation of worker exposure to chemical, physical, biological, and safety workplace hazards through appropriate monitoring are key elements of a hazard identification and assessment process.

No new or unusual processes that would result in unique health or safety issues are proposed for the SIPRC construction effort. Hazards would include typical industrial hazards such as falls, spills, vehicle accidents, and injuries from tool and machinery operation. Construction-related environment, safety and health risks would be typical of this type of activity and would be mitigated through implementation of standard construction safety practices as required by OSHA and DOE. Workers would be expected to receive applicable training, be protected through appropriate controls and oversight, and be afforded the same level of safety and health protection found at similar developments.

Care would be required during the installation and hook-up of utilities to ensure that proper precautions and procedures were followed if these activities approach any contaminated areas. There are no known chemical or radiological hazards/concerns in this area and no radiological exposures are expected from construction activities. However, prior to any ground disturbance, a radiological survey would be conducted of the area as part of the required excavation/penetration permit process. Provided that these precautions were taken, no adverse effects to construction workers or staff because of potential exposure to contaminated media would be anticipated.

Operation Safety

Operations associated with ORNL activities are conducted in strict compliance with DOE regulations (e.g., 10 CFR 851) and OSHA standards. Additionally, the ORNL Integrated Safety

Management (ISM) Program integrates ESH&Q management and effective protection strategies into work performed at the laboratory. Prior to startup, all production and research activities would be reviewed following the ORNL ISM tools for work control. Research activities would be governed using the Research Hazard Analysis and Control System. This system is designed to assist research staff in the identification of hazards and appropriate controls, to facilitate the review of ESH&Q subject matter experts, and to provide a mechanism for line management to authorize work activities. As a result of this process, a Research Safety Summary is issued to define the operating boundaries of research activities in the laboratory. Production activities would be governed by established Standard Operating Procedures and Research Safety Summaries that are reviewed and approved by ESH&Q personnel and line management.

Workers would be expected to receive applicable training, be protected through appropriate controls and oversight, and be afforded the typical level of safety and health protection found throughout ORNL. Potential environment, safety and health impacts would be consistent with current operational risks at ORNL and would be mitigated though adherence to established DOE environment, safety and health protocols.

During operation, the SIPRC would house production, research and testing operations related to stable isotope production. Some production activities would use materials that are flammable, corrosive, reactive, pyrophoric, oxidizing and/or toxic. The anticipated types and quantities of hazardous materials would be distributed among individual hazardous material control areas and would not exceed maximum allowable quantities identified for business or hazard (H) occupancies, as defined by the International Building Code and applicable National Fire Protection Association standards.

Designated H-occupancy areas would be used as hazardous material control areas to store bulk quantities of hazardous materials and to control the inventory throughout the balance of the facility to within the maximum allowable quantities designated for H-occupancies. Additionally, these materials would be handled and stored in accordance with applicable regulations and DOE Orders, such as 29 CFR 1910 and DOE Order 151.1C.

Production activities, and to a lesser degree, research and testing activities might also use moderate quantities of highly toxic, reactive liquids and/or gases, many of which are fluorinated. Hazards related to toxic and highly toxic materials would be managed primarily through engineered controls including ventilated storage cabinets and toxic gas management systems. All equipment would be installed and operated under applicable standards. Primary physical hazards associated with this facility are those commonly encountered in chemical laboratories. These are considered “standard industrial hazards.”

Significant radiological hazards are not anticipated for the building. However, programmatic growth may result in very limited operations involving radiological materials. Additionally, EMIS machines are classified as radiation generating devices and would be surveyed by Radiological Control personnel prior to initial use. Other radiation generating devices may occasionally be used in the facility.

Operations may also include the use of sealed radiological sources commonly encountered in laboratory equipment, trace and ultra-trace quantities of unsealed radioactive materials, and feedstocks containing Technologically Enhanced Naturally Occurring Radioactive Material (TENORM). The TENORM material that would be handled in SIPRC would require the development of a radiological work permit that specifies radiological controls to be used. The material can be handled on a benchtop and does not require additional containment or radiological design efforts. These controls would focus on contamination potential and control and would include techniques appropriate for low energy beta emitters. The facility would at most be considered a Below Hazard Category-3 Facility (subcategorized as a Low Radiological Hazard Facility) and the expected quantities of material could be managed under 10 CFR 835, *Occupational Radiation Protection*.

DOE regulation 10 CFR 835 establishes radiation protection standards and program requirements for DOE and DOE contractor operations with respect to the protection of workers from ionizing radiation. The primary objective of radiological protection is to minimize external and internal personnel exposures to radioactive materials. This objective can be accomplished through providing adequate radiation posting, sampling, monitoring, and notification or alarm capabilities; applying as low as reasonably achievable (ALARA) principles; incorporating facility and system radiation protection features into the designs; and through other measures.

3.10.2.2 No Action Alternative

Under the No Action Alternative, the SIPRC project would not be implemented and there would be no change in stable isotope production operations at ORNL. In the short-term, exposures of workers and the public would be bounded by existing conditions.

3.11 ACCIDENTS

This section presents the DOE-required evaluation of potential environmental effects of accident and malevolent acts for the SIPRC. In addition to addressing potential impacts on worker health and safety (Section 3.10), DOE recommends consideration of the potential impacts of “reasonably foreseeable accidents” (DOE 2002). The term “reasonably foreseeable” refers to incidents with a risk in the range of one in a million to one in ten million. Accident analysis also includes the results of an intentional destructive or terrorist act (DOE 2006). The results of the accident impact analysis provide information to the decision process regarding the possible (as opposed to the expected) impacts from choosing a given course of action.

Accident risk is based on two factors: probability of occurrence and magnitude of consequence. Accident types may include occasional accidents (risk of 1 in 100 to 1 in 10,000) such as trips and falls, remote accidents (probability of 1 in 10,000 to 1 in 1,000,000) such as a tank rupture or loss of reactor coolant, and improbable accidents (probability of less than 1 in 1,000,000) such as a plane crash.

3.11.1 Affected Environment

The affected environment for accidents and malevolent acts would be the area directly and indirectly affected by a reasonably foreseeable incident that would be the highest consequence credible accident. The affected environment would include personnel, facilities, and equipment directly associated with the SIPRC and other ORNL personnel or facilities in the immediate vicinity. An accident or malevolent act at the SIPRC would not affect any off-site populations or the off-site environment.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action

Construction and operation of the SIPRC could potentially result in hazards identified as low risk, such as non-routine accidents, fires, and a release of hazardous materials. These types of events have a higher probability of occurring but would be routinely addressed by safety and response programs and plans. There is also the low probability of an accident caused by natural phenomena (e.g., severe storm or earthquake). Because of design measures and existing safety programs, there is no major reasonably foreseeable accident scenario arising from construction or operation, such as a major fire or structural failure with severe impacts.

Intentional destructive actions would not result in the types of concerns that would arise for construction requiring large volumes of hazardous or radioactive materials. The SIPRC does not require large amounts of hazardous materials to be stored during construction and radioactive materials would not be present on-site until construction activities were completed. Therefore, intentional destructive acts during construction would have an uncertain but very low probability and limited impacts.

Requirements for chemical accident prevention are described in 40 CFR 68, *Chemical Accident Prevention Provisions*. During operation, the SIPRC is not expected to contain inventory amounts for any chemical listed in §68.130 that would exceed the Threshold Quantities described therein. The maximum reasonably foreseeable scenario would be a fire or explosion that would cause the release of hazardous materials, potentially resulting in on-site and off-site exposure. Such an incident would have a low probability; however, the emergency response to contain and reduce the severity of environmental exposure would be immediate and robust with coordination among several agencies.

An intentionally destructive act, such as a terrorist attack or sabotage, would have a low probability of success. Such an event would have to overcome several existing preventive measures. Public access to ORNL is controlled by force protection/anti-terrorism measures such as security fences, vehicle patrols by security guards, and security checkpoints at the portals on Bethel Valley Road. Additionally, appropriate measures would be implemented for the SIPRC to control building access and provide security (e.g., identification badges, proximity cards, alarms, cameras, etc.). In addition, a preliminary security vulnerability assessment, as required by DOE-STD-1189, has concluded that “the security needs of this project are adequately covered by the existing safety requirements described in *ORNL-LPD/SDADM-623: Oak Ridge National Laboratory Site Security Plan*.”

3.11.2.2 No Action Alternative

Under the No Action Alternative, current stable isotope production and facility operations (e.g., routine facility maintenance) would continue within existing facilities. There would be no accident scenarios that would result in the uncontrolled release of radioactive materials and exposures to on-site or off-site individuals or other environmental impacts.

3.12 UTILITIES

3.12.1 Affected Environment

ORNL has its own infrastructure to support activities including a dedicated fire department, a medical center, a security force, a wastewater treatment plant, and a steam plant. The water supply system is a shared supply system between the City of Oak Ridge, ORNL, and the Y-12 National Security Complex. The water treatment plant is operated by the City of Oak Ridge. Utility service for the electricity, natural gas, water, and telecommunications required for ORNL to operate are supplied by other entities. In addition to producing steam and compressed air, ORNL operates and maintains systems for the collection and treatment of sanitary, process, and industrial-type wastes.

Existing utilities in proximity to the SIPRC site include sanitary water and potable water north of White Oak Avenue. Steam is in the immediate area, but no condensate return is present. Natural gas and chilled water are located further away (over 1,000 feet to the nearest point of access), depending on the route. Existing electrical power feeds run in an east-west direction on the north side of White Oak Avenue while an existing telecommunications duct bank runs east to west to the south of White Oak Avenue.

3.12.1.1 Electrical

Electric power is provided for the region by the Tennessee Valley Authority (TVA). The current transmission system includes the TVA 500-kilovolt (kV) direct current high voltage transmission line from Bull Run Fossil Plant to Watts Bar Nuclear Plant. This long-distance delivery system is transformed down to 161 kV alternating current at switching stations within ORNL. Near the proposed SIPRC, the existing electrical power feeds run in an east west direction on the north side of White Oak Avenue.

3.12.1.2 Natural Gas

Natural gas is provided to ORNL facilities in Bethel Valley via a receiving station in the vicinity of the 7000 Area. The ORNL natural gas tap is at Metering Station B located north of Bethel Valley Road at the Melton Valley Access Road intersection. Natural gas is distributed from Station B to several pressure reducing stations across the ORNL campus. The closest natural gas connection is a high-pressure piping network northeast of the SIPRC site near the intersection of White Oak Avenue and Melton Access Road.

3.12.1.3 Potable Water

The City of Oak Ridge supplies potable water meeting all regulatory requirements for drinking water to ORNL from the water treatment plant located north of the Y-12 National Security Complex on the east end of Bear Creek Road. Potable water from the water treatment plant is provided to the ORNL water distribution system via a single 24-in. cast iron gravity line. The City of Oak Ridge is constructing a new ultrafiltration membrane water treatment plant to replace the existing conventional treatment plant. The new plant will treat up to 12 million gallons per day of water and be able to deliver water more reliably and efficiently than the current treatment plant (EPA 2021e).

Operating and maintaining the water distribution system, UT-B is responsible for compliance with the water supply rules enforced by the TDEC Division of Water Resources. The water line feeds the ORNL reservoir system consisting of one 1.5-million-gal concrete reservoir and one 1.5-million-gal steel reservoir on Chestnut Ridge, and two 1.5-million-gal steel reservoirs on Haw Ridge. From these reservoirs, water flows by gravity through the plant distribution grid. The water is used for potable, fire protection, and process purposes. The general condition of the system can be described as good (OREM 2013). Facilities in the 6000 Area near the proposed SIPRC are furnished potable water underground from a 12-inch water pipe running in an east west direction on the north side of White Oak Avenue.

3.12.1.4 Sanitary Wastewater

The ORNL sewage system services Bethel Valley and Melton Valley with sanitary wastewater flowing to an on-site sanitary wastewater treatment plant located at the western end of ORNL. The sanitary wastewater treatment plants current capacity is 300,000 gallons per day, while the average daily flow to the plant is less than 186,000 gallons per day (ORNL 2020). Wastewater effluent is discharged through one of the ORNL NPDES-permitted outfalls into White Oak Creek. An existing sanitary sewer line is located near the proposed SIPRC running in an east west direction on the north side of White Oak Avenue.

3.12.1.5 Fire Protection

ORNL has a Fire Department at Building 7130 along with automatic fire sensors and sprinkler systems in most facilities. In addition to drinking water, process water, and sanitary water, water from the potable water system is dedicated to fire suppression systems, protecting both facilities and personnel. These water systems are protected from freezing during the winter months by being located at least three feet below ground surface. Near the proposed SIPRC, the potable/fire water line is a 12-inch pipe running in an east west direction on the north side of White Oak Avenue.

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action

Construction and operation of the SIPRC would require new connections to the existing utility infrastructure at ORNL using lateral connections. The existing ORNL utility infrastructure has enough capacity to accommodate the additional utility requirements of the SIPRC and no adverse utility impacts would occur. Existing underground utilities would be identified prior to any site preparation activities. Removal of site utilities would be performed on an as-required basis; however, this is not expected based on current information. Any utilities abandoned in place on the SIPRC site would be capped at the end point of removal and would be filled with flowable fill before final capping.

Electrical

Operation of the SIPRC would require normal power and special power along with standby power capabilities. The existing medium voltage feeder, which is routed parallel on the north side of White Oak Avenue, would be tapped to provide a single primary 13.8kV, 3-phase system to the building. Site distribution would be overhead, supported by steel poles to the immediate exterior vicinity of the building. There is enough existing electrical capacity available in the ORNL system to meet the needs of the SIPRC without disrupting other ORNL operations and local needs.

Emergency power generation would be provided by a 1,250 kilowatts/1,500 kilovolt-amps on-site diesel generator. In addition, for microprocessor loads and other loads where no power interruption can be tolerated, an uninterruptible power supply system capable of supporting the entire critical building load would be provided.

Natural Gas

A new connection to the existing high-pressure piping network along with a new pressure regulator would be created in the existing utility right-of-way along the north side of White Oak Avenue and extended to the SIPRC site. The gas utility would include 1,600 linear feet of new service pipe to supply 10 pounds per square inch gas to the building. The direct-buried gas service line would be installed at least three feet below ground surface.

Potable Water and Fire Protection

Water would be supplied to the SIPRC for sanitary purposes along with domestic use, safety showers, eye wash fixtures and fire protection. The SIPRC building would connect to the existing 12-inch potable and fire water main running east west on the north side of White Oak Avenue with an 8-inch tapping sleeve and valve. The new, solitary 8-inch ductile iron pipe would run from the connection on the north side of White Oak Avenue, under the road, and travel along the service entrance to the south of the building. New fire hydrants would be installed along this route, a site hydrant in the landscaping to the east of the building and a building hydrant to the south of the building. The building would be protected with a standard wet sprinkler system. For protection against the system freezing, dry sidewall sprinkler systems connected to the wet system would provide fire protection for the loading docks. The fire water would be separated from the domestic water outside the building and supply fire water inside the building. All water lines would be installed at least three feet below ground surface.

Sanitary Wastewater

The sanitary sewer line for the SIPRC would utilize a connection to the existing gravity sewer system on the north side of White Oak Avenue. The connection would be made through a new manhole on the existing line using a 6-inch ductile iron pipe. Floor drains would not be provided in lab areas or in emergency shower areas. Floor drains would be provided in bathrooms, mechanical rooms, and loading docks. Hub sinks and floor sinks would be provided for equipment discharge. All sanitary drainage piping would be routed by gravity to maintain a positive slope with a maximum velocity of 2-feet per second and the sanitary sewer lines would be installed at least 3 feet below ground surface.

3.12.2.2 No Action Alternative

If the No Action Alternative were implemented, the SIPRC would not be constructed and operated at ORNL. The existing utility infrastructure would remain as is.

3.13 TRANSPORTATION

3.13.1 Affected Environment

ORNL main campus locations are accessible only by road. Although portions of the site border the Clinch River, there is no barge facility that directly serves ORNL. There is also no direct rail access to ORNL. Vehicle circulation at ORNL may be divided into two sectors: off-site and on-site circulation. Off-site circulation consists of staff movements to and from work and between the various Oak Ridge installations on work assignments and materials delivery. Off-site roads include White Wing road [State Route (SR) 95], which provides access to the west end of ORR's Bethel Valley area, and South Illinois Avenue (SR 62) and Scarboro Road, which provide access to the eastern end of Bethel Valley. Interstate 40 runs east-west to the southwest of ORNL.

On-site circulation consists of materials handling, movement of personnel between buildings and to and from parking lots, and contractor and vendor personnel movement. The primary road through ORNL is Bethel Valley Road, which is closed to non-authorized traffic. East of ORNL, Bethel Valley Road acts as a connecting road from SR 62 in the City of Oak Ridge. West of ORNL, Bethel Valley Road intersects SR 95. The primary north and south road corridors within ORNL are First, Second, Third, Fourth, and Fifth streets. The major east and west corridors are White Oak Avenue and Central Avenue. Materials area transported via the same routes used by employees and visitors. The proposed SIPRC is located on the south side of White Oak Avenue, which can be accessed via Bethel Valley Road from both the west and the east.

Average daily traffic counts for SR 95, Bethel Valley Road, and SR 62 are shown in Table 3.13. The data in that table shows that (SR 95) and Bethel Valley Rd. have handled more traffic in the past while SR 62 handles a significant amount of traffic in general.

Table 3.13. Average Daily Traffic Counts of Major Routes Near the Proposed Action

Year	State Route 95	South Illinois Avenue	Bethel Valley Road
2018	5,830	33,680	7,015
2017	5,066	34,180	8,146
2016	5,043	33,293	8,024
2015	5,496	33,567	8,869
2014	5,326	33,433	9,107
2013	5,451	31,792	8,624
2012	6,618	32,509	8,529
2011	6,388	32,875	8,439
2010	6,867	29,540	8,238
2009	5,810	32,367	8,498
2008	6,666	31,959	8,007

Source: TDOT 2020

By far, the largest portion of the off-site traffic circulation generated by ORNL is personnel commuting to and from work. The average commute of an ORNL employee working in Bethel Valley is about 35 miles with the majority of ORNL's commuting traffic coming from Oak Ridge via Bethel Valley Road. Peak traffic occurs between 6:30 a.m. to 9:30 a.m. for the morning commute and between 3:30 p.m. to 5:30 p.m. for the evening commute. Minimal traffic delays are experienced during these peaks because work shifts are staggered, car and vanpooling are practiced, and most deliveries to and shipments from ORNL are timed to avoid the peak traffic times. Road maintenance and the movement of heavy equipment or escorted shipments typically occur during the workday after traffic flow has subsided.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action

Negligible increases in daily construction traffic (i.e., workers and equipment/material deliveries) to the SIPRC site would not have an adverse impact on the existing road network or traffic. Additionally, no upgrades or improvements to on-site roads are anticipated. Traffic control measures (e.g., signs, traffic cones, flaggers) could be utilized to minimize the potential for accidents and traffic delays on White Oak Avenue. These measures would allow construction vehicles and equipment safe ingress and egress from the SIPRC construction site.

The SIPRC would employ approximately 75-100 workers representing 60 full time positions. Of the 75-100 jobs, approximately 40-60 would be new hires. The production area is expected to run operations continuously with approximately 20 workers occupying the building at any given time. Since only a small number of SIPRC employees would be new hires and operations would be conducted in shifts each day, the transportation impact from new commuters to ORNL would be negligible.

3.13.2.2 No Action Alternative

Under the No Action Alternative, the SIPRC project would not be implemented. The existing transportation network and traffic conditions would likely continue to remain as they presently are, and no additional transportation impacts would occur.

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4. CUMULATIVE IMPACTS

Cumulative impacts are those that may result from the incremental impacts of an action considered additively with the impacts of other past, present, and reasonably foreseeable future actions. Cumulative impacts are considered regardless of the agency or person undertaking the other actions (40 CFR 1508.7) and can result from the combined or synergistic effects of individually minor actions over a period.

4.1 POTENTIALLY CUMULATIVE ACTIONS

Table 4.1 includes a summary of past, present, and reasonably foreseeable future actions that are considered pertinent to the analysis of cumulative impacts for the proposed SIPRC. The actions are located at ORNL, on the ORR, or in the vicinity (< 20 miles) of the ORR.

Table 4.1. Past, Present, and Reasonably Foreseeable Future Actions with Potential to Interact with Proposed Action

Name	Description	Location	Status
ORNL Modernization Initiative (DOE/EA-1618)	This initiative is providing infrastructure replacement and upgrades at ORNL. Actions include enhancing the health and safety of workers, reducing operating costs, accommodating projected program growth, and allowing relocation of staff and certain support services (e.g., emergency response and maintenance) out of the Central Campus and other facilities that are in less than “mission ready” condition. A Finding of No Significant Impact (FONSI) was issued on July 28, 2008.	ORNL	Ongoing
ORSTP at ORNL (DOE/EA-1575)	The proposed action was for advanced technology transfer and other missions of the DOE Office of Science at ORNL through the establishment of the Oak Ridge Science and Technology Project (ORSTP). The ORSTP is supporting technology commercialization, facilitating the creation of new companies, and stimulating technology-based recruitment as a part of its core purpose. To establish the ORSTP, DOE leased underutilized facilities and land parcels at the ORNL Central Campus. A FONSI was issued on February 20, 2008.	ORNL	Ongoing
U-233 Material Downblending and Disposition (DOE/EA-1651)	This project is modifying selected ORNL facilities; processing the ORNL inventory of uranium-233; and transporting the processed material to a long-term disposal facility. A FONSI was issued on January 13, 2010.	ORNL	Ongoing
Oak Ridge Integrated Facility Disposition Project (IFDP)	Activities under the IFDP are disposing of legacy materials and facilities at ORNL and Y-12 using an integrated approach that results in risk reduction and eliminates $70 million to $90 million per year in cost of operations. Under the IFDP, the decontamination and decommissioning of approximately 188 facilities at ORNL, 112 facilities at Y-12, and remediation of soil and groundwater contamination would occur over the next 30 to 40 years. The IFDP will be conducted as a remedial action under CERCLA.	ORR	Ongoing

Name	Description	Location	Status
Environmental Management Disposal Facility	Because the existing on-site Environmental Management Waste Management Facility is above 70 percent capacity and will soon be full, a new disposal facility is needed in the mid-2020s to complete critical cleanup projects at Y-12 and ORNL. The on-site disposal alternative located at Central Bear Creek Valley is the preferred remedy for disposal of waste from DOE's ORR CERCLA cleanup program. The final capacity assumed to be needed for completion of ORR cleanup is estimated at 2.2 million cubic yards. Waste types will include soil, sediment, and sludge, along with demolition debris. Most of the waste (just over two thirds) is anticipated to be debris.	ORR	Ongoing
Ongoing and Future Operations at Y-12 (DOE/EIS-0387, and DOE/EIS-0387-SA-01)	The proposed action was for ongoing and future operations at Y-12 including changes to site infrastructure and levels of operation using production capacity as the key metric. In the Record of Decision (ROD) dated July 20, 2011 (76 FR 43319), NNSA decided to construct and operate a Capability-sized Uranium Processing Facility (UPF) at Y-12 as a replacement for certain enriched uranium processing facilities that were more than 50 years old. In DOE/EIS-0387-SA-01, NNSA evaluated meeting uranium processing requirements using a hybrid approach of upgrading existing facilities and building new UPF facilities. In the Amended ROD dated July 12, 2016 (81 FR 45138), NNSA decided to implement a revised approach for meeting enriched uranium requirements, by upgrading existing enriched uranium processing buildings and to separate the single structure UPF into a new design consisting of multiple buildings, with each constructed to safety and security requirements appropriate to the building's function.	Y-12	Ongoing
Property Transfer to Develop a General Aviation Airport at East Tennessee Technology Park (ETTP) (DOE/EA-2000)	This activity would transfer 170 acres of DOE property located at ETTP to the Metropolitan Knoxville Airport Authority for the purpose of constructing and operating a general aviation airport. A FONSI was issued on February 24, 2016.	ETTP	Ongoing
Versatile Test Reactor (DOE/EIS-0542)	The proposed action is for DOE to build a Versatile Test Reactor, or VTR. This new research reactor would be capable of performing irradiation testing at much higher neutron energy fluxes than what is currently available. This capability would help accelerate the testing of advanced nuclear fuels, materials, instrumentation, and sensors. It would also allow DOE to modernize its essential nuclear energy research and development infrastructure, and conduct crucial advanced technology and materials testing necessary to re-energize the U.S. nuclear energy industry. The VTR would either be sited at the Idaho National Laboratory (INL) or at ORNL. Preparation of an Environmental Impact Statement (EIS) is ongoing.	ORNL INL	Proposed
Radioisotope Processing Facility (RPF)	The proposed RPF at ORNL is the construction and operation of a new Hazard Category 2 nuclear hot cell processing facility. The RPF would include up to eight modular hot cells with dedicated laboratory space, supporting glove boxes and fume hoods, and loading bays. It would accommodate processing of several different isotopes of interest and provide for expanded isotope production.	ORNL	Proposed

Name	Description	Location	Status
Supplement Analysis for Construction of the Second Target Station at the Spallation Neutron Source	This activity would construct and operate a Second Target Station for the Spallation Neutron Source. The Second Target Station project would fulfill the original master plan through the construction of 10 new structures. The Second Target Station was covered in the original Spallation Neutron Source EIS (DOE/EIS-0247). The entire complex would include approximately 400,000 gross square feet of new construction.	ORNL	Ongoing
Clinch River Site for Small Modular Reactors	The proposed action would construct and operate small modular reactors at the Clinch River site. On December 17, 2019 TVA obtained approval for an early site permit from the NRC. The 20-year permit--referred to as an Early Site Permit--approves the 935-acre Clinch River site near Oak Ridge, Tennessee for a nuclear facility that can produce up to 800 megawatts total.	Oak Ridge, TN 4 miles west	Proposed
Energy*Solutions* – Bear Creek Processing Facility	This activity is the continued operation of Energy*Solutions* – Bear Creek Processing Facility including the processing and packaging of radioactive material for permanent disposal. The facility houses radioactive materials processing capabilities including bulk waste assay, decontamination, recycle, compaction, incineration, metals melting, and a variety of specialty waste stream management options. The facility operates under regulatory authority of the Tennessee Department of Environmental Control, Division of Radiological Health in agreement with NRC.	ORR 4.5 miles west	Ongoing
Bull Run Fossil Plant	Bull Run Fossil Plant is located on Bull Run Creek near Oak Ridge. The plant has a summer net capability of 865 megawatts and generates approximately 6 billion kilowatt-hours of electricity a year, enough to supply 400,000 homes. After a detailed review of fuel, transmission, economic and environmental impacts, as well as reviewing public input, on February 14, 2019, TVA approved the retirement of the Bull Run Fossil Plant by December 2023.	Clifton, TN 8.5 miles northeast	Future
Kingston Fossil Plant	Kingston Fossil Plant is located on Watts Bar Reservoir on the Tennessee River near Kingston, Tennessee. Kingston's nine units boast a summer net capability of 1,398 megawatts, and can generate approximately 10 billion kilowatt-hours a year, which is enough electricity to power approximately 700,000 homes. To meet the demand, Kingston burns about 14,000 tons of low-sulfur blend coal a day, an amount that would fill 140 railroad cars. Emissions-reducing features include the installation of selective catalytic reduction systems, which reduced nitrogen oxide emissions by 90 percent, and two scrubbers, which reduced sulfur dioxide emissions by 95 percent. TVA has cleaned up a coal ash spill that occurred in December of 2008.	Kingston, TN 11.5 miles west	Ongoing

4.2 CUMULATIVE IMPACTS BY RESOURCE AREA

Land Use. Approximately 11 acres would be disturbed for the construction of the SIPRC. This is much less than one percent of the nearly 5,000-acre ORNL area. Although the proposed SIPRC site is presently undeveloped it is surrounded by developed portions of ORNL and the incremental change in the current land use would have a negligible impact. Also, many of the other present and reasonably foreseeable future actions identified in Section 4.1 would occur in existing industrial or otherwise well-developed areas. Therefore, the incremental impact to land use from the SIPRC, when added to impacts from other past, present, and reasonably foreseeable future actions, would not be substantial.

Geology and Soils. The geology of the SIPRC site would not be changed with the construction of the SIPRC. Although the native soil structure of the SIPRC site would be destroyed the amount of soil disturbed would be a small percentage of the total soil disturbed at ORNL. Cumulative impacts from the SIPRC would not be substantial when added to the impact from other past, present, and reasonably foreseeable future actions.

Water Resources. The primary cumulative impacts on surface water would result from an increase in surface disturbance and increased impervious areas that have the potential to increase surface water runoff and sediment delivery downstream. Cumulative impacts would be minimized through the implementation of measures to minimize erosion and the use of temporary or permanent stormwater controls such as detention or retention basins and other structures, and stabilization of disturbed areas through landscaping and vegetation. Therefore, the incremental impact to water resources from the SIPRC, when added to impacts from other past, present, and reasonably foreseeable future actions, would not be substantial.

Ecological Resources. Cumulative activities could increase the amount of overall habitat loss from vegetation removal and could potentially lead to habitat degradation. Direct impacts could include permanent and temporary impacts on habitat from land clearing activities resulting in habitat fragmentation. Impacts on vegetation, wildlife, and special status species from some reasonably foreseeable future actions could be like those for the Proposed Action. Habitats on the ORR, particularly mature forest areas, are proactively managed, and any activities that could affect these resources are evaluated in detail. Natural resource managers are aware of the ORR's ecological importance to the region and are committed to conserving habitats and species. Management actions and planning would minimize and mitigate cumulative ecological impacts to the extent practicable.

Cultural Resources. All DOE actions on the ORR are required to meet NHPA requirements. For projects that involve ground disturbance, measures are in place in case of an unanticipated discovery of cultural materials. The SIPRC would not substantially contribute to any cumulative impact on cultural resources when added to impacts from other past, present, and reasonably foreseeable future actions.

Air Quality. Ongoing and reasonably foreseeable future project could result in incremental temporary increases in air pollutant emissions. Pollutants could include particulate matter in the form of fugitive dust from construction activities and emissions of various pollutants from operations. Because the emissions from construction activities related to the SIPRC would be minor and temporary they would not substantially contribute to air quality cumulative impacts when added to impacts from other past, present, and reasonably foreseeable future actions. Emissions from SIPRC operations would be minor and they would also not substantially contribute to cumulative air quality impacts.

Noise. Most of the potential impacts from noise would be short-term and aligned with the construction phase of the SIPRC. The only sensitive noise receptors that potentially could be impacted would be ORNL workers in the close vicinity to the project. Operational noise associated with the SIPRC would be negligible. Given the large distance from the closest offsite receptors, cumulative noise from construction or operation of projects at ORNL and other locations within the ORR would be indistinguishable from background. Also, most of the reasonably foreseeable future actions listed in Section 4.1 would not occur at the same location and at the same time as the SIPRC and would not contribute to cumulative noise effects.

Socioeconomics and Environmental Justice. Local and regional and local development activities are likely to result in increased population and employment and the increase in jobs and income levels would be considered small a small and beneficial impact on the local and regional economies. The proposed SIPRC is expected to represent a small part of the reasonably foreseeable future actions and its effect on cumulative impacts would be correspondingly small. There would be no disproportionate high and adverse impacts on minority and low-income populations from the SIPRC and it would not contribute to cumulative environmental justice impacts.

Waste Management. Incremental increases would result from the addition of identified reasonably foreseeable future projects. However, there is enough excess capacity to meet ongoing and future waste management demand related to waste generation, treatment, or disposal. Wastes generated from the SIPRC would be minimal and insignificant. Therefore, any incremental waste management impact from the SIPRC, when added to impacts from other past, present, and reasonably foreseeable future actions, would not be substantial.

Human Health and Safety. Ongoing and reasonably foreseeable future projects are not anticipated to have any unique and unusual human health and safety impacts. Projects would be expected to follow all applicable health and safety rules and regulations to minimize the potential for typical occupational hazards and to limit potential chemical and radiological exposures to workers and the public from normal operations. In addition, new facilities would be of modern design with engineered controls for improved operation, thus resulting in improvements to the overall environmental, safety and health environment. Consequently, cumulative human health and safety impacts from the SIPRC would not be substantial when added to the impact from other past, present, and reasonably foreseeable future actions.

Accidents. Policies and procedures would be implemented for the reasonably foreseeable future projects to minimize potential accidents that could result in adverse impacts on workers, the public, and property. Postulated accident scenarios analyzed for the SIPRC indicate that the conceptual design would meet expectations for public and co-located worker safety. Therefore, there would not be any substantial cumulative impacts from a potential accident at the SIPRC when added to the impact from other past, present, and reasonably foreseeable future actions.

Utilities. Addition of the identified reasonably foreseeable future projects would result in incremental increases in utility usage. However, there is enough excess capacity to meet the demand, and continued upgrades and improvements in the local and regional utility systems would serve to offset/accommodate any potential utility use increases. Additionally, the individual projects described above would likely be implemented in phases over the course of several years, thus enabling the utilization of new, more energy efficient technologies to minimize energy consumption and to provide utility systems sufficient opportunity to meet demand through upgrades and improvements. When added to the impact from other past, present, and reasonably foreseeable future actions, the cumulative impact from the SIPRC on local and regional infrastructure is expected to be minimal.

Transportation. Cumulative transportation impacts in Roane and Anderson Counties could occur from increased development and growth. These potential impacts could be combined with ongoing environmental restoration and development activities on the ORR and with the planned expansion of the state highways by the Tennessee Department of Transportation. The main transportation impact of commercial and industrial development would be an increase in average daily traffic volumes. Associated with increases in traffic is the potential for an increased number of accidents, additional noise and air pollution, and road deterioration and damage. However, the small size of the proposed SIPRC project would not substantially contribute to cumulative transportation impacts when added to the impact from other past, present, and reasonably foreseeable future actions.

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5. LIST OF AGENCIES AND PERSONS CONTACTED

The following agencies and persons were contacted for information and data used in the preparation of this EA.

Name	Affiliation	Location	Topic
Robbie Sykes	U.S. Fish and Wildlife Service	Cookeville, TN	Migratory Birds
David Pelren	U.S. Fish and Wildlife Service	Cookeville, TN	Federally Listed Bats
Carmen Simonton	U.S. Fish and Wildlife Service	Atlanta, GA	Migratory Birds
Dillon Blankenship	TDEC Division of Natural Areas, Natural Heritage Program	Nashville, TN	State Listed Wildlife and Plant Species Wetlands
Vincent Pontello	Tennessee Wildlife Resources Agency	Nashville, TN	State Listed Wildlife Species
Jennifer Barnett	Tennessee Historical Commission	Nashville, TN	Archaeological Resources
Kelly Reid	Tennessee Historical Commission	Nashville, TN	Archaeological Resources
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APPENDIX A

WETLANDS ASSESSMENT

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DOE/EA-2136

Wetland Assessment
Construction and Operation of the
Stable Isotope Production and Research Center

Oak Ridge National Laboratory
Oak Ridge, Tennessee

March 2022

U. S. Department of Energy
Office of Science
Oak Ridge National Laboratory Site Office

DOE/EA-2136

Wetland Assessment
Construction and Operation of the
Stable Isotope Production and Research Center

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Date Issued—March 2022

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Oak Ridge National Laboratory Site Office
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ACRONYMS, SYMBOLS AND ABBREVIATIONS

CWA	Clean Water Act of 1972
DOE	Department of Energy
EO	Executive Order
ORNL	Oak Ridge National Laboratory
SIPRC	Stable Isotope Production and Research Center
TDEC	Tennessee Department of Environment and Conservation
USACE	U.S. Army Corps of Engineers

1. INTRODUCTION

The U. S. Army Corps of Engineers (USACE) defines wetlands as “those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions” (USACE 1987; USACE 2012). Wetlands usually include swamps, marshes, bogs, and similar areas. In identifying a wetland, three characteristics must be present. First is the dominance of hydrophytic vegetation (plants that have morphological or physiological adaptations to grow, compete, or persist in anaerobic soil conditions). Second, hydric soils are present and possess characteristics that are associated with reducing (anaerobic or low oxygen) soil conditions. Third, wetland hydrology must be present (i.e., the site must be flooded or saturated for sufficient duration during the growing season to create anaerobic conditions at the site (USACE 1987, 2012).

This wetland assessment has been prepared in accordance with the *Code of Federal Regulations* Title 10 Part 1022, for the purpose of fulfilling the U. S. Department of Energy’s (DOE’s) responsibilities under Executive Order (EO) 11990, *Protection of Wetlands*. The order encourages federal agencies to implement measures to preserve and enhance the natural and beneficial functions of wetlands. The order also requires federal agencies to take action to minimize or mitigate the destruction, loss, and degradation of wetlands. The sequence of mitigation measures should emphasize the following:

- avoiding actions in wetlands, including new construction or work, unless there is no practicable alternative to that action; and

- minimizing harm should the only practicable alternative require that any particular action take place in a wetland.

Finally, EO 11990 seeks to provide early and adequate opportunities for public review of plans and proposals involving new construction or similar projects in wetlands.

This wetland assessment serves to inform the public of a proposed action at the Oak Ridge National Laboratory (ORNL) that has the potential to affect wetlands on property currently controlled by DOE. This wetland assessment also serves to present measures or alternatives to the proposed action that will reduce or mitigate adverse impacts to wetlands. Information is presented on the following topics: project description, site description, impacts on wetlands, alternatives, and mitigation.

2. PROJECT DESCRIPTION

2.1 PROPOSED ACTION

DOE proposes to construct and operate the Stable Isotope Production and Research Center (SIPRC) to expand current stable isotope production capabilities at ORNL. DOE proposes to construct and operate the SIPRC in a forested area south of White Oak Avenue in the 6000 Area of the ORNL campus (Figure 2.1). Construction would include site preparation activities (i.e., clearing and grading), installation of site utilities including stormwater pollution controls, and completion of the approximately 54,000 square foot, single-story structure to support the required stable isotope research and production capability. Operations at SIPRC would be primarily focused on stable isotope production but would also include research and testing.

2.2 PROPOSED LOCATION

The proposed SIPRC project site (Figure 2.2) consists of approximately 10 heavily vegetated acres on the eastern edge of ORNL's main campus. The site is directly south of White Oak Avenue and is within proximity to the 6000 Area. White Oak Avenue is a two-lane road and is expected to be the primary pedestrian and vehicular means of access to the site. An existing parking lot is located to the west, and a creek with an associated 60-foot riparian buffer zone is directly east and west of the project site.

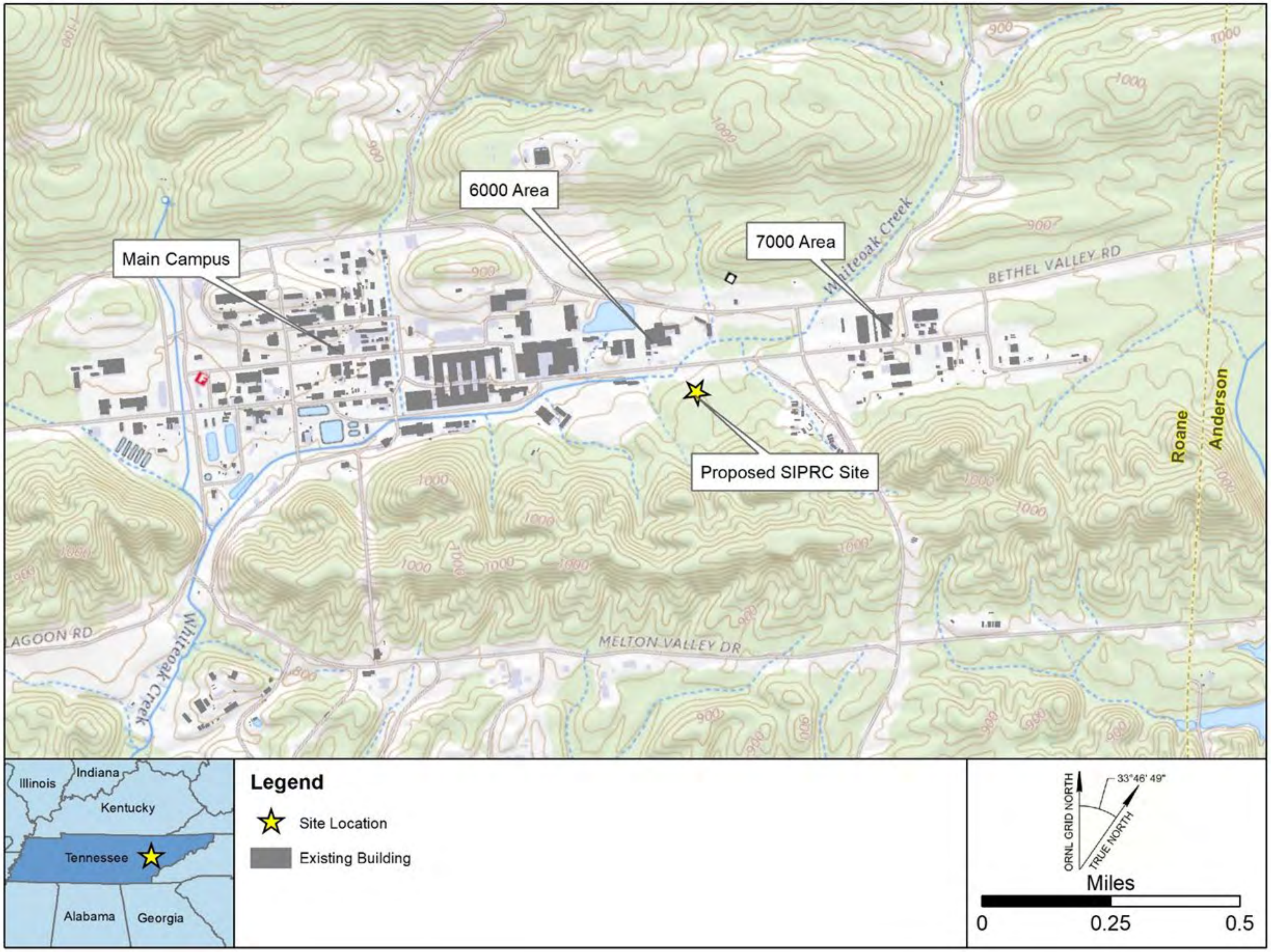


Figure 2.1. Oak Ridge National Laboratory and Proposed Location of the SIPRC.

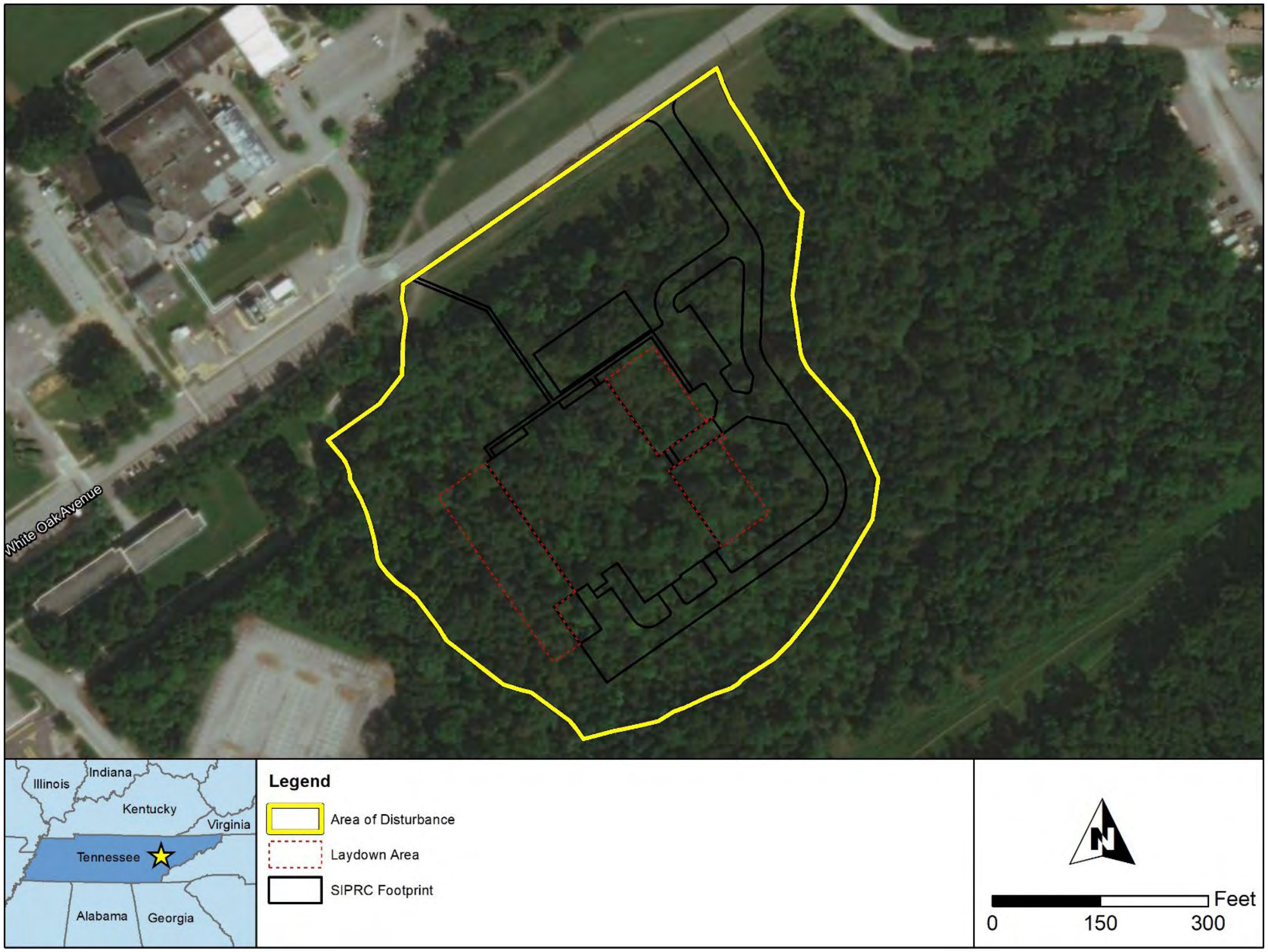


Figure 2.2. Proposed SIPRC Site – South White Oak Area.

2.3 WETLANDS AT THE PROPOSED SIPRC SITE

As part of the Natural Resources Assessment conducted for the SIPRC (ORNL 2021), rapid wetland and stream determinations were conducted in July 2019 within the entire SIPRC study area (approximately 30 acres). The larger SIPRC study area includes the proposed 10-acre SIPRC site shown in Figure 2.2. Between May and July 2021, aquatic features within and adjacent to the SIPRC site were assessed in more detail to meet USACE and Tennessee Department of Environment and Conservation (TDEC) requirements. Field-mapped seeps/springs, and stream and wetland boundaries were mapped via a Trimble Geo 7x by an experienced Hydrologic Technician trained in USACE/TDEC wetland delineation methods (USACE 1987; TDEC 2015, 2020).

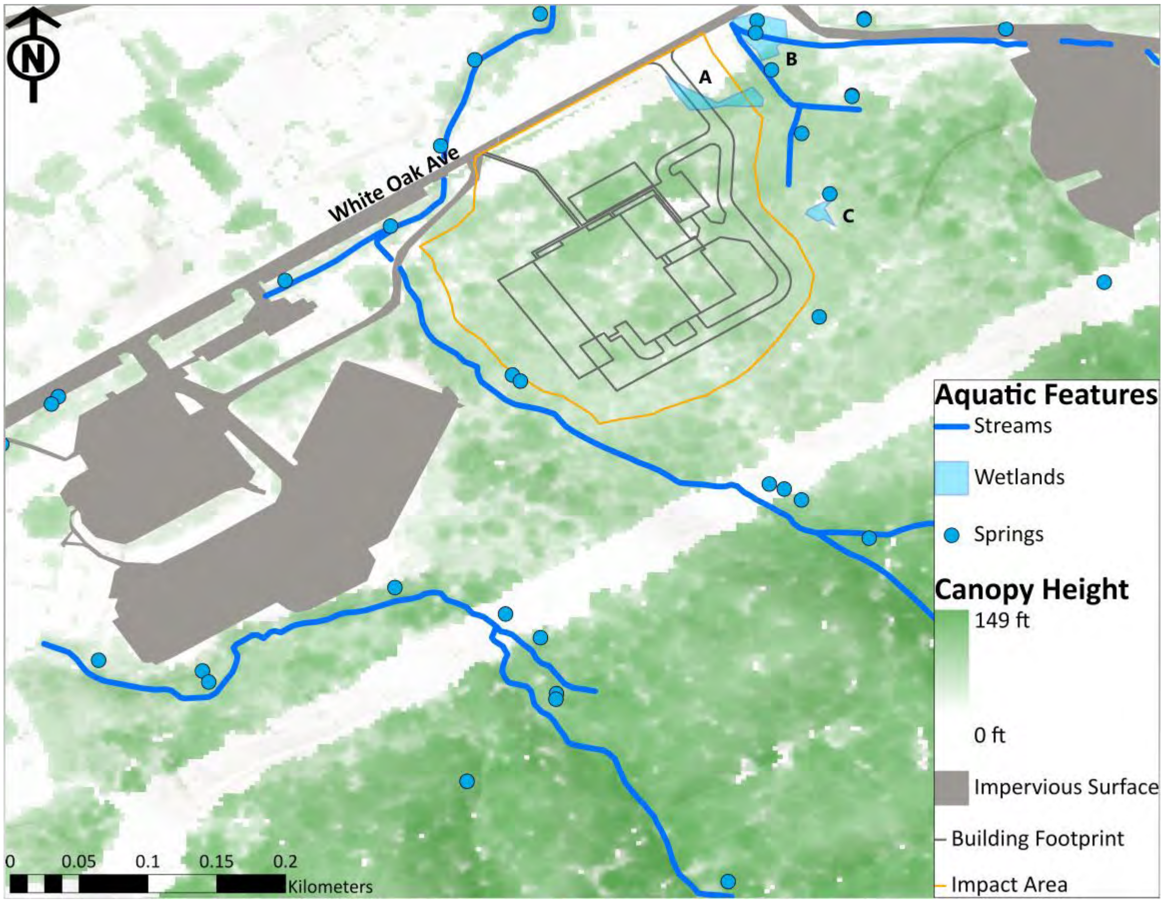
To delineate the boundaries of jurisdictional wetlands, field surveys were conducted to evaluate the dominance of wetland vegetation, soils, and hydrological characteristics per USACE wetland delineation protocols (USACE 1987).

Three wetlands were delineated within the SIPRC study area investigated as part of the 2019 and 2021 SIPRC Natural Resources Assessment (ORNL 2021). These wetlands are labeled A, B, and C (Figure 2.3). Wetland A is almost entirely within the current disturbance limits for the project. The other two wetlands, Wetland B and Wetland C, are both located within 100 feet of the SIPRC area of disturbance. The USACE wetland delineation data forms for each wetland are included in Appendix A.

Wetland A is a 0.123-acre wetland located along the tree line on the northeast side of the SIPRC area of disturbance. Hydrology characteristics come from a seasonally high-water table, flow from adjacent stream and low topography. The wetland contains both palustrine emergent and palustrine forested wetland communities. The emergent plant community occurs in the periodically mown right-of-way adjacent to White Oak Avenue. Dominant species with the mown sections are various wetland carex and grass species. As the soil becomes more saturated, species such as jewelweed, false-nettle, fox sedge, leafy bulrush and cattails grow within the wettest portion of the emergent wetland. The forested wetland portion contains species such as green ash, willow, and privet. The wetland nearly abuts the tributary and contributes to the wetland hydrology. There is a small drainage from the creek to an inundated portion of the forested wetland which flows most of the year.

Wetland B is a 0.171-acre wetland just to the east of Wetland A. It lies within the riparian area of the two tributary streams that split at White Oak Creek Road near the existing access road to the 6556 Area. Hydrology is due to topography and proximity to the two streams. Wetland B contains palustrine emergent and palustrine forested communities. Unlike Wetland A, the emergent vegetation is not mown and is predominantly cattails, with some other wetland species including monkeyflower and wetland sedges. The forested community is predominantly made up of black willow and green ash.

Wetland C is a 0.032-acre wetland located just outside the southeast corner of the area of disturbance. This wetland contains predominantly emergent vegetation and saplings and is located within a dirt trail surrounded by forest. There are multiple pools of standing water along this dirt trail, but Wetland C is the only inundated area that contains hydrophytic vegetation such as green ash seedlings and bearded beggartick. A spring feeds a wet weather conveyance that flows through this wetland and toward the eastern stream.



Source: ORNL 2021

Figure 3.1. Location of Aquatic Resources Found Within the SIPRC Study Area

3. WETLAND IMPACTS

This chapter provides background information for evaluating the potential environmental effects of the Proposed Action. Activities associated with the SIPRC construction could have either positive (i.e., beneficial) impacts or negative (i.e., adverse) impacts on wetlands within the SIPRC study area. Impacts on wetlands may result from activities occurring directly in wetlands or impacts may result indirectly from activities that occur in areas adjacent to wetlands. The consequences of wetland alteration may last for decades (long-term impacts) or they may be minor enough that wetlands could recover in a few years (short-term impacts).

3.1 POSITIVE IMPACTS

Positive impacts include any actions that would improve the quality of wetlands or actions that enhanced the ability of wetlands to perform wetland functions. Examples of positive (beneficial) actions include restoring or enhancing wetland hydrology to increase the hydroperiod in wetlands, planting additional species of wetland plants to increase diversity or structure, and controlling or eradicating exotic, invasive plants in wetlands.

No positive impacts from the Proposed Action were identified for either Wetland A or Wetland B. However, an opportunity for mitigation could provide for preservation, enhancement or restoration of Wetland C. Additionally, possible changes to the SIPRC design could result in an expansion of Wetland A (see Section 3.2.2).

3.2 NEGATIVE IMPACTS

Negative impacts include any activity that adversely affects the survival, quality, natural, and beneficial values of wetlands. Negative impacts would result from any action that eliminates or interferes with the wetlands in the SIPRC study area or reduces their ability to perform normal biological, chemical, hydrological, and physical functions.

Clearing and grading activities within the SIPRC area of disturbance would have a negative impact on Wetland A and potential negative impacts on Wetland B and C. Wetland A would be filled during construction of the SIPRC access road. Although Wetland B and Wetland C are outside of the SIPRC area of disturbance it is possible that site development activities could have a negative hydrological effect because of the proximity of these wetlands to the affected disturbance area. The potential hydrological effect could result from diversion or restriction of the surface and subsurface water flow associated with the two wetlands.

3.3 DIRECT IMPACTS

Direct impacts would result from any activity that occurs directly in a wetland and affects wetland characteristics or functions. Direct impacts may be negative or adverse if they eliminate, interfere with, or reduce normal wetland functions. The most extreme example of direct adverse impacts to wetlands would involve filling wetlands during site preparation or construction activities or draining wetlands by installing culverts or ditches to remove water. Direct impacts may be positive if they restore or improve existing wetland functions. Examples of positive direct impacts on wetlands would include any of the restoration activities described in Sect. 3.1.1.

Clearing and grading activities within the SIPRC area of disturbance would have a direct impact on Wetland A. The direct impact would be caused by filling the wetland. There should be no negative direct impacts on either Wetland B or C since they are located outside of the SIPRC area of disturbance and would be avoided. There is also the potential for a positive direct impact on Wetland C that could result from potential enhancement or restoration mitigation activities.

3.4 INDIRECT IMPACTS

Indirect impacts could result from activities in areas adjacent to the wetland that could interfere with how the wetland functions. Examples of indirect adverse impacts include changes to hydrology near a wetland, siltation from soil erosion at nearby construction sites, spills or leaks of oil or other chemicals from construction equipment, overuse of pesticides or herbicides, and allowing invasive, exotic plant pest species to colonize the wetlands thereby diminishing the diversity and quality of wetland habitat. Examples of indirect positive impacts include controlling soil erosion, controlling or preventing spills or leaks of oil or other chemicals from construction equipment, using pesticides or herbicides safely to prevent contamination and mortality to wetland plants or animals, and controlling or eradicating invasive, exotic plant pest species to protect diversity and habitat quality.

Indirect impacts could occur for Wetland B and Wetland C. Since these two wetlands are located within 100 feet of the SIPRC area of disturbance, indirect adverse impacts could result from changes to the existing hydrology from construction and/or siltation if soil erosion is not adequately controlled. Conversely, if erosion and sedimentation controls are adequate and properly maintained the indirect impacts could be positive.

3.5 LONG-TERM IMPACTS

Long-term impacts include any activities that influence wetland functions for several years or decades. Adverse long-term impacts would include any activities (e.g., draining or filling) that damage wetland functions such that it would take several years or decades for wetland functions to recover to their pre-disturbance level. Adverse long-term impacts are of sufficient magnitude and intensity that site resources may not recover without intervention (restoration). Long-term positive impacts would include activities that provide permanent protection or stewardship of wetland functions or habitat.

Unless design changes are made, construction of the SIPRC access road would result in the filling of Wetland A since it is located within the proposed area of disturbance. This results in an adverse long-term impact to Wetland A. However, Wetland B and Wetland C would not be directly impacted, and their preservation would result in a positive long-term impact. Additionally, potential mitigation (enhancement or restoration) of Wetland C could result in a beneficial long-term impact.

3.6 SHORT-TERM IMPACTS

Short-term impacts include any activities that have relatively minor impacts on wetland functions. An example of a short-term negative effect would be removal of woody vegetation from a wetland. Cutting back woody plants in a wetland would temporarily affect structure but sprouts from cut stems would reestablish structure in a year or two. The recovery period for adverse short-term impacts may take several weeks or months to a few years. Short-term disturbances are generally not severe enough to cause permanent impairment of wetland functions and values. Site resources can usually recover in a short period of time without assistance. The duration of the recovery period depends on the magnitude of disturbance. Positive short-term impacts include any activities that may have a temporary influence in wetlands. An example of a positive short-term effect could be one-time removal of invasive, exotic vegetation from a wetland without considering follow-up treatments to control resprouting or new seedlings from seed germination.

No short-term impacts on any wetlands have been identified for the construction or operation of the SIPRC.

4. ALTERNATIVES AND MITIGATION

The only alternative examined was the No Action Alternative. Under the No Action Alternative, the SIPRC would not be established and operated at ORNL. Ongoing stable isotope research and production activities at ORNL could continue, but the full mission of the SIPRC to expand domestic production of enriched stable isotopes would not be realized and reliance on foreign vendors would continue.

In addition to the No Action Alternative, DOE evaluated the following measures that could mitigate the adverse effects of actions within wetlands.

4.1 AVOIDANCE

Avoidance means that DOE would not engage in any activity that would have adverse impacts on the wetlands within the SIPRC study area. Wetland A is presently located within the SIPRC area of disturbance and cannot be avoided unless changes are made to the SIPRC design. Evaluation of the preliminary design is focused on whether the facility entry drive, parking area, and building can be shifted slightly to the west. This might be enough to avoid directly impacting Wetland A. Wetland B and Wetland C are located outside of the area of disturbance and would be avoided.

4.2 MINIMIZATION

Minimization means restricting actions that would adversely affect wetlands to the absolute minimum required for the project to continue. Minimization could include reducing areas of impact in the wetland and implementing best management practices and sediment controls that reduce or prevent soil erosion and runoff from construction sites; use of buffer zones around the wetland; and minimum grading requirements that reduce land disturbance on steep slopes adjacent to the wetland.

One minimization measure being considered to reduce the potential impact on Wetland A is the construction of a retention wall. Instead of entirely filling Wetland A, the retention wall would result in only a portion of the wetland being filled. This could also provide an opportunity to expand Wetland A into the area between Wetland A and Wetland B.

During the construction of the SIPRC, erosion prevention and sediment control measures such as silt fencing, filter socks, and temporary slope breakers would be implemented to minimize impacts to adjacent surface waters and Wetlands B and C. It is critical that these erosion controls are properly installed and maintained around the perimeter of the construction footprint especially along sloped areas. In addition, a 60-foot riparian buffer on each side of nearby perennial streams and adjacent wetlands would be marked in the field prior to the start of construction to minimize the potential for direct adverse impacts.

4.3 COMPENSATION

Compensation may be used as a mitigative measure when no practicable alternative exists to avoid or minimize disturbance in wetlands. Compensation may require creation of new wetlands, restoration of drained wetlands, preservation of unique wetlands, or enhancement of degraded wetlands. Most regulatory agencies prefer that compensatory mitigation occur in the same watershed as the permitted action. However, specific requirements for compensatory mitigation are subject to negotiation.

Current USACE and TDEC policy favors restoration because restoration projects are generally more successful than creation, and enhancement or preservation only affect existing wetlands. In some cases, preservation or enhancement may be used with approval of the regulatory agency. Wetland creation is usually the least desirable form of compensation because of limited success rates. Wetland mitigation banks offer developers another option for wetland mitigation. Developers may purchase credits in large-scale restoration projects, thus allowing them the opportunity to accomplish their mitigation goals without having to worry about post-mitigation monitoring.

Generally, DOE tries to propose mitigation within the Oak Ridge Reservation instead of purchasing credits from an approved mitigation bank. Usually, TDEC has agreed with this approach because they prefer to keep mitigation in the same or similar watershed that the impacted wetland is in.

Since Wetland A is over one tenth of an acre, compensatory mitigation would be required. Guidelines for compensatory measures include a minimum ratio of 2:1 for restoration, 4:1 for creation and enhancement, and 10:1 for preservation, or a best professional judgement ratio agreed to by the state. A potential mitigation option would be the preservation, enhancement, or restoration of Wetland C since it is located outside of the SIPRC area of disturbance. Preservation, enhancement, or restoration of Wetland C could also mitigate potential impacts to the state-listed four-toed salamanders that occur within the wetland (ORNL 2021).

5. REGULATORY PERMITS

Since the proposed SIPRC project would result in impacts to wetlands, these activities are subject to regulation by the USACE and the TDEC, Division of Water Pollution Control. USACE regulates activities in wetlands and other special aquatic sites through Sect. 404 of the Clean Water Act of 1972 (CWA). The State of Tennessee also regulates activities in wetlands under Sect. 401 of the CWA and the Tennessee Water Quality Control Act of 1977 (Tennessee Administrative Code 69-3-108). Anyone who wishes to discharge dredged or fill material into the waters of the United States, regardless of whether on private or public property, must obtain a Sect. 404 permit from the USACE and a Sect. 401 Water Quality Certification from the state prior to taking the action. State and federal storm water regulations to minimize erosion and sedimentation would also need to be met.

In general, TDEC has lower thresholds for disturbance to wetlands and other waters of the state than the USACE. In some cases, the USACE may determine that it does not have jurisdiction over activities that would affect certain types of wetlands. In these situations, TDEC would serve as the lead regulatory agency. The sequencing for regulatory review by the USACE and TDEC requires applicants to make all efforts to avoid adverse impacts to wetlands if possible, minimize adverse impacts, and compensate for adverse impacts after making all practicable effort to avoid and minimize them. Compensatory requirements depend on the quality of the affected wetlands, the type and degree of impact, and the region of the state where the impact would occur. Compensation mitigation usually includes restoring, enhancing, or preserving wetlands. Compensatory requirements generally must be negotiated with the USACE and TDEC on a case-by-case basis.

Prior to the start of any construction, DOE would coordinate with the TDEC regarding the disturbance to Wetland A and potential indirect impacts to Wetland B and Wetland C. A TDEC Aquatic Resource Alteration Permit/Section 401 Water Quality Certification, and USACE CWA Section 404 Permit would be obtained. The implementation of stream and wetland buffer zones, spill prevention and response plans, and National Pollutant Discharge Elimination System permit requirements would help to minimize the potential indirect impacts from spills, increased sedimentation and stormwater runoff.

6. SUMMARY AND CONCLUSIONS

DOE is proposing to construct and operate the SIPRC to expand current stable isotope production capabilities at ORNL. The SIPRC would be constructed in a forested area south of White Oak Avenue in the 6000 Area of the ORNL campus. Construction would include site preparation activities (i.e., clearing and grading), installation of site utilities including stormwater pollution controls, and completion of the approximately 54,000 square foot, single-story structure to support the required stable isotope research and production capability.

The proposed SIPRC at ORNL would affect wetlands on property controlled by DOE. DOE has prepared this wetland assessment in accordance with the *Code of Federal Regulations* Title 10 Part 1022, for the purpose of fulfilling their responsibilities under EO 11990, *Protection of Wetlands*.

Three wetlands were delineated within the SIPRC study area investigated as part of the 2019 and 2021 SIPRC Natural Resources Assessment. Wetland A is almost entirely within the current disturbance limits for the project. The other two wetlands, Wetland B and Wetland C, are both located within 100 feet of the SIPRC area of disturbance.

Clearing and grading activities within the SIPRC area of disturbance would have a long-term direct adverse impact on Wetland A because of its permanent elimination. Wetland B and Wetland C are both located outside of the SIPRC area of disturbance and would not be directly impacted by construction. However, construction activities within the SIPRC area of disturbance could cause changes in the site hydrology, which could indirectly impact both Wetland B and C. Other potential indirect impacts could include siltation from soil erosion on the construction area, spills or leaks of oil or other chemicals from construction equipment, and allowing invasive, exotic plant pest species to colonize the wetlands thereby diminishing the diversity and quality of the wetland.

Prior to the start of any construction, DOE would coordinate with the TDEC regarding the disturbance to Wetland A and potential indirect impacts to Wetland B and Wetland C. A TDEC Aquatic Resource Alteration Permit/Section 401 Water Quality Certification, and USACE CWA Section 404 Permit would be obtained. The implementation of stream and wetland buffer zones, spill prevention and response plans, and NPDES permit requirements would help to minimize the potential indirect impacts from spills, increased sedimentation and stormwater runoff. Since Wetland A is over one tenth of an acre, compensatory mitigation would also be required. A potential mitigation option would be the preservation, enhancement, or restoration of Wetland C since it is located outside of the SIPRC area of disturbance. Preservation, enhancement, or restoration of Wetland C could also mitigate potential impacts to the state-listed four-toed salamanders that occur within the wetland.

7. REFERENCES

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USACE 2012. Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). Wetlands Regulatory Assistance Program ERDC/EL TR-12-9. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. April.

APPENDIX A
WETLAND DELINEATION DATA FORMS

1

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: SIPR-C City/County: Oak Ridge/Anderson Sampling Date: 07/15/21

Applicant/Owner: ORNL State: TN Sampling Point: A

Investigator(s): Jamie Herold Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 35.931756° Long: -84.304287° Datum: ______

Soil Map Unit Name: see note in Soil NWI classification: PEM & PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐ Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Wetland A is a 0.123 acre wetland located along the tree line on the north side of SIPR-C. It is the only jurisdiction wetland that falls within the area of disturbance, in the location of the entrance road. Most of the PEM portion of the wetland is in a periodically mown right-of-way.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☑ No ☐	Depth (inches): 12	
Water Table Present?	Yes ☑ No ☐	Depth (inches): ______	
Saturation Present? (includes capillary fringe)	Yes ☑ No ☐	Depth (inches): ______	**Wetland Hydrology Present? Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

seasonally high water table
flow from adjacent stream
low topography

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: A

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. green ash (Fraxinus pennsylvanica)	20		FACW
2.			
3.			
4.			
5.			
6.			
	20 = Total Cover		
50% of total cover:	20% of total cover:		

Sapling Stratum (Plot size:)			
1. privet (Ligustrum sinense)	10		FACU
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size:)			
1. privet (Ligustrum sinense)	5		FACU
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)			
1. sallow sedge (C. lurida)	15		OBL
2. leafy bulrush (Scirpus polyphyllus)	10		OBL
3. dark-green bulrush (Scirpus atrovirens)	3		OBL
4. seedbox (Ludwigia alterniolia)	2		FACW
5. poison ivy (Toxicodendron radicans)	10		FAC
6. broadleaf cattail (Typha latifolia)	5		OBL
7. fox sedge (Carex vulpinoidea)	5		OBL
8. jewelweed (Impatiens capensis)	5		FACW
9.			
10.			
11.			
	55 = Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	38	x 1 = 38
FACW species	42	x 2 = 84
FAC species	10	x 3 = 3
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	105 (A)	185 (B)

Prevalence Index = B/A = 1.7

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

Approximately 10% of the wetland was was standing water; half of it was vegetated and half open water

SOIL

Sampling Point: A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	100					clay	
2-4	10YR 4/2	97	10YR 5-6	3	C	PL	clay	
4-10	10YR 4/2	95	2.5Y 5/6	5	C	PL/C	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ☑ **No** ☐

Remarks:

Area Not Surveyed by NRCS.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: SIPR-C City/County: Oak Ridge/Anderson Sampling Date: 07/15/21
Applicant/Owner: ORNL State: TN Sampling Point: B
Investigator(s): Jamie Herold Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): ______
Subregion (LRR or MLRA): ______ Lat: 35.932210° Long: -84.303967° Datum: ______
Soil Map Unit Name: see note in Soil NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes [✓] No [ ] (If no, explain in Remarks.)
Are Vegetation [ ], Soil [ ], or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes [✓] No [ ]
Are Vegetation [ ], Soil [ ], or Hydrology [ ] naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [✓] No [ ]	Is the Sampled Area within a Wetland? Yes [✓] No [ ]
Hydric Soil Present?	Yes [✓] No [ ]	
Wetland Hydrology Present?	Yes [✓] No [ ]	

Remarks:
Wetland B is a 0.101 acre wetland that lies within the riparian area of the two tributary streams that split at White Oak Creek Road

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [✓] Surface Water (A1)
- [✓] High Water Table (A2)
- [✓] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] True Aquatic Plants (B14)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Stunted or Stressed Plants (D1)
- [✓] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [✓] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes [✓] No [ ] Depth (inches): 4
Water Table Present? Yes [✓] No [ ] Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes [✓] No [ ] Depth (inches): ______

Wetland Hydrology Present? Yes [✓] No [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: B

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. black willow (Salix nigra)	20	D	OBL
2. green ash (Fraxinus pennsylvanica)	10		FACW
3.			
4.			
5.			
6.			
	30 = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Sapling Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. black willow (Salix nigra)	10		OBL
2. green ash (Fraxinus pennsylvanica)	10		FACW
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Shrub Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Herb Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. broadleaf cattail (Typha latifolia)	30	D	OBL
2. bulrush (Scirpus atrovirens)	10		OBL
3. allegheny monkey-flower (Mimulus ringens)	10		OBL
4.			
5.			
6.			
7.			
8.			
9. poison			
10.			
11.			
	50 = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	80	x 1 = 80
FACW species	20	x 2 = 40
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	100 (A)	120 (B)

Prevalence Index = B/A = 1.2

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

Approximately 20% of the wetland was was standing water fully vegetated

SOIL Sampling Point: B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-2	10YR 4/2	100					clay	
2-4	10YR 4/2	97	10YR 5-6	3	C	PL	clay	
4-10	10YR 4/2	95	2.5Y 5/6	5	C	PL/C	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ **No** ☐

Remarks:

Area Not Surveyed by NRCS.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: SIPR-C City/County: Oak Ridge/Anderson Sampling Date: 07/15/21

Applicant/Owner: ORNL State: TN Sampling Point: C

Investigator(s): Jamie Herold Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 35.931037° Long: -84.303596° Datum: ______

Soil Map Unit Name: see note in Soil NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐ Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland?	Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Wetland C is 0.032 acre wetland located outside the southeast corner of the area of disturbance. This wetland contains emergent vegetation and saplings and is located within a dirt woods trail surrounded by forest.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☑ Surface Water (A1)	☐ True Aquatic Plants (B14)
☑ High Water Table (A2)	☐ Hydrogen Sulfide Odor (C1)
☑ Saturation (A3)	☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Water Marks (B1)	☐ Presence of Reduced Iron (C4)
☐ Sediment Deposits (B2)	☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Drift Deposits (B3)	☐ Thin Muck Surface (C7)
☐ Algal Mat or Crust (B4)	☐ Other (Explain in Remarks)
☐ Iron Deposits (B5)	
☐ Inundation Visible on Aerial Imagery (B7)	
☐ Water-Stained Leaves (B9)	
☐ Aquatic Fauna (B13)	

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☑ No ☐	Depth (inches): 3	
Water Table Present?	Yes ☑ No ☐	Depth (inches): ______	
Saturation Present? (includes capillary fringe)	Yes ☑ No ☐	Depth (inches): ______	**Wetland Hydrology Present? Yes ☑ No ☐**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: C

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Sapling Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			
Shrub Stratum (Plot size: ______)			
1. green ash (Fraxinus pennsylvanica)	2		FACW
2.			
3.			
4.			
5.			
6.			
= Total Cover	2		
50% of total cover: ____ 20% of total cover: ____			
Herb Stratum (Plot size: ______)			
1. bearded beggarticks (Bidens aristosa)	4		OBL
2. sallow sedge (Carex lurida)	4		OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	8		
50% of total cover: ____ 20% of total cover: ____			
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	8	x 1 = 8
FACW species	2	x 2 = 4
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	10 (A)	12 (B)

Prevalence Index = B/A = 1.2

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
90% of the wetland was standing water with no vegetation

SOIL Sampling Point: C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/1	100					clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ **No** ☐

Remarks:

Area Not Surveyed by NRCS.

APPENDIX B

NATURAL RESOURCES SURVEY REPORT

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NATURAL RESOURCES ASSESSMENT FOR THE STABLE ISOTOPE PRODUCTION AND RESEARCH CENTER (SIPRC), 2021

DRAFT

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August 2021

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1 INTRODUCTION

Oak Ridge National Laboratory (ORNL) is a leading institution in advanced materials, supercomputing, neutrons, and nuclear science. As a research laboratory that is managed by UT-Battelle, LLC for the Department of Energy (DOE), national priorities in energy, security, and scientific discovery necessitate facility improvements and expansions. At the same time, DOE is committed to environmental stewardship. The laboratory is located on the ~32,900-acre Oak Ridge Reservation (ORR), much of which also functions as a state Wildlife Management Area. DOE works not only with the Tennessee Wildlife Resources Agency (TWRA) and Department of Environment and Conservation (TDEC), but with the US Fish and Wildlife Service (USFWS), US Department of Agriculture, and other agencies to serve as an effective steward of the ORR and the natural resources on it. Accordingly, project managers must conform to environmental regulations, agreements, and policy at the federal, state, and institutional level.

The DOE isotope program has identified a need to expand the stable isotope production capability to meet the demand of the nation while also eliminating our nation's dependencies for critical isotopes on foreign suppliers. The demand for enriched stable isotopes over the last decade has increased significantly for medical, national security, and fundamental research projects. This suite of technologies has been developed at ORNL with support from the DOE Isotope Program to address the need for increased domestic stable isotope production. The current production capabilities afforded by prototype capabilities developed through DOE Isotope Program supported research and the follow-on Stable Isotope Production Facility currently under construction, do not provide adequate production capabilities to more adequately and effectively meet the growing demand of the Nation.

Therefore, a new facility at ORNL is proposed to integrate aspects of the stable isotope program including electromagnetic separation and centrifuge technologies; research and development laboratories; stable isotope storage and dispensing operations; and technical services for preparing special isotope forms through physical and chemical conversions. This project will expand the current production capabilities for enriched stable isotopes and add a new building that will facilitate efficient operations and provide space, not only for all the current needs, but will also accommodate the projected large-scale expansion of production systems.

The proposed Stable Isotope Production and Research Center (SIPRC) will involve development of existing natural areas within the ORNL campus, which might contain sensitive resources that require mitigation or avoidance in accordance with existing policy and regulation. This report summarizes current knowledge of natural and cultural resources in the vicinity of SIPRC. In addition to initial on-the-ground surveys in 2019, surveys were also conducted in 2020 and 2021 by the ORNL Natural Resources Management Program and Biodiversity and Ecosystem Health Group staff, this report makes use of historical (pre-1995) and contemporary (1995–present) data from additional confirmed sources (e.g., TDEC). The individuals who obtained and compiled the data that are presented here are familiar with and routinely assess sensitive resources on the ORR.

Accordingly, this report should facilitate more environmentally-sound decisions during planning and development of the SIPRC, provide a foundation for further assessment of sensitive and cultural resources, and thus help project managers better address regulatory guidance and DOE policy regarding sustainable development.

2 METHODS

In addition to on-the-ground surveys by the ORNL Natural Resources Management Program and Biodiversity and Ecosystem Health Group staff who routinely assess and are familiar with sensitive resources on the ORR., this report makes use of both historical (pre-1995) and contemporary (1995–present) data, as obtained from (1) previous reports and observations by ORNL Natural Resources and (2) the Tennessee Department of Environment and Conservation's Natural Heritage Inventory Program (TNNHP). Historical observations (pre-1995) are especially relevant to quantify rare species, which are inherently difficult to detect. Thus, historical observations were presumed valid unless subsequent targeted surveys failed to detect those resources, and/or—in the case of sensitive flora and fauna—other resources that are critical to their persistence were no longer present or adequate.

Sensitive resource surveys were conducted within the SIPRC Study Area. The Study Area includes the project Area of Disturbance, as well as the surrounding forested area (Figure 1). In 2019, a rapid survey was conducted within the Study Area for sensitive species, aquatic resources, and unique ecosystems. These rapid surveys provided a foundation for the more in-depth 2021 surveys within and directly adjacent to the Area of Disturbance. The larger Study Area allows for a better understanding of the ecological connection between the Area of Disturbance and the surrounding forested area. For certain surveys, such as bat monitor placement and forest assessments, the larger survey area was needed inorder to get enough data. It is important to note that the building footprint and area of disturbance indicated in Figure 1 are preliminary and could change during the final design phase.

Figure 1. Natural resources survey areas for the SIPRC study area (red border), area of disturbance (yellow border), and building footprint (pink border).

2.1 Wildlife Surveys

Bat acoustic surveys — Ten bat acoustic monitors (Wildlife Acoustics Song Meter SM4Bat FS Ultrasonic Recorders equipped with SMM-U2 microphones) were positioned in likely flyways and foraging areas, or near potential roost trees within the survey area. Microphones were mounted on 3-meter poles and directed along flyways. Monitors were deployed three times during summer roosting/maternity season: 4 monitors were deployed for 14 days, beginning May 7, 2021; 2 additional monitors were deployed beginning May 10, 2021, for 10 days, and 4 monitors were deployed beginning June 10 for 7 days. Recording began 30 minutes before sunset and ended 30 minutes after sunrise each night. Data was collected and analyzed using Kaleidoscope Pro Analysis Software, version 5 with both zero-crossing and full-spectrum analysis methods, as approved by the US Fish and Wildlife Service.

Visual Encounter Surveys (VES)/cover boards(cb) — A brief initial survey of the SIPRC study area was conducted in the Summer of 2019. Starting in the early spring of 2021, the entire parcel was surveyed to determine the least impactful path for preliminary soil testing and sampling. Possible sensitive or rare resource habitat was identified and excluded from soil testing and sampling. To aid VES, an array of 23 cover boards was placed in locations throughout the site focusing on habitat that may be attractive to herpetofauna, invertebrates, or small mammals. The coverboards were checked weekly from March 2021-July 2021. Any wildlife observed were recorded and photographed when possible.

Avian point counts — In addition to initial bird surveys in 2019, avian point counts at 6 equally spaced locations within the parcel were established and visited at dawn on May 19, 2021 to further assess occupancy and potential importance of the site to migratory birds. During point counts, all bird species seen or heard within a 10-minute period were recorded. Additionally, all birds seen and/or heard during weekly VES/cb checks and daily small mammal trap checks were recorded (see below).

Small mammal trapping —To quantify small mammal abundance and diversity, 62 Sherman live traps were positioned throughout the primary project area, where the most disturbance was expected. Traps were placed in sets of 2 to 3 traps per plot and baited with bird seed. Each trap was checked daily during 2 separate week-long (Mon-Fri) trapping efforts during April and May of 2021.

Funnel trap surveys (small vertebrates and invertebrates) — A funnel trap/drift fence array consisting of ~150 ft of silt fence in an x pattern with a four-way funnel trap at its center was placed near the southeast corner of the impact area. This location was selected to capture small vertebrates and invertebrates that may be moving from/to wetlands/streams across the parcel and from areas such as the grassland/rocky hillside on the south perimeter of the parcel or the Shumard-chinquapin area in the center of the parcel. The trap was checked twice daily when active from March 22 through July 15, 2021.

Nocturnal Species Survey — To gather information on nocturnal species inhabiting the project area, five separate nighttime surveys were conducted between March 29, 2021 and July 19, 2021. These 10-minute-long point counts were conducted near an established wetland in the northeast corner of the SIPRC parcel. Any species heard within the 10 minute survey time were identified by sound and recorded.

Camera-trap surveys— To assess large mammal abundance and diversity, 6 game cameras (HP2X Hyperfire 2 Professional Covert IR) were deployed within the survey area for ~2 weeks per camera intermittently between 30 January 2021 and 5 June 2021.

2.2 Plant Surveys

Plant surveys for the SIPRC study area were conducted July 15th through 18th, 2019. Since there were no known historical rare plant records for this site, surveys were conducted by looking over the entire site while focusing on areas with habitat most suitable for rare plant species. Subsequent plant surveys were conducted throughout the 2021 growing season following the same technique. The nationally recognized University of Tennessee Herbarium website was used to gain more information on rare or uncommon species found on the site.

A survey of the Shumard-chinquapin oak community was conducted at the same time as the 2019 plant survey. This plant community of concern was known to occur in the SIPRC study area. An updated boundary of these communities was flagged and mapped via a Trimble Geo 7x. Information on this community of concern was informed by NatureServe, which has created a system of plant communities which is widely used by government agencies and professionals.

2.3 Aquatic Assessment

Field-based aquatic feature inventory within the SIPRC site—Rapid wetland and stream determinations were conducted in July 2019 for the entire SIPRC Option 4 boundary. Between May and July 2021, aquatic features within and adjacent to the SIPRC footprint were assessed in more detail in order to meet ACOE/TDEC requirements. Surveys were conducted at times when plant identification was most probable.

Field-mapped seeps/springs and stream and wetland boundaries presented here represent aquatic features within the SIPRC study area that were mapped via a Trimble Geo 7x by an experienced Hydrologic Technician trained in ACOE/TDEC wetland delineation methods (ACOE 1987; TDEC 2015, 2019). All streams and channels with stream-like features that occur within the SIPRC study area were assessed via TDEC Hydrologic Determinations (TDEC 2019).

Wetland Surveys – To delineate the boundaries of jurisdictional wetlands, field surveys were conducted to evaluate the dominance of wetland vegetation, soils, and hydrological characteristics per Army Corps of Engineers (ACOE) wetland delineation protocols (ACOE 1987). The wetland vegetation criterion is met if more than 50% of the dominant species within each stratum are hydrophytic. To make this determination, plant species are assigned an indicator status as follows.

- Obligate Wetland (OBL). Occurs almost always (estimated probability >99%) under natural conditions in wetlands.
- Facultative Wetland (FACW). Usually occurs in wetlands (estimated probability 67-99%) but occasionally found in nonwetlands.
- Facultative (FAC). Equally likely to occur in wetlands or nonwetlands (estimated probability 34-66%).
- Facultative Upland (FACU). Usually occurs in nonwetlands (estimated probability 67-99%) but occasionally found in wetlands (estimated probability 1-33%).
- Obligate Upland (UPL). Occurs in wetlands in another region but occurs almost always (estimated probability >99%) under natural conditions in nonwetlands in the region specified.

For classifying an area as hydrophytic, vegetation species codes need to be classified as OBL, FACW, and FAC. Plants are identified to the nearest most likely taxon (the absence of flowering parts or other key indicators at times make positive identification difficult). Ideally plant surveys should be conducted during seasons of plant growth. Soils were evaluated by soil boring and examination of wetland soil characteristics, including soil color, texture, and the presence of mottles, manganese concretions, high organic content, and other indicators of hydric-soil status.

Suspected wetland sites were examined for primary and secondary indicators of wetland hydrology. Estimates of the percentage of surface water coverage, and the average depth of this water, were recorded. Soil saturation and depth to free water in a soil boring hole is another indicator of wetland hydrology. The presence of watermarks, drift lines, oxidized root channels, water-stained leaves, and other indicators of wetland hydrology are also noted.

Stream Surveys – Several streams are located within the SIPRC Study Area, but none are located within the proposed limit of disturbance. These streams are important tributaries to White Oak Creek. Creeks within the study area have been mapped previously and are in ORNL databases. They were therefore not remapped using a Trimble unit. Hydrologic determinations (following the TDEC protocol) were done for streams and wet weather conveyances within the SIPRC study area.

2.4 Forest Inventory

The timber inventory was conducted using point sampling methodology in a systematic grid pattern previously established during prior inventory projects. The grid is constructed to provide sample points at approximately 2.066-acre intervals (300 ft. x 300 ft. /43,560 ft per acre) using Tennessee State Plane (TSP) coordinates. At each sample point with trees, each tree or sapling greater than 2 inches dbh (diameter at breast height, 4.5 ft.) within the minimum sample distance (determined with a 10-factor basal area prism) is characterized by recording species, diameter, length of main stem to 4-inch diameter top, merchantable height (number of 16-ft logs in 0.5 log increments after the first 16-ft log), and quality of the first log. These data are used to calculate estimates of basal area, tree density, species dominance and wood volume.

A Trimble Geo7X GPS unit was used to locate/establish sample points and served as a data logger for position data and field measurements and observations. Tree data includes species, diameter at breast height (dbh), length of the highest/longest main stem branch to 4-inch diameter top, whether the tally tree is alive or dead, whether the first log of the tree is merchantable, number of merchantable logs, and quality of the first log.

2.5 Cultural Resources

This review compiled information available in ORNL Natural Resources GIS databases and aerial photography archives, and scans of archived photography taken by the Army Corps of Engineers in 1942-43 as property was being acquired for the Manhattan Project in Oak Ridge.
A survey was made on February 19, 2021 while vegetation was dormant (no excavations were made nor was a metal detector used).

3 RESULTS AND DISCUSSION

3.1 Wildlife Surveys

All vertebrate wildlife known from the SIPRC parcel (both from 2019 surveys and 2021 surveys) are included in Appendix A. Table 1 includes bat species surveyed in summer 2021. Table 2 includes all animals surveyed in spring/summer of 2021. In total, >105 vertebrate animals are known from the review area in spring/summer of 2021. This includes 10 amphibians, 54 birds, 25 mammals, 15 reptiles, and 1 fish (37 invertebrates were also identified). Of all species known from the SIPRC study area, at least 60 are afforded special legal protection under state or federal law. Among migratory birds, 3 species are assigned as common birds in steep decline, 3 designated to be in need of management action, and 2 that are on the yellow watch list (designations that are created by Partners in Flight). Additionally, 4 birds are considered by USFWS to be Birds of Conservation Concern. (all 54 bird species are afforded protection under the Migratory Bird Treaty Act (16 U.S.C. §§703-711)). Two species are considered In Need of Management by the State of Tennessee, two are state-listed Threatened and one other is listed as Federally Endangered. Of these, two are species that are currently under review for federal listing.

Species accumulation curves for survey results show a deficiency in detection of wildlife (Figure 2). At their simplest, species accumulation curves represent the cumulative number of species observed according to survey effort. When all species (not individuals) have been detected within an area, the curves become saturated. This saturation is indicated by horizontal "flatness" or an asymptote in the number of species observed, as no new species are detected regardless of additional survey effort. Species that are not detected typically represent rarer species, which tend to also be those that are listed or protected under state and federal law. When considering all vertebrate wildlife and migratory birds separately, neither reached saturation during summer 2019/2021 surveys of the SIPRC study area (Figure 2).

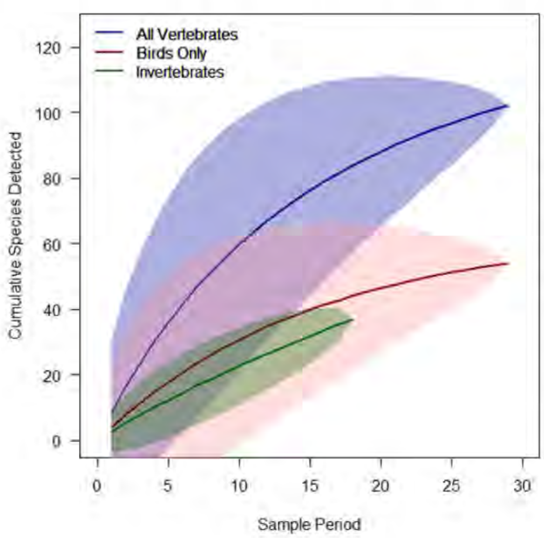

Figure 2. Species accumulation curves for wildlife surveys conducted on the SIPRC parcel. Lines represent the cumulative number of different species detected through time. A lack of "flattening" in the curves indicates that there likely remain undetected rare species on the SIPRC parcel. Lines represent cumulative richness, and shaded regions represent the interquartile range of simulated values for all vertebrates (blue), birds only (red), and invertebrates (green).

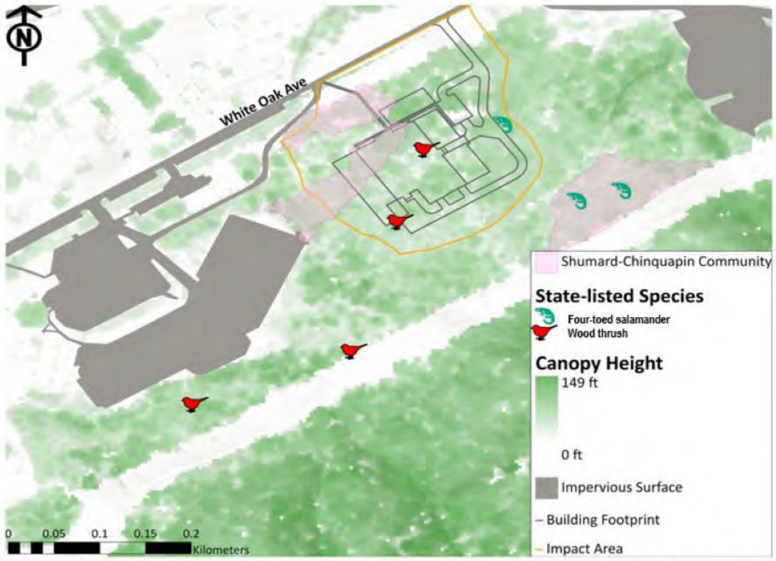

Figure 3. A map depicting the location of State Listed Species within the SIPRC study area (bat species shown separately in Figure 5), and boundaries of 3 Shumard-Chinquapin Oak Communities of conservation concern

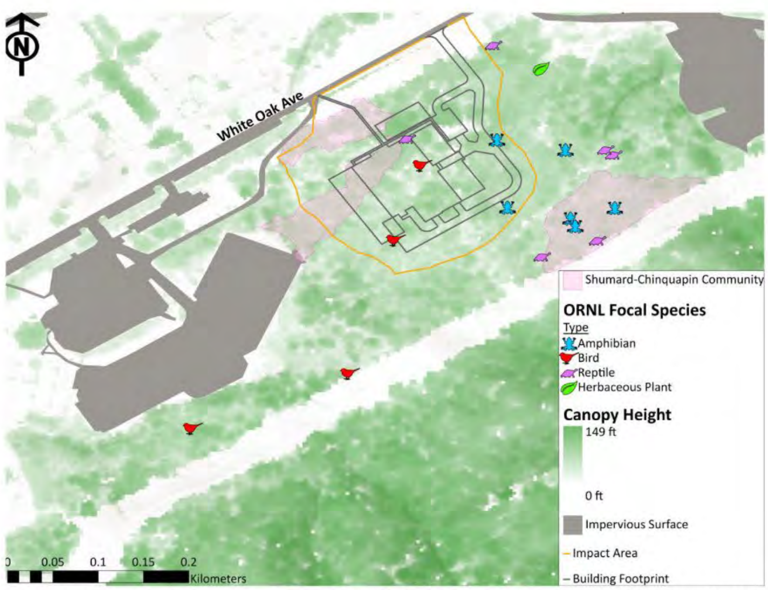

Figure 4. A map depicting the location of ORNL focal species found in the SIPRC study area, and boundary of 3 Shumard-Chinquapin Oak Communities of conservation concern

Bat acoustic surveys (104 survey nights)— Visual surveys of the SIPRC study area found trees with peeling bark and dead snags with peeling bark or crevices to serve as suitable roosting habitat for forest dwelling bat species, and foraging habitat was found throughout the study area. Results from all detectors are included in Table 1. Locations of acoustic monitors are shown in Figure 5. In total, 12 native bat species were detected in spring/summer of 2021. Of these, detection frequencies provide strong evidence for ten species, including Federally Endangered Gray Bat (*Myotis grisescens*), State Threatened Little Brown Bat (*Myotis lucifugus*), and State Threatened Tricolored Bat (*Perimyotis subflavus*). The latter two species are currently under petition for federal listing. Evidence is weak that Federally Endangered Indiana Bat (*Myotis sodalis*) and Federally Threatened Northern Long-eared Bat (*Myotis septentrionalis*) would roost within the SIPRC project area, though a small number of calls were recorded.

Table 1. Results from acoustic bat detectors during summer roosting/maternity season. Number of call detections are included for each detector. A low number of detections, within and between monitors, is considered poor evidence of presence. Shaded rows represent status species. Darker shading indicates greater confidence based on number of calls, suitable habitat, and nearby location records. (FE – Federally Endangered; FT – Federally Threatened; FP – Federal listing petition currently under review; SE – State endangered; ST – State Threatened). *Unit 7 malfunctioned and didn't collect a complete set of data.

Species	**Species Code**	**Bat Detector**										**Considered Present**	**Status**
		Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7***	**Unit 8**	**Unit 9**	**Unit 10**		
Eptesicus fuscus	EPFU	3	7	1	3	5	1	1	1	2	5	Yes	
Lasiurus borealis	LABO	78	326	16	62	53	102	0	3	14	37	Yes	
Lasiurus cinereus	LACI	35	164	6	84	10	139	0	2	12	0	Yes	
Lasionycteris noctivagans	LANO	145	346	17	36	78	49	0	4	3	1	Yes	
Lasiurus seminolus	LASE	17	310	6	7	20	19	0	9	17	9	Yes	
Myotis grisescens	MYGR	11	105	5	10	20	41	0	2	4	1	Yes	FE, SE
Myotis lucifugus	MYLU	24	28	12	36	70	28	1	7	4	4	Yes	FP, ST
Myotis septentrionalis	MYSE	0	0	0	1	0	0	0	0	0	0	Unlikely	FT, ST
Myotis sodalis	MYSO	0	0	0	2	3	3	0	0	0	2	Possible	FE, SE
Nycticeius humeralis	NYHU	3	19	1	1	4	21	0	2	3	11	Yes	
Perimyotis subflavus	PESU	6	7	2	5	4	13	0	21	4	5	Yes	FP, ST
Tadarida brasiliensis	TABR	25	276	9	5	27	24	4	8	6	15	yes	

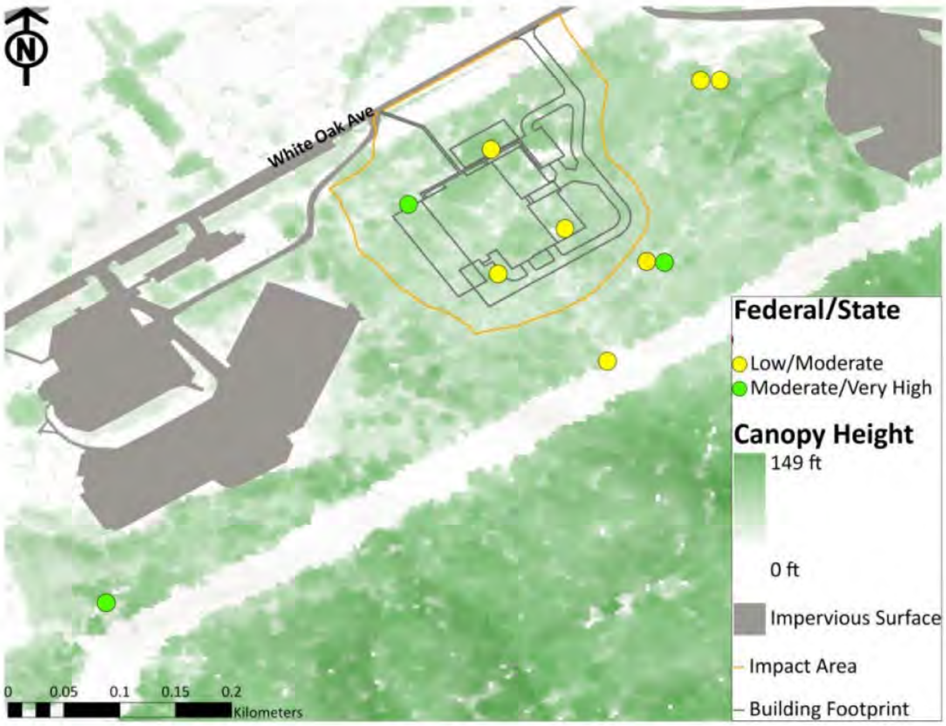

Figure 5. A map depicting the location of bat monitoring sites. Different colors represent the number of federal and state listed bats respectively (Low = 1 species, Moderate = 2 species, High = 3 species, Very High = 4 species).

Bird point counts (~20 person-hours). — Migratory birds also represent a major management focus for ORNL and DOE. For example, Carter (2020) provides details related to DOE's responsibilities specific to the ORR, and the 2013 memorandum of understanding between USFWS and DOE can be found at https://www.energy.gov/sites/prod/files/2013/10/f3/Final%20DOE-FWS%20Migratory%20Bird%20MOU.pdf.

In total, 54 bird species were identified during the spring/summer of 2021. All of the 54 species identified are protected under the Migratory Bird Treaty Act. Of the 54 species, 3 species are assigned as common birds in steep decline, 4 designated to be in need of management action, and 2 that are on the yellow watch list; designations are created by Partners in Flight. Additionally, 4 species are considered by USFWS to be birds of management concern, and 4 species are deemed by USFWS to be Birds of Conservation Concern. The wood thrush (*Hylocichla mustelina*), a species identified within the survey area, is one of ORNL's focal species. The Wood thrush is also state listed In Need of Management, in addition to being on the yellow watch list and a bird of conservation concern (Table 2).

Small mammal trapping (427 total trap-nights). — No status small mammal species were detected during spring/summer of 2021. Common species observed included deer mice (*Peromyscus* spp), eastern chipmunk (*Tamias striatus*), eastern harvest mouse (*Reithrodontomys humulis*), and woodland vole (*Microtus pinetorum*) (Figure 6). Historical data from ORNL and TDEC indicate the presence of southern bog lemmings (*Synaptomys cooperi*) near the vicinity of the SIPRC project area. This species is listed as 'In Need of Management' by both TWRA and TDEC. Its current presence is possible but unconfirmed.

Figure 6. Small mammals observed during small mammal trapping. Deer mice (*Peromyscus spp.*), top right and bottom left; and woodland vole (*Microtus pinetorum*), upper left and another woodland vole, shown lower right with a white spot on its head; no other specimens displayed this unique coloration.

Visual encounter surveys/coverboard arrays (~25 person hours). — Eighty-seven species were observed during VES, some of these are pictured in Figure 7. Notably, a nesting American woodcock *(Scolopax minor)* and young were observed on multiple occasions during the spring of 2021. This secretive species is often associated with wooded wetlands (McAuley et al 2020). Gravid females and nests of state-listed four-toed salamanders *(Hemidactylium scutatum)* were located in the southeastern quadrant of the parcel near springs and wetlands. Multiple red salamanders *(Pseudotriton ruber)* were observed, including larvae. This species is uncommon outside of the Great Smoky Mountains National Park (TWRA 2005). Red salamanders are found in seeps and spring-fed streams and are indicative of higher water quality. Although we were unable to find northern pinesnakes *(Pituophis melanoleucus*) or eastern slender glass lizards *(Ophisaurus attenuatus longicaudus)* during our survey, it should be noted that suitable habitat for these cryptic, state-listed species is present within the SIPRC parcel.

Funnel trap survey (small vertbrates) (85 trap-nights) — Species captured during the survey include 4 reptiles: eastern ratsnake (*Pantherophis alleghениensis*), corn snake (*Pantherophis guttatus*), five-lined skink (*Plestiodon fasciatus*), and eastern black kingsnake (*Lampropeltis nigra*); 3 amphibians: upland chorus frog (*Pseudacris feriarum*), northern two-lined salamander (*Eurycea bislineata*), and red salamander (*Pseudotriton ruber*); 4 mammals: eastern chipmunk (*Tamias striatus*), deer mice *(Peromyscus* sp.), cinereus shrew (*Sorex cinereus*), and norhern short-tailed shrew (*Blarina brevicauda*) as well as 20 species of identified common invertebrates (Figure 7).

Figure 7. Examples of species captured during VES/funnel trapping (Common snapping turtle (*Cheldrya serpentina*), Black nose dace (*Rhinichthys atratulus*), American woodcock (*Scolopax minor*), Five-lined skink (*Plestiodon fasciatus),* Northern two-lined salamander (*Eurycea bislineata*), Eastern box turtle (*Terrapene carolina*), Corn snake (*Pantherophis guttatus*), Eastern black kingsnake (*Lampropeltis nigra*), and Northern short-tailed shrew (*Blarina brevicauda*).

Nocturnal Species Survey (~2 person hours). — Anuran species identified during nighttime surveys were Cope's gray treefrog (*Hyla chrysoscelis*) and spring peeper (*Pseudacris crucifer*).

Camera-trap surveys. (154 survey days/nights)— Mammals identified via game cameras were bobcat (*Lynx rufus*), white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), and various *Peromyscus* (mouse) species. Birds identified were tufted titmouse (*Baeolophus bicolor*), Swainson's thrush (*Catharus ustulatus*), common grackle (*Quiscalus quiscula*), and wild turkey (*Meleagris gallopavo*). Pictures from game cameras shown in Figure 8.

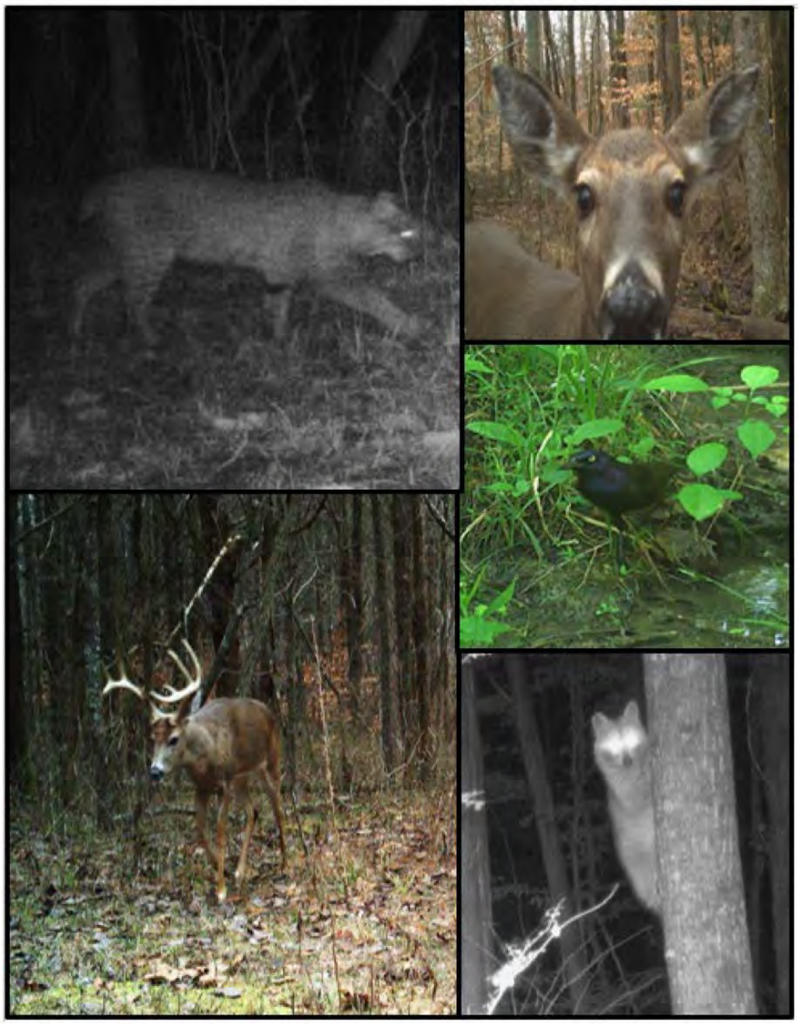

Figure 8. Animals documented on game cameras within the SIPRC project area.

Additional Observations

Table 2. Wildlife species present within the SIPRC study area. Status codes: SR – considered rare or regionally important by Tennessee Department of Environment and Conservation; SN – State listed In Need of Management; ST – State Threatened; SE – State Endangered; FT – Federally Threatened; FE – Federally Endangered; FP – federal listing petition currently under review; MBTA – protected under the Migratory Bird Treaty Act; FWS MC – considered by USFWS as a Focal Species and/or Species of Management Concern; BCC – considered by USFWS as bird of conservation concern; CBSD – Partners in Flight designated as a common bird in steep decline; MA – Partners In Flight species in need of management action; YV - Partners in Flight designated on the Yellow watch list (R – Red watch list)

Common name	Scientific name	Status	Notes
	Birds		
Wild Turkey	*Meleagris gallopavo*	MBTA	
Yellow-billed Cuckoo	*Coccyzus americanus*	MBTA +BCC + CBSD	
Chuck-will's-widow†	*Antrostomus carolinensis*	MBTA + BCC + CBSD	
Ruby-throated Hummingbird	*Archilochus colubris*	MBTA	
American Woodcock	*Scolopax minor*	MBTA + MA	
Black Vulture	*Coragyps atratus*	MBTA	
Red-shouldered Hawk	*Buteo lineatus*	MBTA	
Red-tailed Hawk	*Buteo jamaicensis*	MBTA	
Barred Owl	*Strix varia*	MBTA	
Red-bellied Woodpecker	*Melanerpes carolinus*	MBTA	
Downy Woodpecker	*Dryobates pubescens*	MBTA	
Pileated Woodpecker	*Dryocopus pileatus*	MBTA	
Eastern Phoebe	*Sayornis phoebe*	MBTA	
Eastern Wood-Pewee	*Contopus virens*	MBTA + MA	
Acadian Flycatcher	*Empidonax virescens*	MBTA	
White-eyed Vireo	*Vireo griseus*	MBTA	
Red-eyed Vireo	*Vireo olivaceus*	MBTA	
Blue Jay	*Cyanocitta cristata*	MBTA	
American Crow	*Corvus brachyrhynchos*	MBTA	
Carolina Chickadee	*Poecile carolinensis*	MBTA	
Tufted Titmouse	*Baeolophus bicolor*	MBTA	
Tree Swallow	*Tachycineta bicolor*	MBTA	
White-breasted Nuthatch	*Sitta carolinensis*	MBTA	
Blue-gray Gnatcatcher	*Polioptila caerulea*	MBTA	
Carolina Wren	*Thryothorus ludovicinus*	MBTA	
Gray Catbird	*Dumetella carolinensis*	MBTA	
Eastern Bluebird	*Sialia sialisis*	MBTA	
Swainson's Thrush	*Catharus ustulatus*	MBTA	
Hermit Thrush	*Catharus guttatus*	MBTA	

Wood Thrush	*Hylocichla mustelina*	MBTA + BCC + SN + Y	ORNL Focal Species
American Robin	*Turdus migratorius*	MBTA	
Cedar Waxwing	*Bombycilla cedrorum*	MBTA	
House Finch	*Haemorhous mexicans*	MBTA	
American Goldfinch	*Spinus tristis*	MBTA	
White-crowned Sparrow	*Zonotrichia leucophry*	MBTA	
Eastern Towhee	*Pipilo erythrophthalms*	MBTA + MA	
Yellow-breasted Chat	*Icteria virens*	MBTA + MA	
Orchard Oriole	*Icterus spurius*	MBTA	
Red-winged Blackbird	*Agelaius phoeniceus*	MBTA	
Brown-headed Cowbird	*Molothrus ater*	MBTA	
Common Grackle	*Quiscalus quiscula*	MBTA + CBSD	
Louisiana Waterthrush	*Parkesia motacilla*	MBTA	
Kentucky Warbler	*Geothlypis formosa*	MBTA + BCC + Y	
Common Yellowthroat	*Geothlypis trichas*	MBTA	
Hooded Warbler	*Setophaga citrina*	MBTA	
Northern Parula	*Setophaga americana*	MBTA	
Yellow Warbler	*Setophaga petechia*	MBTA	
Chestnut-sided Warbler	*Setophaga pensylvania)*	MBTA	
Pine Warbler	*Setophaga pinus*	MBTA	
Yellow-throated Warbler	*Setophaga dominica*	MBTA	
Scarlet Tanager	*Piranga olivacea*	MBTA	
Northern Cardinal	*Cardinalis cardinalis*	MBTA	
Blue Grosbeak	*Passerina caerulea*	MBTA	
Indigo Bunting	*Passerina cyanea*	MBTA	
Mammals			
Gray bat	*Myotis grisescens*	SE + FE	
Little brown bat	*Myotis lucifugus*	ST	
Northern long-eared bat	*Myotis septentrionalis*	ST + FT	
Indiana bat	*Myotis sodalis*	SE + FE	
Tricolored bat	*Perimyotis subflavus*	FP + ST	
Southern bog lemming[§]	*Synaptomys cooperi*	SN[§]	
Eastern Chipmunk	*Tamias striatus*		
Eastern harvest mouse	*Reithrodontomys humulis*		
Deer mouse	*Peromyscus spp.*		
Woodland vole	*Microtus pinetorum*		
Cinereus Shrew	*Sorex cinereus*		
Northern short-tailed shrew	*Blarina brevicauda*		
Eastern gray squirrel	*Sciurus carolinensis*		
Eastern Cottontail Rabbit	*Sylvilagus floridanus*		
Raccoon	*Procyon lotor*		
Bobcat	*Lynx rufus*		
Coyote	*Canis latrans*		
White-tailed deer	*Odocoileus virginianus*		

	Amphibians		
Four-toed salamander	*Hemidactylium scutatum*	SN	ORNL Focal Species
Southern two-lined salamander	*Eurycea bislineata*		
Spotted Salamander	*Ambystoma maculatum*		
Red salamander	*Pseudotriton ruber*		
Northern Slimy Salamander	*Plethodon glutinosus*		
Northern Dusky Salamander	*Desmognathus fuscus*		
Upland chorus frog	*Pseudacris feriarum*		
Gray treefrog	*Hyla versicolor*		
Cope's Gray Treefrog	*Hyla chrysoscelis*		
Green frog	*Lithobates clamitans*		
Spring peeper	*Pseudacris crucifer*		
	Reptiles		
Smooth earth snake	*Virginia valeriae*		
Eastern wormsnake	*Carphophis amoenus*		
Eastern racer snake	*Coluber constrictor*		
Northern watersnake	*Nerodia sipedon*		
Black kingsnake	*Lampropeltis nigra*		
Eastern ratsnake	*Pantherophis*		
Little brown skink	*Scincella lateralis*		
Common five-lined skink	*Plestiodon fasciatus*		
Broadhead skink	*Plestiodon laticeps*		
Common snapping turtle	*Cheyldra serpentina*		
Eastern box turtle	*Terrapene carolina*		

† Record based on few acoustic monitor detections, but presence is assumed given habitat and nearby records.

§ Record predates ORNL Natural Resources Management Program. Additional targeted surveys are needed.

3.2 Plant Surveys

Plant Surveys – There are no records of plant species in this area that are on the state or federal protection lists (unpublished ORNL natural areas document). There is a population of blueflag iris *(Iris virginica)*, an ORNL focal species, located outside the current limit of disturbance. Though not on state or federal protection lists, it is uncommon in East Tennessee. According to UT herbarium records, there are only records from four counties in East Tennessee. Examples of plants and fungus found at SIPRC are shown in Figure 9.

Rare Plant Communities –The SIPRC Study Area contains sites dominated by chinkapin oak (*Quercus muehlenbergii*) and Shumard Oak (*Quercus shumardii*). Three areas within the SIPRC Study Area have been identified as chinkapin-Shumard oak communities of concern. Two of these areas preside mainly in the current limit of disturbance. Dry sites with shallow soils over limestone dominated by oak trees (found chiefly on limestone) are uncommon plant communities. NatureServe has named two communities (Associations) with chinkapin oak and Shumard oak as dominants. Both are considered to be rare and deserving protection. These were defined and reported from areas other than the Ridge and Valley of Tennessee where the ORR lies. Further study may determine that the community on the survey site should be one of the two communities described by NatureServe or possibly an undescribed community. In any case, the community on the site is of conservation concern.

Figure 9. Examples of plants and fungus found at SIPRC Study Area. Clockwise from top left: Blueflag iris (*Iris virginica*), an ORNL focal species; resurrection fern (*Pleopeltis polypodioides);* Hoary Puccoon *(Lithospermum canescens);* dew drops on native blueberry species (*Vaccinium sp.*), and Deadman's fingers fungus (*Xylaria polymorpha)*.

3.3 Aquatic Assessment

Wetlands Surveys – Three wetlands were delineated within the larger SIPRC study area in 2019 and were reconfirmed in July 2021. Wetland delineation forms for each wetland are located in Appendix B of this report. These wetlands are labeled A, B and C (Figure 10). Of these three, the only wetland that occurs within the current disturbance limits is Wetland A. The other two wetlands, Wetland B and Wetland C, are both located within 100 feet of the proposed area of disturbance. Although the current design will only directly impact Wetland A, both Wetland B and C will be indirectly impacted due to changes in hydrology from construction. Acreage for each wetland is as follows:

Wetland A (Figure 11) is a 0.123 acre wetland located along the tree line on the north side of SIPRC. It is the only jurisdictional wetland that falls within the area of disturbance, in the location of the entrance road. Hydrology characteristics come from a seasonally high water table, flow from adjacent stream and low topography. The wetland contains both palustrine emergent and palustrine forested wetland communities as categorized by Cowardin wetland classification system. The emergent plant community occurs in the periodically mown right-of-way adjacent to White Oak Avenue. Dominant species within the mown sections are various wetland carex and grass species. As the soil becomes more saturated, species such as jewelweed, false-nettle, fox sedge, leafy bulrush and cattails grow within the wettest portion of the emergent wetland. The forested wetland portion contains species such as green ash, willow, and privet. The wetland nearly abuts the tributary, contributing to the wet hydrology. A small drainage from the creek to an inundated portion of the forested wetland flows most of the year.

Wetland B (Figure 12) is a 0.171 acre wetland just to the east of Wetland A. It lies within the riparian area of the two tributary streams that split at White Oak Avenue near the 6556 access road. Hydrology is due to topography and proximity to the two streams. Wetland B contains palustrine emergent and palustrine forested communities. Unlike Wetland A, the emergent vegetation is not mown and is predominantly cattails, with some other wetland species including monkeyflower and wetland sedges. The forested community is predominantly made up of black willow and green ash.

Wetland C (Figure 12) is 0.032 acre wetland located just outside the southeast corner of the area of disturbance. This wetland contains predominantly emergent vegetation and saplings and is located within a dirt woods trail surrounded by forest. There are multiple pools of standing water along this dirt trail, but Wetland C is the only inundated area that contains hydrophytic vegetation such as green ash seedlings and bearded beggartick. A spring to the west of the wetland feeds a wet weather conveyance that flows through this wetland and toward the eastern stream. Water flowed throughout the duration of the 2021 survey period. Although all wetlands provided amphibian breeding habitat, Wetland C was the only wetland containing a state listed species. This is discussed further in the Conclusions section.

Figure 10 does not show wetland locations depicted in the '99 wetlands GIS database, which is a commonly used map layer for ORNL projects. Historical boundaries were reevaluated in 2019 and found to no longer have the characteristics necessary to be considered wetlands. This is likely due to shifts in hydrology over time. None of the historical wetland boundaries fell within the area of disturbance.

Streams Surveys – Streams shown in Figure 10 are known streams on the ORNL Campus. These streams meet the TDEC Hydrologic Determination stream indicator requirements. In addition to the streams shown on the map, numerous wet weather conveyances were found within the study area. Although no fish surveys were conducted, a Black nose dace (*Rhinichthys atratulus*) was documented.

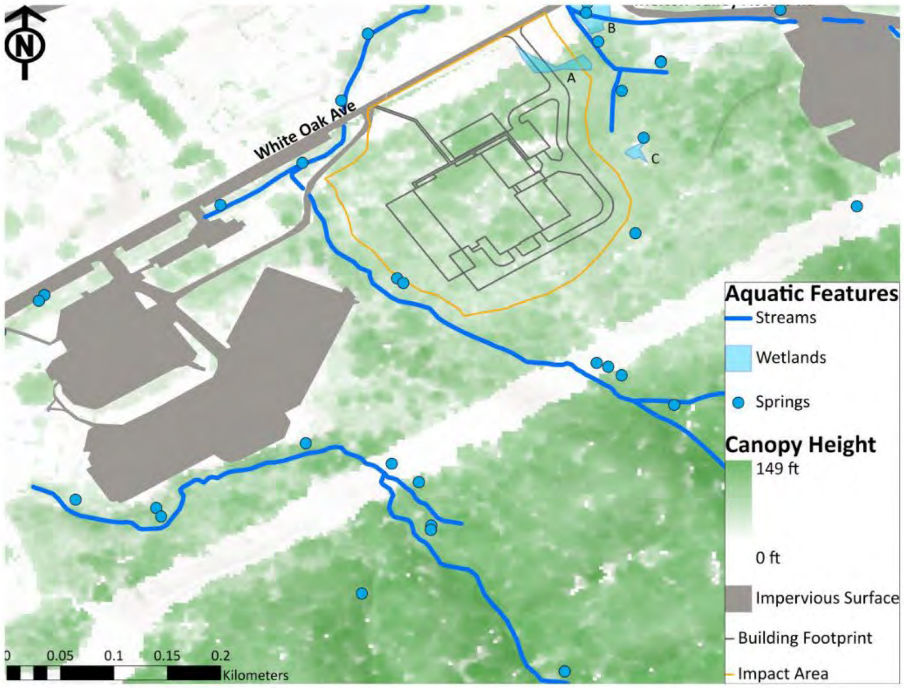

Figure 10. A map depicting the location of aquatic resources found within the SIPRC study area.

Figure 11. Pictures of Wetland A showing palustrine forested (top) and palustrine emergent (bottom).

Figure 12. Wetland B (top) and Wetland C (bottom), both located outside of the immediate SIPRC footprint

Additional Observations

The SIPRC study area is laced with streams, wet weather conveyances, ditches, and low-lying areas. Although not all of these qualify as aquatic resources requiring permitting and mitigation, they are extremely important to the hydrology of the area. Alterations will not only impact aquatic resources, but the wildlife and plant species located within and near wetlands and streams as well.

The area is prone to flooding, receiving large amounts of runoff from the ridge and gas line. In addition, the karst geology allows for fluctuating water levels that create temporary pools of water essential for many amphibian species. Figure 13 shows flooding event on May 4, 2021, after a large rainfall.

Figure 13. Pictures showing flooding of SIPRC. All pictures were taken within the area of disturbance, but flooding occurs throughout much of the SIPRC study area.

3.4 Forest Inventory

Forests are dynamic systems, constantly responding to changing conditions imposed by natural and anthropogenic forces. A snapshot of the current condition of the SIPRC area forest was determined from a forest inventory undertaken in June 2021. Fieldwork for the inventory was conducted between June 15, 2021 and June 28, 2021. Inventory data points within the SIPRC footprint were visited to prepare the following analysis (Figure 14).

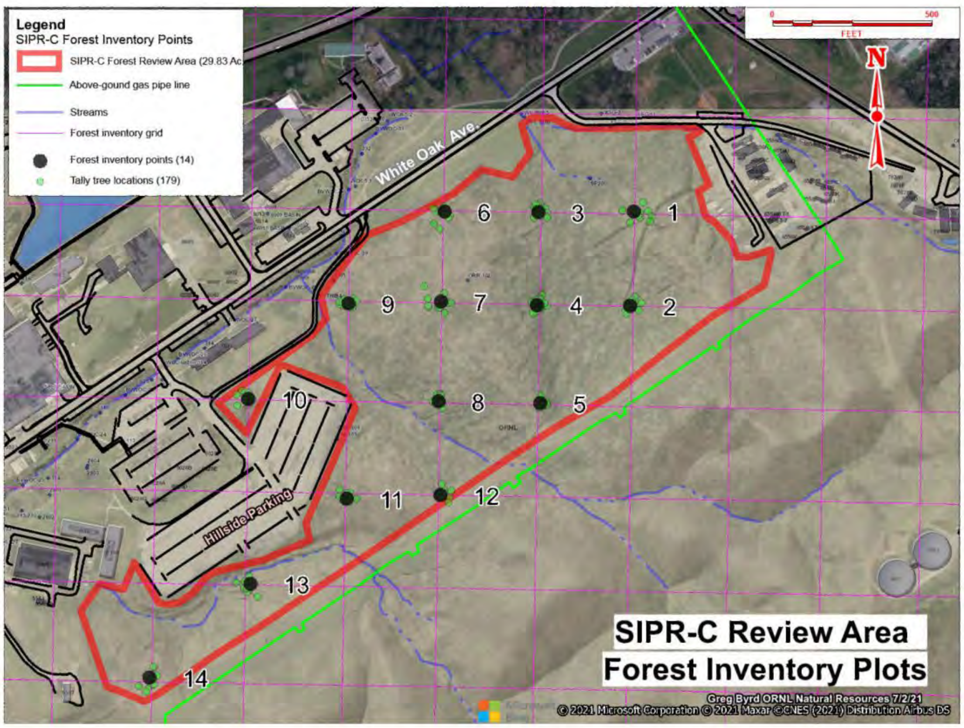

Figure 14. SIPRC Forest Inventory Points.

Land use — For the purposes of this report, the land use of the SIPRC area is considered to be entirely forestland, although with varying stages of succession (stand age). The SIPRC review area was designed to avoid inclusion of developed areas including parking lots, utilities and maintained rights-of-way. Therefore, the forested area is considered 100% of the 29.83-acre site.

Basal Area — Total basal area of the SIPRC forest is 3,814 sq. ft. Standing dead trees accounted for approximately 9.5% of the total basal area. Approximately 50% of all standing dead trees appear to be eastern redcedar overtopped and deprived of sunlight by more vigorous hardwood competition. The average live basal area of forest is 115.7 sq. ft. per acre.

A list of species and live tree basal area statistics are provided in Table *3.* Live Basal Area by Species. Twenty-six species were identified among live trees; Fraxinus (ash) was identified to genus, though no still living specimens were inventoried. Trees with a diameter at breast height (dbh, 4.5 feet) ≥ 10.0 inches account for 52.5% of the total basal area. Among trees ≥ 10.0 inches dbh, 5 species contribute > 5% of forest basal area, including eastern redcedar (36.47 %) tulip poplar (17.65%), red maple (9.41%), shortleaf pine (7.06%), and Shumard oak (5.88%). Among sapling-size trees (2.0 ≤ dbh ≤ 10.0 inches), species ranking based on basal area representing > 5% includes 5 species: eastern redcedar (35.06%), redbud (10.39%), red maple (9.09), sugar maple (7.79%), and yellow poplar (5.19%).

At the genus level, redcedar and tulip poplar remain dominant among trees ≥ 10" dbh, oaks combined account for 12.94% of the live basal area of trees ≥ 10.0 inches dbh (Table 4) but provide only 6.49% of the sapling size class basal area. White oaks (includes white, post, and chinquapin oaks) provide 5.88% of the live basal area of trees ≥ 10.0 inches dbh and represent 6.49% of the sapling size class basal area. Red oaks (includes southern red, black, and Shumard oaks) provide 7.06% of the live basal area of trees ≥ 10.0 inches dbh, but only represent 3.90% of the sapling size class basal area. Pines account for 11.76% of the live basal area of trees ≥ 10.0 inches dbh and 3.90% of live basal area of trees < 10 inches dbh. Maples account for 9.41% of the live basal area of trees ≥ 10.0 inches dbh and 16.88% of live basal area of trees < 10 inches dbh.

Table 3. Live Basal Area by Species

		Basal Area (ft^2)			
Scientific Name	Common Name	Trees (dbh > 10 in.)	Saplings (2 > dbh < 10 in.)	All tally trees (dbh > 2 in.)	Merchantable
Juniperus virginiana	red cedar	660.5	575.3	1235.8	617.9
Liriodendron tulipifera	tulip poplar	319.6	21.3	340.9	234.4
Acer rubrum	red maple	170.5	149.2	319.6	149.2
Pinus echinata	short-leaf pine	127.8	0.0	127.8	127.8
Quercus shumardii	Shumard oak	106.5	0.0	106.5	85.2
Pinus virginiana	Virginia pine	85.2	63.9	149.2	85.2
Oxydendron arboreum	sourwood	42.6	63.9	106.5	0.0
Prunus serotina	black cherry	42.6	21.3	63.9	0.0
Quercus alba	white oak	42.6	21.3	63.9	42.6
Quercus stellata	post oak	42.6	0.0	42.6	42.6
Ulmus rubra	slippery elm	42.6	21.3	63.9	21.3
Carya cordiformis	bitternut hickory	21.3	0.0	21.3	21.3
Carya glabra	pignut hickory	21.3	0.0	21.3	21.3
Cercis canadensis	redbud	21.3	170.5	191.8	0.0
Quercus muehlenbergii	chinquapin oak	21.3	21.3	42.6	0.0
Quercus velutina	black oak	21.3	21.3	42.6	21.3
Ulmus alata	winged elm	21.3	21.3	42.6	21.3
Acer saccharum	sugar maple	0.0	127.8	127.8	0.0
Carya tomentosa	mockernut hickory	0.0	21.3	21.3	0.0
Cornus florida	flowering dogwood	0.0	63.9	63.9	0.0
Diospyros virginiana	persimmon	0.0	42.6	42.6	0.0
Fagus grandifolia	American beech	0.0	42.6	42.6	0.0
Juglans nigra	black walnut	0.0	21.3	21.3	0.0
Liquidambar styraciflua	sweetgum	0.0	85.2	85.2	0.0
Quercus falcata	southern red oak	0.0	42.6	42.6	0.0
Robinia pseudoacacia	black locust	0.0	21.3	21.3	0.0
	Totals	1811.11	1640.62	3451.73	1491.51

Table 4 Basal Area by Genus

		Basal Area (ft^2)			
Genus	Common Name	Trees (dbh > 10 in.)	Saplings (2 > dbh < 10 in.)	All tally trees (dbh > 2.0 in.)	Merchantable
Juniperus	red cedar	660.5	575.3	1235.8	617.9
Liriodendron	tulip poplar	319.6	21.3	340.9	234.4
Quercus	oak	234.4	106.5	340.9	191.8
	white oak	106.5	42.6	149.1	85.2
	red oak	127.9	63.9	191.8	106.5
Pinus	pine	213.1	63.9	277.0	213.1
Acer	maple	170.5	277.0	447.5	149.2
Ulmus	elm	63.9	42.6	106.5	42.6
Carya	hickory	42.6	21.3	63.9	42.6
Oxydendrum	sourwood	42.6	63.9	106.5	0.0
Prunus	cherry	42.6	21.3	63.9	0.0
Cercis	redbud	21.3	170.5	191.8	0.0
Cornus	dogwood	0.0	63.9	63.9	0.0
Diospyros	persimmon	0.0	42.6	42.6	0.0
Fagus	beech	0.0	42.6	42.6	0.0
Juglans	walnut	0.0	21.3	21.3	0.0
Liquidambar	sweetgum	0.0	85.2	85.2	0.0
Robinia	locust	0.0	21.3	21.3	0.0
	Totals	1811.1	1640.6	3451.7	1491.5

Tree Number and Density — Number of trees and saplings in the SIPRC forest totals 13,807 averaging 463 stems per acre of trees > 2.0 inches dbh (Table 5). There are 58.2 trees >9.9 inches dbh per acre on average across all forested sample points in the area, totaling 1,736 trees. There is an average of 404 sapling trees (< 10.0 inches dbh) per acre in this forest, totaling 12,071 saplings. For trees ≥ 10.0 inches dbh, eastern redcedar (26.7) provides the greatest average number of stems per acre, followed by, tulip poplar (8.3), red maple (4.6), shortleaf pine (2.7), and Virginia pine (2.7). Among sapling-size trees, species ranking for average number of stems per acre include eastern redcedar (73.6), redbud (64.4), sugar maple (49.5), red maple (48.9), sweetgum (27.0), and sourwood (25.1).

Volume of Merchantable Timber — Volume of merchantable timber in the SIPRC forest totals 155,771 board feet (bf, International ¼" rule), averaging 5,222 bf per acre (Table 6). Eastern redcedar (55,894 bf), and tulip poplar (33,436 bf) collectively contribute 57% of the merchantable timber in this area. Species rank for number of merchantable stems (Table 5) includes, eastern redcedar (734), tulip poplar (130), red maple (111), shortleaf pine (82) and Virginia pine (81).

Table 5. Species Rank by Number of Stems

		Total Trees				Average Trees per Acre			
Scientific Name	Common Name	Trees (dbh > 10.0 inches)	Saplings (2 > dbh < 10.0 inches)	All tally trees (dbh > 2.0 inches)	Merchantable Trees	Trees dbh > 10.0 inches	Saplings 2 > dbh < 10.0 inches	All tally trees (dbh > 2.0 inches)	Merchantible Trees
Juniperus virginiana	red cedar	795	2197	2992	734	26.7	73.6	100.3	24.6
Liriodendron tulipifera	tulip poplar	248	125	372	130	8.3	4.2	12.5	4.4
Acer rubrum	red maple	138	1459	1597	111	4.6	48.9	53.5	3.7
Pinus echinata	short-leaf pine	82	0	82	82	2.7	0.0	2.7	2.7
Pinus virginiana	Virginia pine	81	387	468	81	2.7	13.0	15.7	2.7
Oxydendrum arboreum	sourwood	62	748	810	0	2.1	25.1	27.2	0.0
Quercus shumardii	Shumard oak	53	0	53	38	1.8	0.0	1.8	1.3
Ulmus rubra	slippery elm	50	359	409	18	1.7	12.0	13.7	0.6
Prunus serotina	black cherry	48	80	128	0	1.6	2.7	4.3	0.0
Cercis canadensis	redbud	33	1921	1954	0	1.1	64.4	65.5	0.0
Carya cordiformis	bitternut hickory	32	0	32	32	1.1	0.0	1.1	1.1
Carya glabra	pignut hickory	26	0	26	26	0.9	0.0	0.9	0.9
Ulmus alata	winged elm	26	244	270	26	0.9	8.2	9.1	0.9
Quercus stellata	post oak	21	0	21	21	0.7	0.0	0.7	0.7
Quercus alba	white oak	18	185	202	18	0.6	6.2	6.8	0.6
Quercus velutina	black oak	17	232	250	17	0.6	7.8	8.4	0.6
Quercus muehlenbergii	chinquapin oak	5	43	49	0	0.2	1.5	1.6	0.0
Acer saccharum	sugar maple	0	1477	1477	0	0.0	49.5	49.5	0.0
Carya tomentosa	mockernut hickory	0	68	68	0	0.0	2.3	2.3	0.0
Cornus florida	flowering dogwood	0	838	838	0	0.0	28.1	28.1	0.0
Diospyros virginiana	persimmon	0	160	160	0	0.0	5.4	5.4	0.0
Fagus grandifolia	American beech	0	214	214	0	0.0	7.2	7.2	0.0
Juglans nigra	black walnut	0	80	80	0	0.0	2.7	2.7	0.0
Liquidambar styraciflua	sweetgum	0	804	804	0	0.0	27.0	27.0	0.0
Quercus falcata	southern red oak	0	258	258	0	0.0	8.6	8.6	0.0
Robinia pseudoacacia	black locust	0	193	193	0	0.0	6.5	6.5	0.0
	Totals	1736	12071	13807	1335	58.2	404.6	462.8	44.7

Table 6. Volume of Timber in boardfeet(bf)

		Volume (bf)	
Scientific Name	Common Name	Compartment Total	Average per Acre
Juniperus virginiana	red cedar	55,894	1,874
Liriodendron tulipifera	tulip poplar	33,436	1,121
Pinus echinata	short-leaf pine	20,076	673
Acer rubrum	red maple	10,846	364
Quercus shumardii	Shumard oak	9,751	327
Pinus virginiana	Virginia pine	8,887	298
Quercus alba	white oak	5,224	175
Quercus stellata	post oak	3,969	133
Quercus velutina	black oak	2,654	89
Carya glabra	pignut hickory	1,530	51
Carya cordiformis	bitternut hickory	1,484	50
Ulmus rubra	slippery elm	1,030	35
Ulmus alata	winged elm	989	33
	Totals	155,770	5,222

Large Diameter Trees —Table 7 provides a list of the largest diameter trees of selected species. The tally tree with greatest dbh in the area is a 30.0-inch Shumard oak. Few trees with dbh ≥ 30 inches would be expected given the relatively small tract size and its previous use as grazing land rather than forest or woodlot. Those likely to occur would appear along abandoned fence lines which were not intercepted during the inventory.

Table 7. Largest Diameter of Each Species

Scientific Name	Common Name	dbh of largest tally tree (inches)	Number of tally trees with dbh ≥ 30.0 inches
Acer rubrum	red maple	21.8	
Acer saccharum	sugar maple	9.6	
Carya cordiformis	bitternut hickory	11.1	
Carya glabra	pignut hickory	12.2	
Carya tomentosa	mockernut hickory	7.6	
Cercis canadensis	redbud	10.9	
Cornus florida	flowering dogwood	5.5	
Diospyros virginiana	persimmon	9.0	
Fagus grandifolia	American beech	7.0	
Juglans nigra	black walnut	7.0	
Juniperus virginiana	red cedar	18.5	
Liquidambar styraciflua	sweetgum	5.3	
Liriodendron tulipifera	tulip poplar	26.6	
Oxydendron arboreum	sourwood	12.1	
Pinus echinata	short-leaf pine	21.2	
Pinus virginiana	Virginia pine	15.0	
Prunus serotina	black cherry	14.4	
Quercus alba	white oak	23.0	
Quercus falcata	southern red oak	6.2	
Quercus muehlenbergii	chinquapin oak	27.0	
Quercus shumardii	Shumard oak	30.0	1
Quercus stellata	post oak	20.2	
Quercus velutina	black oak	15.0	
Robinia pseudoacacia	black locust	4.5	
Ulmus alata	winged elm	12.3	
Ulmus rubra	slippery elm	14.7	
	Totals ≥30.0" dbh		1

Canopy Height — Forest canopy height above ground (Figure 15) was determined from 2017 LiDAR data. The highest canopy height ranged up to 100 feet and tended to correspond to inventoried yellow poplar, various oaks, and shortleaf pine. Lowest canopy height corresponds to forest edges, areas of early forest succession, remnants of cedar barrens, and gaps created by yellow pine mortality during a pine beetle outbreak during 2000-2001.

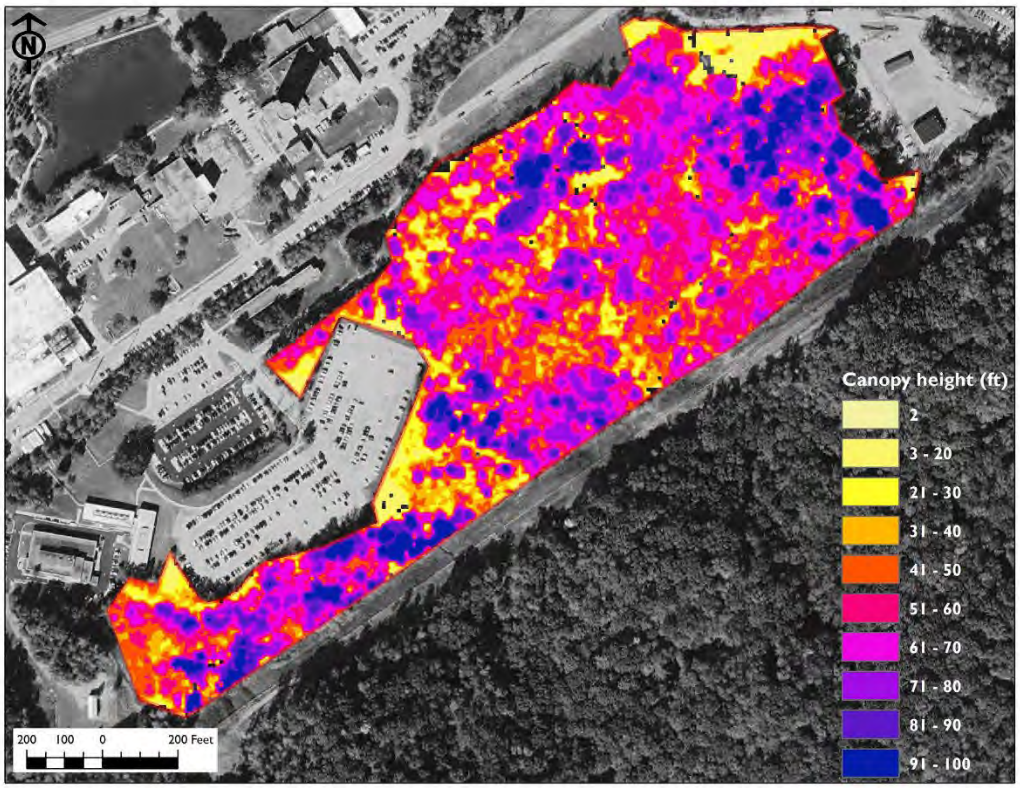

Figure 15. SIPRC Site Forest Canopy Height by 2017 LiDAR

Forest Regeneration — Although no quantitative data was taken during the inventory, among the most common seedling species observed were ash, red maple, dogwood, black cherry, service berry, chinquapin oak, southern red oak, black cherry, American holly, sugar maple, rusty blackhaw, sourwood, and eastern redcedar. One species, willow oak (*Quercus phellos*), was observed just within the site's northern edges but not among seedlings in the interior. This species has not been documented during previous forest inventories, though is planted nearby on Eighth Street. As oak acorns are primarily disseminated by wildlife, one explanation for this occurrence pattern would be droppings from edge roosting birds.

3.5 Cultural Resources

Six historic structures were present within the SIPRC study area, according to records. A dwelling had been located at the intersection of a dirt woods trail and the asphalt 6556 area access. Other larger structures included a crib shed and barn. While not discernable photographically, between the first two structures may have been a privy, spring house and smoke house. These structures, along with locations of fence lines and paths, are noted in Figure 16 and Table 8.

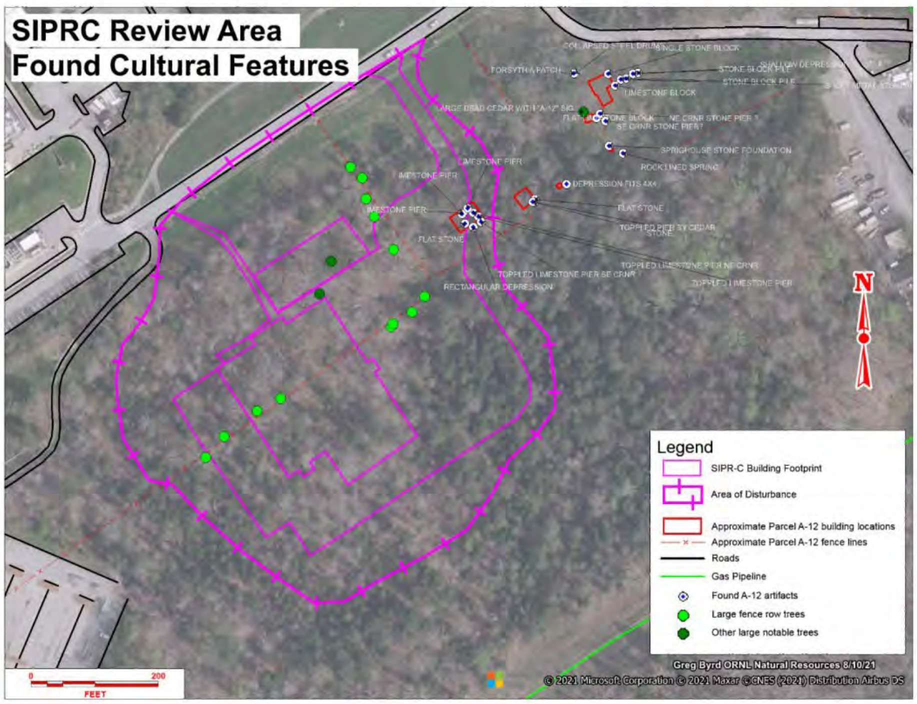

Figure 16. Map depicting locations of historical structures in or near the SIPRC building footprint and area of disturbance.

Table 8. Locations and details of historical structures near the SIPRC building footprint.

ID	Description	LATITUDE	LONGITUDE	2021 Condition	Dimension	Roof	Foundation	Frame
1	Barn A12-23	35.931429	-84.304146		26X40	metal	rock pier	Fr.Bx.
2	Crib & shed A12-22	35.931511	-84.303836		20x20	metal	rock pier	Box
3	Privy A12-24	35.931564	-84.303653		4X5	metal	wood base	box
4	Tenant House A12-19	35.931979	-84.303430		14X34; 14X24	metal	rock pier	Fr. Ceiled
5	Springhouse Path	35.931850	-84.303413		44.801	N/A	N/A	N/A
6	Interior fence line	35.932069	-84.304051		162.478	N/A	N/A	N/A
7	Interior fence line	35.931393	-84.303890		179.188	N/A	N/A	N/A
8	A14 boundary fence	35.932115	-84.305175		850.932	N/A	N/A	N/A
9	A14 boundary fence	35.930289	-84.305745		1024.75	N/A	N/A	N/A
10	Interior fence line	35.931851	-84.302736		192.398	N/A	N/A	N/A
11	Spring House A12-21	35.931734	-84.303315	Location proximate	6X8	Old bd.	rock Pier	box
12	Smokehouse A12-20	35.931854	-84.303493	Location Obscured	10x14	Old bd.	rock pier	Log

4 CONCLUSIONS

This report includes a compilation of new and existing data regarding sensitive flora and fauna, forest condition, and cultural and historical resources that would be impacted by the proposed SIPRC project. In total, 105 species of wildlife were documented within the survey area (Appendix A). Of these, at least 60 species are afforded legal protection under state or federal law (USFWS), in addition to 54 bird species that are afforded protection under the Migratory Bird Treaty Act (16 U.S.C. §§703-711) and several species within the review area carry additional USFWS designations as BCC, BMC, and USFW Focal species (Table 2, Appendix A). Discussions and potential consultation with USFWS should be initiated to determine project requirements for minimizing impacts to these species in accordance with regulations and agreements between DOE and USFWS. No rare plant species occur within the SIPRC study area.

The SIPRC study area is a mosaic of sensitive species habitat. The area is predominantly shallow to exposed karst with an abundance of seeps, wetlands, and wet woods. The central portion consists of relic glades and chinkapin oak (*Quercus muehlenbergii*)/ Shumard Oak (*Quercus shumardii*) forest communities (which are of conservation concern). While the eastern portion can be characterized by its proximity to wetlands, an intermittent stream and a rocky sloping ridge connects with the linear grassland created by the gas line row along the northern border. Many birds, deer, and insect pollinators were observed in the grassland. Along with the three stream channels that flow through the gas line right-of-way, the grassland creates an opportunity for connectivity and movement of many species between the SIPRC parcel and other portions of the ORR, including the forested parcel to the north. The diversity of the habitat and seasonal limitation greatly increases the chance that some species went undetected during our survey.

The only federally-listed species within the SIPRC project area are bats. One status bat species was considered present, however, this species, the gray bat, is cave obligate and would only use the SIPRC site to forage. Two additional status species are expected with very high confidence (Table 1). These are the tricolored bat and little brown bat (state-listed threatened, under consideration for federal listing). Other than bats, the state listed In Need of Management four-toed salamander (*Hemidactylium scutatum*) has been confirmed, and the presence of state endangered valley flame crayfish (*Cambarus deweesae*) cannot be ruled out, as well as the presence of previously undescribed crayfish and subterranean-adapted isopods.

The study results identify a potential need for mitigation based on possible impacts to federal and state listed species. Avoidance is the preferred first approach. If avoidance is not possible, consultation between DOE and USFWS will be required for both federally listed bats and birds protected under the Migratory Bird Treaty Act. TDEC and TWRA must also be notified concerning known impacts to state-listed fauna. Although only points are shown on the maps, the habitat range of these species is much larger and disruption to any portion of the habitat may have negative impacts on the species. This should be discussed further with TDEC. Acceptable mitigation measures for many species depends on the type of habitat disturbed and ultimately on the results of negotiations with the regulatory agencies.

There are minimal jurisdictional wetlands in the SIPRC study area, with only Wetland A being in the current area of disturbance that may require mitigation. Although there will likely be minimal jurisdictional wetland impact, the area is prone to flooding, receiving large amounts of runoff from the ridge and gas line. Wet weather conveyances, ditches, and standing pools of water can be found throughout the study area. In addition, the karst geology allows for fluctuating water levels that create temporary pools of water essential for many amphibian species. This creates an area that, although not meeting jurisdictional wetland characteristics, provides much of the same ecological wetland benefits. These temporarily flooded areas are equally as important as wetlands for many of the wildlife species mentioned in this report and this should be taken into account when mitigation is discussed. In addition to wetlands, the streams located in the study area are tributaries to White Oak Creek. White Oak Creek has been greatly impacted by development over the years, including impacts from channelization, infrastructure, impervious surfaces, and runoff to name a few.

Activity that would result in appreciable permanent loss of the resource value of wetlands requires mitigation which results in no overall net loss of resource value. Guidelines of compensatory measures include a minimum ratio of 2:1 for restoration, 4:1 for creation and enhancement, and 10:1 for preservation, or at a best professional judgment ratio agreed to by the state. Wetland A, being over 1/10 of an acre, could require mitigation even though it is a relatively small wetland. One potential mitigation option would be the preservation, enhancement or restoration of Wetland C. Wetland C presents an opportunity for mitigation measures just outside the SIPRC impact zone. Currently an access road intersects this wetland, which was blocked during sensitive resource survey after the discovery of gravid state-listed four-toed salamanders (*Hemidactylium scutatum*). Northern dusky salamanders (*Desmognathus fuscus*) and northern two-lined salamander (*Eurycea bislineata*) nests were also found within the wetland. Water was observed flowing from a spring westward towards the eastern intermittent stream of the SIPRC study area throughout the survey. We suggest permanently discontinuing use of this access road beyond the SP200 sample site.

In addition to wetlands, riparian areas and bottomlands, the SIPRC study area also contains dry sites. These dry sites have shallow soils over limestone dominated by oak trees (found chiefly on limestone) and contain uncommon plant communities. Three of these dry areas in the study area have been identified as chinkapin oak and Shumard oak communities, which are communities of concern, considered to be rare and deserving of protection. Two communities lie predominantly within the area of disturbance, while one lies at the southeastern portion of the of the larger study area along the gas line. Efforts could be put into expanding this chinkapin-Shumard oak community that does not lie within the area of disturbance as compensation for the loss of the other two areas. Much of the survey area has potential to become this special community with proper management. Invasive species control and prescribed burns would be the most important management tools.

As noted in the Introduction, the building footprint and area of disturbance are only preliminary designs. The current area of disturbance is very close to the 60-foot riparian buffer zone of both streams. ORNL best management practices require a 60 foot buffer from top of bank on both sides of a stream to improve habitat and water quality. If the area of disturbance shifts into the riparian zones, this may require additional mitigation or restoration. Shifts toward the east will increase impacts to four-toed salamanders. Disturbance, as defined in this report, is any soil movement, vegetation clearing, laydown or spoil areas, or areas compacted by equipment or structures.

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APPENDIX A – SPECIES TABLE

Species	Common Name	Class	Status
Plestiodon laticeps	Broadhead skink	Reptile	
Virginia valeriae	Eastern Smooth earthsnake	Reptile	
Carphophis amoenus	Worm snake	Reptile	
Scincella lateralis	Little brown skink	Reptile	
Coluber constrictor	Black racer	Reptile	
Plestiodon fasciatus	Five-lined skink	Reptile	
Nerodia sipedon	Northern watersnake	Reptile	
Lampropeltis triangulam	Eastern milksnake	Reptile	
Opheodrys aestivus	Rough green snake	Reptile	
Diadophis punctatus	Ringneck snake	Reptile	
Lampropeltis nigra	Black kingsnake	Reptile	
Pantherophis alleghenienisis	Eastern ratsnake	Reptile	
Pantherophis guttatus	Corn snake	Reptile	
Terrapene carolina	Eastern box turtle	Reptile	
Cheyldra serpentina	Common snapping turtle	Reptile	
Hemidactylium scutatum	Four-toed salamander	Amphibian	SN
Pseudacris feriarum	Upland chorus frog	Amphibian	
Eurycea bislineata	Northern two-lined salamander	Amphibian	
Ambystoma maculatum	Spotted salamander	Amphibian	
Pseudotriton ruber	Red salamander	Amphibian	
Plethodon glutinosus	Northern slimy salamander	Amphibian	
Desmognathus fuscus	Northern dusky salamander	Amphibian	
Hyla versicolor	Gray treefrog	Amphibian	
Lithobates clamitans	Green frog	Amphibian	
Pseudacris feriarum	Spring Peeper	Amphibian	
Septesicus fuscus	Big brown bat	Mammal	
Lasiurus borealis	Eastern red bat	Mammal	
Lasiurus cinereus	Hoary bat	Mammal	
Lasionycteris noctivagans	Silver-haired bat	Mammal	
Lasiurus seminolus	Seminole bat	Mammal	
Myotis grisescens	Gray bat	Mammal	FE + SE
Myotis lucifugus	Little brown bat	Mammal	FP + ST
Myotis septentrionalis	Northern long-eared bat	Mammal	FT + ST
Myotis sodalis	Indiana bat	Mammal	FE + SE
Nycticeius humeralis	Evening bat	Mammal	
Perimyotis subflavus	Tricolored bat	Mammal	FP + ST

Tadarida brasiliensis	Brazilian free-tailed bat	Mammal	
Odocoileus virginianus	white-tailed deer	Mammal	
Sylvilagus floridanus	Eastern Cottontail	Mammal	
Sciurus carolinensis	Eastern gray squirrel	Mammal	
Procyon lotor	Raccoon	Mammal	
Lynx rufus	Bobcat	Mammal	
Canis latrans	Coyote	Mammal	
Peromyscus	Deer mouse	Mammal	
Tamias striatus	Eastern chipmunk	Mammal	
Peromyscus	white-footed deermouse	Mammal	
Reithrodontomys humulis or Peromyscus	mouse (possibly eastern harvest mouse)	Mammal	
Blarina brevicauda	Northern short-tailed shrew	Mammal	
Microtus pinetorum	Woodland vole	Mammal	
Sorex cinereus	Cinereus Shrew	Mammal	
Scolopax minor	American Woodcock	Bird	MBTA
Baeolophus bicolor	Tufted Titmouse	Bird	MBTA
Sitta carolinensis	White-breasted Nuthatch	Bird	MBTA
Buteo jamaicensis	Red-tailed Hawk	Bird	MBTA
Strix varia	Barred owl	Bird	MBTA
Sayornis phoebe	Eastern Phoebe	Bird	MBTA
Cyanocitta cristata	Blue Jay	Bird	MBTA
Poecile carolinensis	Carolina Chickadee	Bird	MBTA
Sialia sialis	Eastern Bluebird	Bird	MBTA
Turdus migratorius	American Robin	Bird	MBTA
Cardinalis cardinalis	Northern Cardinal	Bird	MBTA
Catharus ustulatus	Swainson's Thrush	Bird	MBTA
Thryothorus ludovicianus	Carolina Wren	Bird	MBTA
Dryocopus pileatus	Pileated Woodpecker	Bird	MBTA
Corvus brachyrhynchos	American Crow	Bird	MBTA
Zonotrichia leucophrys	White-crowned Sparrow	Bird	MBTA
Setophaga americana	Northern Parula	Bird	MBTA
Buteo lineatus	Red-shouldered Hawk	Bird	MBTA
Setophaga citrina	Hooded Warbler	Bird	MBTA
Parkesia motacilla	Louisiana waterthrush	Bird	MBTA
Coragyps atratus	Black Vulture	Bird	MBTA
Vireo olivaceus	Red-eyed Vireo	Bird	MBTA
Agelaius phoeniceus	Red-winged Blackbird	Bird	MBTA
Geothlypis trichas	Common Yellowthroat	Bird	MBTA
Polioptila caerulea	Blue-gray Gnatcatcher	Bird	MBTA
Pipilo erythrophthalmus	Eastern Towhee	Bird	MBTA + MA
Melanerpes carolinus	Red-bellied Woodpecker	Bird	MBTA

Spinus tristis	American Goldfinch	Bird	MBTA
Piranga olivacea	Scarlet Tanager	Bird	MBTA
Molothrus ater	Brown-headed Cowbird	Bird	MBTA
Vireo griseus	White-eyed Vireo	Bird	MBTA
Setophaga dominica	Yellow-throated Warbler	Bird	MBTA
Setophaga pensylvanica	Chestnut-sided Warbler	Bird	MBTA
Meleagris gallopavo	Wild Turkey	Bird	MBTA
Geothlypis formosa	Kentucky Warbler	Bird	MBTA + BCC + Y
Antrostomus carolinensis	Chuck-will's-widow	Bird	MBTA + BCC + CBSD
Setophaga pinus	Pine Warbler	Bird	MBTA
Setophaga petechia	Yellow Warbler	Bird	MBTA
Icteria virens	Yellow-breasted Chat	Bird	MBTA + MA
Passerina cyanea	Indigo Bunting	Bird	MBTA
Dumetella carolinensis	Gray Catbird	Bird	MBTA
Hylocichla mustelina	Wood Thush	Bird	MBTA +BCC +SN + Y
Bombycilla cedrorum	Cedar Waxwing	Bird	MBTA
Passerina caerulea	Blue Grosbeak	Bird	MBTA
Quiscalus quiscula	Common Grackle	Bird	MBTA + CBSD
Contopus virens	Eastern-wood Pewee	Bird	MBTA + MA
Archilochus colubris	Ruby-throated Hummingbird	Bird	MBTA
Catharus guttatus	Hermit Thrush	Bird	MBTA
Coccyzus americanus	Yellow-billed Cuckoo	Bird	MBTA + BCC + CBSD
Empidonax virescens	Acadian Flycatcher	Bird	MBTA
Tachycineta bicolor	Tree Swallow	Bird	MBTA
Haemorhous mexicanus	House Finch	Bird	MBTA
Dryobates pubescens	Downy Woodpecker	Bird	MBTA
Icterus spurius	Orchard Oriole	Bird	MBTA
Rhinichthys atratulus	Blacknosed dace	fish	
Polydesmidae	Armored millipede spp.	invertebrate	
Calosoma sayi	Black caterpillar hunter	invertebrate	
Cambarus bartonii	Brook Crayfish	invertebrate	
Supella spp.	Cockroach spp.	invertebrate	
Philomycus carolinianus	Carolina mantle slug	invertebrate	
Harpaphe haydeniana	Cherry millipede	invertebrate	
Colias philodice	Clouded sulfur butterfly	invertebrate	
Anisoptera	Dragonfly spp.	invertebrate	
Lumbricina	Earth worms	invertebrate	
Malacosoma americanum	Eastern tent caterpillars	invertebrate	

Papilio glaucus	Eastern tiger swallowtail butterfly	invertebrate	
Malacosoma disstria Hübner	Forest tent caterpillar	invertebrate	
Euptoieta spp.	Fritillary butterfly ssp	invertebrate	
Speyeria cybele	Great spangled fritillary butterfly	invertebrate	
Chrysopidae	Green lacewing	invertebrate	
Opiliones spp.	Harvestmen	invertebrate	
Deltochilum spp.	Humpback dung beetle	invertebrate	
Tetragnathidae	Long jawed orb weaver	invertebrate	
Ephemeroptera	Mayfly nymphs	invertebrate	
Culicidae	Mosquitoes	invertebrate	
Phyciodes tharos	Pearl crescent butterfly	invertebrate	
Magicicada septendecim	Periodical cicada (17 yr)	invertebrate	
Battus philenor	Pipevine swallowtail butterfly	invertebrate	
Polygonia interrogationis	Question mark butterfly	invertebrate	
Udeopsylla spp.	Robust camel cricket	invertebrate	
Tettigoniinae	Shield katydid	invertebrate	
Orthosia spp.	Speckled green fruitworm moth	invertebrate	
Papilio troilus	Spicebush swallowtail butterfly	invertebrate	
Dolomedes spp.	Striped fishing spider	invertebrate	
Vaejovis carolinianus	Southern Unstriped Scorpion	invertebrate	
Cambarus dubius	Upland burrowing crayfish	invertebrate	
Carabus violaceus	Violet ground beetle	invertebrate	
Cepaea hortensis	White lipped snail	invertebrate	
Parcoblatta pensylvanica	Wood roach	invertebrate	
Lycosidae	Wolf spider	invertebrate	
Harpaphe haydeniana	Yellow spotted millipede	invertebrate	
Eurytides marcellus	Zebra swallowtail	invertebrate	

FT: Federally Threatened, FE: Federally Endangered, ST: State Threatened, SE: State Endangered, SN: State Listed in Need of Management, MBTA: Species Protected under the Migratory Bird Treaty Act, BCC: Bird of Conservation Concern, MA: Management Action Needed, CBSD: Common Bird in Steep Decline, Y: Yellow Watch List

APPENDIX B – WETLAND DELINEATION FORMS

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: SIPR-C City/County: Oak Ridge/Anderson Sampling Date: 07/15/21
Applicant/Owner: ORNL State: TN Sampling Point: A
Investigator(s): Jamie Herold Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): ______
Subregion (LRR or MLRA): ______ Lat: 35.931756° Long: -84.304287° Datum: ______
Soil Map Unit Name: see note in Soil NWI classification: PEM & PFO
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ☐
Are Vegetation ☐ Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland?	Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐		
Wetland Hydrology Present?	Yes ✓ No ☐		

Remarks:
Wetland A is a 0.123 acre wetland located along the tree line on the north side of SIPR-C. It is the only jurisdiction wetland that falls within the area of disturbance, in the location of the entrance road. Most of the PEM portion of the wetland is in a periodically mown right-of-way.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 12	
Water Table Present?	Yes ✓ No ☐	Depth (inches): ______	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): ______	**Wetland Hydrology Present?** Yes ✓ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
seasonally high water table
flow from adjacent stream
low topography

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: A

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. green ash (Fraxinus pennsylvanica)	20		FACW
2.			
3.			
4.			
5.			
6.			
= Total Cover	20		
50% of total cover: ____ 20% of total cover: ____			
Sapling Stratum (Plot size: ______)			
1. privet (Ligustrum sinense)	10		FACU
2.			
3.			
4.			
5.			
6.			
= Total Cover	10		
50% of total cover: ____ 20% of total cover: ____			
Shrub Stratum (Plot size: ______)			
1. privet (Ligustrum sinense)	5		FACU
2.			
3.			
4.			
5.			
6.			
= Total Cover	5		
50% of total cover: ____ 20% of total cover: ____			
Herb Stratum (Plot size: ______)			
1. sallow sedge (C. lurida)	15		OBL
2. leafy bulrush (Scirpus polyphyllus)	10		OBL
3. dark-green bulrush (Scirpus atrovirens)	3		OBL
4. seedbox (Ludwigia alterniolia)	2		FACW
5. poison ivy (Toxicodendron radicans)	10		FAC
6. broadleaf cattail (Typha latifolia)	5		OBL
7. fox sedge (Carex vulpinoidea)	5		OBL
8. jewelweed (Impatiens capensis)	5		FACW
9.			
10.			
11.			
= Total Cover	55		
50% of total cover: ____ 20% of total cover: ____			
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	38	x 1 = 38
FACW species	42	x 2 = 84
FAC species	10	x 3 = 3
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	105 (A)	185 (B)

Prevalence Index = B/A = 1.7

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

Approximately 10% of the wetland was was standing water; half of it was vegetated and half open water

SOIL Sampling Point: A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	100					clay	
2-4	10YR 4/2	97	10YR 5-6	3	C	PL	clay	
4-10	10YR 4/2	95	2.5Y 5/6	5	C	PL/C	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] 2 cm Muck (A10) **(LRR N)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7)
- [ ] Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- [ ] Thin Dark Surface (S9) **(MLRA 147, 148)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- [ ] Umbric Surface (F13) **(MLRA 136, 122)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 148)**
- [ ] Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 2 cm Muck (A10) **(MLRA 147)**
- [ ] Coast Prairie Redox (A16) **(MLRA 147, 148)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes [x] No [ ]

Remarks:

Area Not Surveyed by NRCS.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: SIPR-C City/County: Oak Ridge/Anderson Sampling Date: 07/15/21
Applicant/Owner: ORNL State: TN Sampling Point: B
Investigator(s): Jamie Herold Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): concave Slope (%):
Subregion (LRR or MLRA): Lat: 35.932210° Long: -84.303967° Datum:
Soil Map Unit Name: see note in Soil NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ☐
Are Vegetation ☐ Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐	
Wetland Hydrology Present?	Yes ✓ No ☐	

Remarks:
Wetland B is a 0.101 acre wetland that lies within the riparian area of the two tributary streams that split at White Oak Creek Road

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 4	
Water Table Present?	Yes ✓ No ☐	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches):	**Wetland Hydrology Present? Yes ✓ No ☐**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

1
2

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: B

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. black willow (Salix nigra)	20	D	OBL
2. green ash (Fraxinus pennsylvanica)	10		FACW
3.			
4.			
5.			
6.			
	30 = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. black willow (Salix nigra)	10		OBL
2. green ash (Fraxinus pennsylvanica)	10		FACW
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. broadleaf cattail (Typha latifolia)	30	D	OBL
2. bulrush (Scirpus atrovirens)	10		OBL
3. allegheny monkey-flower (Mimulus ringens)	10		OBL
4.			
5.			
6.			
7.			
8.			
9. poison			
10.			
11.			
	50 = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	80	x 1 = 80
FACW species	20	x 2 = 40
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	100 (A)	120 (B)

Prevalence Index = B/A = 1.2

Hydrophytic Vegetation Indicators:

- ☑ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

Approximately 20% of the wetland was was standing water fully vegetated

SOIL Sampling Point: B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	100					clay	
2-4	10YR 4/2	97	10YR 5-6	3	C	PL	clay	
4-10	10YR 4/2	95	2.5Y 5/6	5	C	PL/C	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ☑ No ☐

Remarks:

Area Not Surveyed by NRCS.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: SIPR-C City/County: Oak Ridge/Anderson Sampling Date: 07/15/21
Applicant/Owner: ORNL State: TN Sampling Point: C
Investigator(s): Jamie Herold Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): ______
Subregion (LRR or MLRA): ______ Lat: 35.931037° Long: -84.303596° Datum: ______
Soil Map Unit Name: see note in Soil NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ☐
Are Vegetation ☐ Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ☐		Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present? Yes ✓ No ☐		
Wetland Hydrology Present? Yes ✓ No ☐		

Remarks:
Wetland C is 0.032 acre wetland located outside the southeast corner of the area of disturbance. This wetland contains emergent vegetation and saplings and is located within a dirt woods trail surrounded by forest.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

✓ Surface Water (A1)	☐ True Aquatic Plants (B14)
✓ High Water Table (A2)	☐ Hydrogen Sulfide Odor (C1)
✓ Saturation (A3)	☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Water Marks (B1)	☐ Presence of Reduced Iron (C4)
☐ Sediment Deposits (B2)	☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Drift Deposits (B3)	☐ Thin Muck Surface (C7)
☐ Algal Mat or Crust (B4)	☐ Other (Explain in Remarks)
☐ Iron Deposits (B5)	
☐ Inundation Visible on Aerial Imagery (B7)	
☐ Water-Stained Leaves (B9)	
☐ Aquatic Fauna (B13)	

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ✓ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ☐ Depth (inches): 3
Water Table Present? Yes ✓ No ☐ Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes ✓ No ☐ Depth (inches): ______

Wetland Hydrology Present? Yes ✓ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: C

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ______ 20% of total cover: ______			

Sapling Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			
50% of total cover: ______ 20% of total cover: ______			

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. green ash (Fraxinus pennsylvanica)	2		FACW
2.			
3.			
4.			
5.			
6.			
= Total Cover	2		
50% of total cover: ______ 20% of total cover: ______			

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. bearded beggarticks (Bidens aristosa)	4		OBL
2. sallow sedge (Carex lurida)	4		OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	8		
50% of total cover: ______ 20% of total cover: ______			

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			
50% of total cover: ______ 20% of total cover: ______			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	8	x 1 = 8
FACW species	2	x 2 = 4
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	10 (A)	12 (B)

Prevalence Index = B/A = 1.2

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)
90% of the wetland was standing water with no vegetation

SOIL Sampling Point: C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 5/1	100					clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

Area Not Surveyed by NRCS.

1

APPENDIX C
CORRESPONDENCE

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Department of Energy
Office of Science
Consolidated Service Center

9800 South Cass Avenue
Lemont, Illinois 60439

P.O. Box 2001
Oak Ridge, Tennessee 37831

November 29, 2021

Ms. Kelley Reid
Tennessee Historical Commission
Department of Environment and Conservation
2941 Lebanon Road
Nashville, Tennessee 37214

Dear Ms. Reid,

NATIONAL HISTORIC PRESERVATION ACT, SECTION 106 COMPLIANCE-ARCHEOLOGICAL SURVEY DETERMINATION FOR THE CONSTRUCTION OF STABLE ISOTOPE PRODUCTION AND RESEARCH CENTER LOCATED AT THE OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE

The United States Department of Energy (DOE) is preparing a draft National Environmental Policy Act (NEPA) Environmental Assessment as a part of planning for construction and operation of a new facility at the Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. The Stable Isotope Production and Research Center (SIPRC) will enable DOE to effectively support national science and technology missions. Construction of the SIPRC will adversely impact a small portion of a recently identified pre-WWII homesite located near the proposed facility footprint.

The *Evaluation of Previously Recorded and Inventoried Archeological Sites on the Oak Ridge Reservation, Anderson and Roane Counties, Oak Ridge, Tennessee, January 1996,* review overlooked the presence of archeological properties within the proposed project area. However, recent additional walkthroughs and research conducted discovered archeological sites. The enclosed report, *Review of Existing Cultural Resources Data for the Stable Isotope Production and Research Center*, is being submitted for reference. This document contains a detailed account of the affected area and pictures. The expected area of disturbance would include the remains of Barn A12-23, described within the enclosed report as: *"a 26' x 40' board box structure with a metal roof and rock piers*" (at the time of the Manhattan Project USACOE survey), located about 235 feet southwest of the Spring House. Although the original metal roof and wooden structural components have long since deteriorated, the report's contemporary observations included: *"This is the least disturbed foundation on the SIPRC site. At least seven rock piers were easily located and appeared to have been spaced at about 10' feet apart."*

In accordance with Stipulation IX.B of the Programmatic Agreement Among the Department of Energy, Oak Ridge Operations Office, *The Tennessee State Historic Preservation Office and the Advisory Council on Historic Preservation Concerning the Management of Historical and*

NATIONAL HISTORIC PRESERVATION ACT, SECTION 106 COMPLIANCE-ARCHEOLOGICAL SURVEY DETERMINATION FOR THE CONSTRUCTION OF STABLE ISOTOPE PRODUCTION AND RESEARCH CENTER LOCATED AT THE OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE

Cultural Properties at the Oak Ridge National Laboratory, DOE requests your determination as to whether a Phase I Archeological Survey is warranted prior to SIPRC construction or if we can consider the Section 106 process complete. If there are any questions or additional information is required, please contact me (865) 576-0835.

Sincerely,

KATATRA VASQUEZ Digitally signed by KATATRA VASQUEZ Date: 2021.11.30 09:31:14 -05'00'

Katatra C. Vasquez
Cultural Resources
Management Coordinator

Enclosure

cc w/enclosure:
Christopher Wilson, ACHP
DOE Information Center
Lloyd Stokes, ORHPA
Josh Silverman, AU-20, FORS
Carrie Barber, ORNL
Wesley Goddard, ORNL
Paul Larson, ORNL
Ernest Ryan, ORNL
David D. Skipper, ORNL
Michele G. Branton, SC-OSO
Thomas W. Doty III, SC-OSO
Mildred Lopez-Ferre, TS-421, SC-CSC
Johnny Moore, SC-OSO Site Manager
Doug Reed, SC-OSO
Peter Siebach, TS-421, SC-CSC

TENNESSEE HISTORICAL COMMISSION
2941 LEBANON PIKE
NASHVILLE, TENNESSEE 37243-0442
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

December 1, 2021

Ms. Katatra C. Vasquez
U.S. Department of Energy
Oak Ridge Office
P.O. Box 2001
Oak Ridge, TN 37831

RE: DOE / Department of Energy, Stable Isotope Production and Research Center, Oak Ridge National Laboratory, Oak Ridge, Roane County, TN

Dear Ms. Vasquez:

In response to your request, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicants for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

Based on the information provided, we find that the undertaking will not adversely affect the Oak Ridge National Laboratory Historic District; however, In order to complete our review of this undertaking, we will need to receive from you a detailed archaeological survey report on the area of potential effect for this undertaking. A list of individuals and organizations which have indicated a desire to work in Tennessee is available at https://www.tn.gov/content/dam/tn/environment/archaeology/documents/arch_CONSLIST.pdf This list is solely for the convenience of persons or firms seeking archaeological services. It does not indicate nor imply any sanction, certification, or approval by the State of Tennessee.

Upon receipt of the survey report, we will continue our review of this undertaking as expeditiously as possible. Until such time as this office has rendered a final comment on this project, your Section 106 obligation under federal law has not been met. Please inform this office if this project is canceled or not funded, licensed, or permitted by the federal agency. Questions and comments may be directed to Jennifer M. Barnett ((615) 687-4780, Jennifer.Barnett@tn.gov).

Your cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

STATE OF TENNESSEE

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Division of Natural Areas
Natural Heritage Program
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 2nd Floor
Nashville, Tennessee 37243
Phone 615/532-0431 Fax 615/532-0046

January 13, 2022

Ernest Ryan
Oak Ridge National Laboratory
One Bethel Valley Road
Oak Ridge, TN 37831

Subject: Stable Isotope Production and Research Center
(35.93100°, -84.30466°)
Roane County, TN
Rare Species Database Review

Dear Mr. Ryan:

Thank you for your correspondence of 10 December 2021 requesting a rare species database review for the proposed Stable Isotope Production and Research Center at the Oak Ridge National Laboratory.

Per your submittal:

On behalf of the US Department of Energy Office of Science and Oak Ridge National Laboratory (ORNL), we are seeking consultation with TWRA regarding our preparation of a (NEPA) Environmental Assessment in support of project planning for a new facility at ORNL. Below is a brief description of the proposed new facility, along with known sensitive resources for the site and discussion of protective control measures that will be taken to minimize impacts of construction and operation...

Purpose and Need: Construction and operation of the Stable Isotope Production and Research Center (SIPRC) is needed to ensure the United States' ongoing and future capability to produce stable (non-radioactive) isotopes for a variety of science and technology missions. SIPRC will be a state-of-the art facility able to build upon and substantially increase existing capabilities by consolidating operations from inadequate existing lab spaces into a single purpose-built facility. The preferred site for the SIPRC is located within a previously undeveloped parcel (approximately 29.8 acres) just south of White Oak Avenue and in convenient proximity to existing office and lab spaces currently dedicated to ORNL's Isotope R&D mission. We are preparing an Environmental Assessment for construction and operation of the SIPRC in accordance with the DOE Implementing Procedures for NEPA, and that process has involved substantial and intensive sensitive resource surveys and monitoring during the past year, and we believe calls for additional consultation with your agency (and others).

In the future, we expect to engage in additional consultations with TWRA, during our preparation of application for coverage under any applicable aquatic resource alteration permits. However, today's *consultation request is specific to gathering your agency's inputs to our draft Environmental Assessment. The ORNL Natural Resources staff was charged with conducting a natural resources assessment on the 29.8-acre parcel. The actual proposed area of disturbance encompasses only a portion of this parcel (approximately 10 acres)...*

This area features karst topography typical of Bethel Valley, including the presence of seeps and small pockets of wetland, and high-quality habitat for wetland species. Based on our present knowledge of the site, a combination of protective control measures will be necessary to minimize and mitigate impacts to the natural area during construction and operation of this new facility. Development of these protective control measures is ongoing concurrently with project design, and these will become clearly defined and established during the site permitting process.

We have reviewed the state's natural heritage database with regard to the project boundaries, and we find that the following rare species have been observed previously within one mile of the project area.

Type	Scientific Name	Common Name	Global Rank	St. Rank	Fed. Prot.	St. Prot.	Habitat
Vascular Plant	*Delphinium exaltatum*	Tall Larkspur	G3	S2	--	E	Glades and Barrens
Vascular Plant	*Juncus brachycephalus*	Small-headed Rush	G5	S2	--	S	Seeps and Wet Bluffs
Vertebrate Animal	*Aneides aeneus*	Green Salamander	G3G4	S3S4	--	Rare, Not State Listed	Damp crevices in shaded rock outcrops and ledges; beneath loose bark and cracks of trees and sometimes in/or under logs.
Vertebrate Animal	*Ophisaurus attenuatus longicaudus*	Eastern Slender Glass Lizard	G5T5	S3	--	D	Dry upland areas including brushy, cut-over woodlands and grassy fields; nearly statewide but obscure; fossorial.
Vertebrate Animal	*Pituophis melanoleucus melanoleucus*	Northern Pinesnake	G4T4	S3	--	T	Well-drained sandy soils in pine/pine-oak woods; dry mountain ridges; E portions of west TN, E to lower elev of the Appalachians.
Vertebrate Animal	*Synaptomys cooperi*	Southern Bog Lemming	G5	S4	--	D	Marshy meadows, wet balds, & rich upland forests.

Within four miles of the project area the following additional rare species have been reported:

Type	Scientific Name	Common Name	Global Rank	St. Rank	Fed. Prot.	St. Prot.	Habitat
Vascular Plant	*Aureolaria patula*	Spreading False-foxglove	G3	S3	--	S	Oak Woods and Edges
Vascular Plant	*Bolboschoenus fluviatilis*	River Bulrush	G5	S1	--	S	Marshes
Vascular Plant	*Diervilla lonicera*	Northern Bush-honeysuckle	G5	S2	--	T	Rocky Woodlands and Bluffs

Type	Scientific Name	Common Name	Global Rank	St. Rank	Fed. Prot.	St. Prot.	Habitat
Vascular Plant	*Elodea nuttallii*	Nuttall's Waterweed	G5	S2	--	S	Aquatic; Streams and Ponds
Vascular Plant	*Eurybia schreberi*	Schreber's Aster	G4	S1	--	S	Mesic Woods & Seepage Slopes
Vascular Plant	*Fothergilla major*	Mountain Witch-alder	G3	S2	--	T	Rocky Slopes And River Banks
Vascular Plant	*Juglans cinerea*	Butternut	G3	S3	--	T	Rich Woods and Hollows
Vascular Plant	*Liparis loeselii*	Fen Orchis	G5	S1	--	T	Calcareous Seeps
Vascular Plant	*Lonicera dioica*	Mountain Honeysuckle	G5	S2	--	S	Mountain Woods and Thickets
Vascular Plant	*Platanthera flava var. herbiola*	Tubercled Rein-orchid	G4?T4Q	S2	--	T	Swamps and Floodplains
Invertebrate Animal	*Cyprogenia stegaria*	Fanshell	G1	S1	LE, XN	E	Medium to large streams and rivers with coarse sand and gravel substrates; Cumberland and Tennessee river systems.
Invertebrate Animal	*Io fluvialis*	Spiny Riversnail	G1G2	S2	--	Rare, Not State Listed	Shallow waters of shoals that are rapid to moderate and well-oxygenated; Tennessee River & main tributaries; E Tennessee.
Invertebrate Animal	*Lampsilis abrupta*	Pink Mucket	G1G2	S2	LE	E	Generally a large river species, preferring sand-gravel or rocky substrates with mod-strong currents; Tennessee & Cumberland river systems.
Invertebrate Animal	*Obovaria retusa*	Ring Pink	G1	S1	LE,XN	E	Large rivers in gravel and sand bars; Tennessee & Cumberland river watersheds; many historic locations currently inundated.
Invertebrate Animal	*Plethobasus cooperianus*	Orangefoot Pimpleback	G1	S1	LE, XN	E	Large rivers in sand-gravel-cobble substrates in riffles and shoals in deep flowing water; Cumberland & Tennessee river systems.

Type	Scientific Name	Common Name	Global Rank	St. Rank	Fed. Prot.	St. Prot.	Habitat
Invertebrate Animal	*Plethobasus cyphyus*	Sheepnose	G3	S2S3	LE	E	Large to medium-sized rivers, in riffles and coarse sand/gravel subst; TN & Cumb river systems incl KY Reservoir; W Uplands & Rim.
Invertebrate Animal	*Theliderma cylindrica strigillata*	Rough Rabbitsfoot	G3G4T2	S2	LE	E	Small-medium sized rivers, in clear, shallow riffles with sand-gravel substrates; Tenn. & Cumb. river systems; upland form.
Vertebrate Animal	*Chrosomus tennesseensis*	Tennessee Dace	G3	S3	--	D	First order spring-fed streams of woodlands in Ridge and Valley limestone region; Tennessee River watershed.
Vertebrate Animal	*Cryptobranchus alleganiensis*	Hellbender	G3	S3	--	E	Rocky, clear creeks and rivers with large shelter rocks.
Vertebrate Animal	*Hemidactylium scutatum*	Four-toed Salamander	G5	S3	--	D	Woodland swamps, shallow depressions, & sphagnum mats on acidic soils; middle & east Tennessee.
Vertebrate Animal	*Hemitremia flammea*	Flame Chub	G3	S3	--	D	Springs and spring-fed streams with lush aquatic vegetation; Tennessee & middle Cumberland river watersheds.
Vertebrate Animal	*Limnothlypis swainsonii*	Swainson's Warbler	G4	S3	--	D	Mature, rich, damp, deciduous floodplain and swamp forests.
Vertebrate Animal	*Myotis grisescens*	Gray Myotis	G4	S2	LE	E	Cave obligate year-round; frequents forested areas; migratory.
Vertebrate Animal	*Peucaea aestivalis*	Bachman's Sparrow	G3	S1B	--	E	Dry open pine or oak woods; nests on the ground in dense cover.
Vertebrate Animal	*Setophaga cerulea*	Cerulean Warbler	G4	S3B	--	D	Mature deciduous forest, particularly in floodplains or mesic conditions.
Vertebrate Animal	*Sorex dispar*	Long-tailed Shrew	G4	S2	--	D	Mountainous, forested areas with loose talus; east Tennessee.

Type	Scientific Name	Common Name	Global Rank	St. Rank	Fed. Prot.	St. Prot.	Habitat
Animal Assemblage	Rookery	Heron Rookery	G5	SNR	--	Rare, Not State Listed	

The Division of Natural Areas - Natural Heritage Program has reviewed the location of the proposed project workspace with respect to rare plant species. Based on your surveys of the project area, we do not anticipate any impacts to occurrences of rare, threatened, or endangered plant species from this project. That said, our office concurs with the determinations regarding plants and plant communities outlined in the draft Natural Resources Assessment you submitted, especially regarding oak communities and potential impacts to wildlife habitat and overall connectivity. Our office would support any efforts to avoid or minimize impacts to the most sensitive portions of the parcel.

We ask that you coordinate this project with the Tennessee Wildlife Resources Agency (Region 3, Bobby Brown, 931-484-9571, bobby.brown@tn.gov) to ensure that legal requirements for protection of state listed rare animals are addressed. Additionally, we ask that you contact the U.S. Fish and Wildlife Service Field Office, Cookeville, Tennessee (931-525-4970) for comments regarding federally listed species. Please ensure that best management practices to address erosion and sediment are implemented and maintained during construction activities. Note that the General Aquatic Resource Alteration Permit states that "use of monofilament-type erosion control netting or blanket is prohibited in the stream channel, stream banks, or any disturbed riparian areas within 30 feet of top of bank." Where necessary and feasible, we encourage use of biodegradable netting under the CGP (Construction General Stormwater Permit) as well.

Thank you for considering Tennessee's rare species throughout the planning of this project. Should you have any questions, please do not hesitate to contact me at 615-532-4799 or dillon.blankenship@tn.gov.

Sincerely,

Dillon

Dillon Blankenship | Environmental Review Coordinator
Tennessee Natural Heritage Program

From: Vincent Pontello <Vincent.Pontello@tn.gov>
Sent: Wednesday, January 26, 2022 3:58 PM
To: Ryan Jr, Ernest <ryaneljr@ornl.gov>; Shannon A. Young <Shannon.A.Young@tn.gov>
Subject: [EXTERNAL] Re: Informal Consultation - New ORNL Project - Stable Isotope Production and Research Center (SIPRC)

Earnest,

Thank you for the detailed information you have provided. This project consists of the Construction of the Stable Isotope Production and Research Center (SIPRC). The preferred site for the SIPRC is located within a previously undeveloped parcel (approximately 29.8 acres) just south of White Oak Avenue. I have reviewed the documents provided and concur with the species data and avoidance strategies. Our agency's main concern will be regarding the four-toed salamander *Hemidactylium scutatum*. I recommend that disturbance to streams and areas with wet/moist soils are avoided during the breeding period from Jan1 through June 1st. In addition, I recommend species sweeps and potential relocations are performed in wetland areas immediately prior to disturbance. Please coordinate with your ORNL Wildlife Ecologist for these requests. I also recommend that coordination takes place with the USFWS for federally listed species. The US Army Corp of Engineers and the Tennessee Department of Conservation will need to be contacted to address stream and/or wetland mitigation if needed. Please contact me if you need further assistance.

Vincent L. Pontello
Assistant Chief, Biodiversity Division, Aquatics Program
Tennessee Wildlife Resources Agency
464 Industrial Blvd.
Crossville TN, 38555

From: Ryan Jr, Ernest
Sent: Friday, December 10, 2021 8:50 AM
To: Vincent Pontello <Vincent.Pontello@tn.gov>; Shannon Young <Shannon.A.Young@tn.gov>
Cc: Larson, Paul <larsonep@ornl.gov>; Cain, Wendy <cainwa@ornl.gov>; Siebach, Peter <Peter.Siebach@science.doe.gov>; McCracken, Kitty <mccrackenmk@ornl.gov>; Goddard, Wesley <goddardwd@ornl.gov>; Ryan Jr, Ernest <ryaneljr@ornl.gov>; Herold, Jamie <heroldjm@ornl.gov>; Carter, Evin <cartere@ornl.gov>; Barber, Caroline <barbercs@ornl.gov>; Deacon, Michael <michael.deacon@aecom.com>; Doty Iv, Thomas <dotytw@ornl.gov>
Subject: FW: Informal Consultation - New ORNL Project - Stable Isotope Production and Research Center (SIPRC)
Importance: High

On behalf of the US Department of Energy Office of Science and Oak Ridge National Laboratory (ORNL), we are seeking consultation with TWRA regarding our preparation of a (NEPA) Environmental Assessment in support of project planning for a new facility at ORNL. Below is a brief description of the proposed new facility, along with known sensitive resources for the site and discussion of protective control measures that will be taken to minimize impacts of construction and operation. You will find attached a graphic file identifying the location of the proposed action relative to the Main ORNL Campus located in Oak Ridge, Tennessee. We are also submitting the draft natural resources survey input we developed as part of preparing the Environmental Assessment.

Purpose and Need: Construction and operation of the Stable Isotope Production and Research Center (SIPRC) is needed to ensure the United States' ongoing and future capability to produce stable (non-radioactive) isotopes for a variety of science and technology missions. SIPRC will be a state-of-the art facility able to build upon and substantially increase existing capabilities by consolidating operations from inadequate existing lab spaces into a single purpose-built facility. The preferred site for the SIPRC is located within a previously undeveloped parcel (approximately 29.8 acres) just south of White Oak Avenue and in convenient proximity to existing office and lab spaces currently dedicated to ORNL's Isotope R&D mission. We are preparing an Environmental Assessment for construction and operation of the SIPRC in accordance with the DOE Implementing Procedures for NEPA, and that process has involved substantial and intensive sensitive resource surveys and monitoring during the past year, and we believe calls for additional consultation with your agency (and others).

In the future, we expect to engage in additional consultations with TWRA, during our preparation of application for coverage under any applicable aquatic resource alteration permits. However, today's consultation request is specific to gathering your agency's inputs to our draft Environmental Assessment. The ORNL Natural Resources staff was charged with conducting a natural resources assessment on the 29.8-acre parcel. The actual proposed area of disturbance encompasses only a portion of this parcel (approximately 10 acres). Please find attached the natural resources assessment document that presents the results of the survey (attachment 3).

This area features karst topography typical of Bethel Valley, including the presence of seeps and small pockets of wetland, and high-quality habitat for wetland species. Based on our present knowledge of the site, a combination of protective control measures will be necessary to minimize and mitigate impacts to the natural area during construction and operation of this new facility. Development of these protective control measures is ongoing concurrently with project design, and these will become clearly defined and established during the site permitting process.

Pertinent Information regarding sensitive resources known for the site:

1. Surveys conducted by ORNL Natural Resources Management Program staff 2019-2021, identified habitat for the four-toed salamander (*Hemidactylium scutatum*) (state-listed – In Need of Management). Portions of that habitat will be impacted by this project. Gravid female four-toed salamanders on nests were found on the western edge of the disturbance area and additional gravid females were found in the southeastern quadrant of the larger study parcel outside of the disturbance zone.

2. Habitat for eastern slender glass lizard (*Ophisaurus attenuatus longicaudus*) (state-listed – In Need of Management) and pine snake (*Pituophis melanoleucus*) (state-listed – Threatened) was also identified on the site. There is a historical record for pine snake on that site. (Note: Records for both species on the Oak Ridge Reservation are historical with no recent discoveries.)

3. Wood thrush (*Hylocichla mustelina*) (state-listed – In Need of Management) were recorded on the site within the proposed area of disturbance.

Measures to be taken to minimize impacts:

1. Soil disturbance will be minimized to the maximum extent possible to limit potential impacts to ground-dwelling species (e.g., reptiles and amphibians) and ORNL Natural Resources staff will be in the field to insure that clearing limits are adhered to and to direct the contractor away from sensitive habitat (e.g., sensitive/listed species habitat, stream riparian zones, wetlands, seeps, springs, archeological features/homestead sites).

2. Federal and state listed bats were recorded on the site during the natural resources survey. However, based on the nature of the habitat in the proposed area of disturbance, we do not believe that there will be an effect on bat populations.

3. Clearing will be limited to the maximum extent possible on the parcel. However, portions of habitat for the state-listed four-toed salamander and wood thrush will be impacted by the project. All clearing will occur outside the nesting season for the wood thrush and for most other migratory birds known to occur on the site. Based on the results of on-site surveys conducted in 2020, most birds known to frequent the site would nest between April 1 and October 30 (see attached list = attachment 4). Surveys will be conducted for early nesters (February 1 thru March 31) prior to any proposed clearing on the site.

4. No federal or state-listed plants have been found on the site to date. A rare forest community (Shumard-chinkapin oak) is present on the site and blue flag iris (*Iris virginica*) was noted in a wetland area. Both the oak community and iris are considered uncommon, but have no federal or state listing. Efforts will be made to avoid Shumard-chinkapin oak communities on the site; however, there will be encroachment into these communities in the northwestern portion of the proposed disturbance area. The area where the iris is located will not be impacted.

5. A portion of a 0.123 acre wetland in the northeastern corner of the site will be impacted by the project. Two other small wetland areas on the parcel will not be impacted by the project.

Additional consultations with TWRA and TDEC will be conducted during the process of applying for the required ARAP and Construction Stormwater Permits. These consultations would take place following submittal of completed and ongoing detailed sensitive resources assessment reports, which will provide much more detailed information on the site. Consultation with USFWS regarding federally listed bats is currently being conducted.

Please do not hesitate to reach out to us with any questions, concerns, or requests for additional information, and thank you in advance, for your assistance in moving forward with this effort!

Ernest Ryan Jr [redacted]

ORNL NEPA/NHPA Compliance Program
Site Access – DOE Oak Ridge Reservation

1

From: Carter, Evin <cartere@ornl.gov>
Sent: Friday, February 25, 2022 9:32 PM
To: Vincent.Pontello@tn.gov
Cc: Ryan Jr, Ernest <ryaneljr@ornl.gov>; Doty Iv, Thomas <dotytw@ornl.gov>; Giffen, Neil <giffennr1@ornl.gov>; Skipper, David <skipperdd@ornl.gov>; Goddard, Wesley <goddardwd@ornl.gov>; Barber, Caroline <barbercs@ornl.gov>
Subject: Re: SIPRC EA - TWRA consultation

Vincent,

Thank you for your response. I am forwarding this email to DOE / ORNL NEPA Compliance to serve as official consultation with the TWRA for the SIPR-C project.

Many thanks for your assistance with this consultation.

Evin Carter, PhD
Wildlife Ecologist | ORNL
[redacted]

From: Vincent Pontello <Vincent.Pontello@tn.gov>
Sent: Friday, February 25, 2022 8:22 PM
To: Carter, Evin <cartere@ornl.gov>
Subject: [EXTERNAL] Re: SIPRC EA - TWRA consultation

Dr. Carter,

Thank you for the updated information and species recommendations. I concur with your comments and they will satisfy the needs of the TWRA. Please contact me if you need further assistance.

Vincent L. Pontello
Assistant Chief, Biodiversity Division, Aquatics Program
Tennessee Wildlife Resources Agency
464 Industrial Blvd.
Crossville TN, 38555

2

2019 to present, suggest that most egg deposition on the ORR occurs in March and April. Nest-guarding continues as late as June. Accordingly, *we recommend that sweeps and potential relocations of breeding four-toed salamanders be performed prior to egg deposition (i.e., beginning in late January) wherever future disturbance is expected.*

ORNL Natural Resource Management's Wildlife Management Task can commence sweeps now even if disturbance isn't expected until next year. This should help save time for all parties and ensure we reduce impacts to the extent possible.

Thanks,

Evin Carter, PhD
Wildlife Ecologist | ORNL
[redacted]

From: Carter, Evin <cartere@ornl.gov>
Sent: Thursday, February 24, 2022 10:35 AM
To: Ryan Jr, Ernest <ryaneljr@ornl.gov>; Doty Iv, Thomas <dotytw@ornl.gov>
Cc: Giffen, Neil <giffennr1@ornl.gov>; Skipper, David <skipperdd@ornl.gov>; Goddard, Wesley <goddardwd@ornl.gov>; Barber, Caroline <barbercs@ornl.gov>; Vincent Pontello <Vincent.Pontello@tn.gov>
Subject: [EXTERNAL] Re: SIPRC EA - TWRA consultation

Vincent,
Regarding TWRA consultation for the SIPR-C project, could you please review the email below and advise if TWRA concurs with these recommendations?

Many thanks,

Evin Carter, PhD
Wildlife Ecologist | ORNL
[redacted]

From: Carter, Evin <cartere@ornl.gov>
Sent: Thursday, February 24, 2022 10:03 AM
To: Ryan Jr, Ernest <ryaneljr@ornl.gov>; Doty Iv, Thomas <dotytw@ornl.gov>
Cc: Giffen, Neil <giffennr1@ornl.gov>; Skipper, David <skipperdd@ornl.gov>; Goddard, Wesley <goddardwd@ornl.gov>; Barber, Caroline <barbercs@ornl.gov>
Subject: SIPRC EA - TWRA consultation

Hi Ernest and all,

Vincent Pontello (Tennessee Wildlife Resources Agency - TWRA) and I discussed comments provided by the TWRA for the SIPR-C project, specifically as they related to the four-toed salamander. Here are the arrived upon recommendations. **I am cc'ing Mr. Pontello here to confirm the TWRA's concurrence with the following**:

- ORNL monitors four-toed salamanders (*Hemidactylium scutatum*) on the Oak Ridge Reservation (ORR) as part of the ORNL Wildlife Management Task, and this monitoring will continue periodically at the SIPR-C site and others to inform construction activities and reduce impacts where possible.
- We recommend that disturbance to streams and areas with wet/moist soils (especially those containing terrestrial mosses) be avoided *where possible* during the breeding season of four-toed salamanders, which occurs from January through June (these dates can vary by year and breeding site).
- *If disturbance cannot be avoided during the period of January through June*, species sweeps will be performed by the ORNL Wildlife Management Task in suspected breeding habitat *immediately prior to any disturbance*.
- Additionally, four-toed salamanders are at higher risk but most easily located during the egg deposition and nest-guarding phase in and around aquatic environments that are partially lined by terrestrial mosses. Observations by the ORNL Wildlife Management Task, occurring from

Department of Energy
Office of Science
ORNL Site Office
P.O. Box 2008
Oak Ridge, Tennessee 37831-6269

March 6, 2022

Mr. Daniel Elbert
Field Supervisor
U.S. Fish and Wildlife Service
South Atlantic-Gulf Interior Region
Tennessee Ecological Services Field Office
446 Neal Street
Cookeville, Tennessee 38501

Dear Mr. Elbert:

DESCRIPTION OF THE PROPOSED STABLE ISOTOPE PRODUCTION AND RESEARCH CENTER (SIPRC) PROJECT

The SIPRC project is being proposed for construction and operation on the Oak Ridge National Laboratory campus in East Tennessee. This project will require removal of approximately 10 acres of trees. Acoustic surveys for bats indicate that portions of the area may be used by gray bats (*Myotis grisescens* - Federally listed Endangered), little brown bats (*Myotis lucifugus* - under consideration for Federal listing and State listed Threatened), and tricolored bats (*Perimyotis subflavus* - under consideration for Federal listing and State listed Threatened), most likely for foraging or traveling to foraging grounds. Very low numbers of calls were recorded for Indiana bats (*Myotis sodalis* - Federally listed Endangered) and northern long-eared bats (*Myotis septentrionalis* - Federally listed Threatened). Low numbers of calls for all listed species were recorded within the footprint of the SIPRC building (see attached report for details).

The SIPRC project area is located near the base of the north slope of Haw Ridge. Paved roads, parking lots, buildings, and other structures border the project area to the north, east, and west. The southern border is a steam line right-of-way and, south of that, mature forest. The Department of Energy (DOE) has determined that removal of trees on the project site is not likely to adversely affect bat species which are currently Federally listed or under consideration for Federal listing.

Based on the results of on-site surveys conducted in 2019 and 2021, most birds under protection of the Migratory Bird Treaty Act known to frequent the site would nest between April 1 and October 30. Surveys will be conducted for early nesters (February 1 through March 31) prior to any proposed clearing on the site. Clearing trees from the SIPRC project area would be conducted between November 15 and March 31 to avoid seasons when bats and birds are roosting or nesting. DOE is also reaching out to the Migratory Bird Permit Office with U.S. Fish and Wildlife Service for further guidance on migratory birds.

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DOE is seeking your concurrence with the information provided herein and/or advice for the next steps needed for the SIPRC project to move forward, including whether a mitigation plan is needed. Thank you for your consideration.

If there are any questions or additional information required, please contact Walt Doty at (865) 576-7321 or dotytw@ornl.gov.

Sincerely,

Johnny O. Moore, Manager
ORNL Site Office

Enclosure

cc w/enclosure:
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