

Ecological Support for Environmental Assessment for the Expansion of Idaho National Laboratory's National Security Test Range and the Radiological Response Training Range. Rev 1.

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August 1, 2017

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1. Introduction

NSTRX

The U.S. Department of Energy (DOE) proposes to modify and add to the established National and Homeland Security Test Range (NSTR) at the Idaho National Laboratory (INL) Site. This expansion of the R&D range will support DOE's requirement to protect its critical assets and to provide assistance to National and Homeland Security. The expanded range will be used for a variety of research projects including explosive effects, in situ explosive detection and ballistic penetration. The expansion of the NSTR facility (NSTRX) would consist of an additional test bed/circle, downrange target area with berm and road, modified range safety fan/impact zone, equipment laydown/construction area, a permanent administrative/data acquisition area which would include buildings, potable water, commercial power and septic systems, and improvements to and an alternate access road.

The purpose of this report is to evaluate the potential impacts to ecological resources including threatened, endangered and sensitive species due to construction and operation of the NSTRX.

The information found in the following sections, 1.1 and 1.2 was directly provided by the National and Homeland Security Organization.

1.1 *The Preferred Alternative*

Because this is an addition to and modification of an existing project and will occur in the same general location, there are no other alternatives described in this report. In addition, some ecological data was collected outside the growing season and will therefore include a number of assumptions. The description of the Affected Environment and the analysis of the Environmental Impacts provided in this report are therefore limited by these assumptions.

Alternatives:

The following alternatives were evaluated:

Establishing the downrange target area south of the current test pad

This option was rejected because of the severe terrain features. Targets simply could not be seen at the distances needed.

Moving the firearms down range and shooting toward the observation point

This is not feasible because weapons would be directed toward populated areas (the second laydown area). In addition, the safety buffer is not great enough. From the observation point to the north range safety perimeter it is approximately 2,154 yards (1970 m).

Constructing/utilizing facilities at MFC

For the past nine years, since the development of the NSTR, range personnel have not had a reason to utilize facilities at MFC. MFC is located approximately 7 miles (11 km) away from the NSTR. It is impractical and would be time consuming to travel this distance down a dirt road several times a day.

Firing downrange at other ranges on the INL

Utilizing other firing ranges at the INL (CFA Live Fire Range or the MFC Range) is not feasible for several reasons. First, there is not a way to securely conduct sensitive tests at either of the Laboratory Protection ranges. The NSTR's remote location, ability to block access and ability to monitor the surroundings allows sensitive tests to be conducted in a secure manner. Testing could include a new weapon system or components, testing targets or both. Second, the variety of weapons used at the NSTR is greater than what can be used at the other on-site ranges. Finally, the INL Protective Force must meet its training and qualification requirements. In total these activities consume about six months of range time per year. In addition, the INL has agreements with NRF and other agencies to use these other ranges. Limited range time would impact N&HS operations.

1.2 Project Description

The NSTR is located north of Idaho National Laboratory's (INL's) Materials and Fuels Complex (MFC). The environmental impacts of constructing and operating the existing NSTR were evaluated in the "Final Environmental Assessment for the National Security Test Range and Finding of No Significant Impact" (DOE/EA-1557 April 2007). The requirements of the Environmental Assessment (EA) were implemented in environmental checklist (EC) INL-07-016 and two revisions to the EC. This EA evaluates adding capabilities at NSTR to meet the needs of customers and an increasing business base.

The following activities form the proposed action for adding capabilities at NSTR, and are discussed in greater detail later in the document:

1. Creation of a new, separate 900-ft (274 m) diameter circle with addition of a new road leading from the existing observation area to the new pad/circle. See Figure 1. (Note that the road leading to the new pad is not complete on Figure 1. The final route will be determined once the weather allows. The area has been surveyed.)
2. Firing rocket-propelled grenades (RPGs) and other live warheads on the current test pad.
3. Move the administrative buffer area north and west. The northern perimeter arch will move approximately 450 yards (411 m) to the north. The southwest corner will move to the west approximately 1,265 yards (1,157 m) and angle back toward the existing administrative buffer area as one heads north (forming a triangular shape). See Figure 2.
4. Installation of support infrastructure including permanent office and work buildings, commercial power, potable water and septic system.
5. Build a downrange target area within the Administrative Buffer Area. This would include a new road and construction of several target locations at distances up to 3,281 yards (3,000 m). See Figures 1 and 3.
6. Conduct portions of work described in DOE/EA-1776, Idaho National Laboratory Radiological Response Training Range (RRTR) Environmental Assessment at the NSTR. Additional isotopes are proposed. Work includes use of explosives to disperse radioactive materials and use of projectile devices and explosives to disable improvised devices. Encapsulating foam and gel blocks would also be employed.
7. Conduct training activities including use of sealed radioactive sources, X-ray

- radiography, explosive disablement of simulated improvised devices, and release of short-lived radionuclides at indoor locations, e.g., inside of a cargo container.
8. Conduct ballistic projectile testing at the 2nd laydown area.
9. Use Unmanned Aerial Vehicles (UAVs), including delivery of payloads to ground-based test articles on the range.
10. Alternative access to T-25 near MFC. See Figure 4.
11. Creation of a ballistic firing point on the access road to the new test pad/circle.
12. Changing the “priority” of T-25.

Creation of a New 900-Ft (274 m) Diameter Circle

The current test circle is insufficient to accommodate future customer needs. Examples include: (1) the release of short-lived radionuclides would result in an exclusion zone for up to a month, preventing other routine range activities; (2) extended preparation for one test program has the potential to hinder or prevent other routine range activities; and (3) existing data collection equipment and test infrastructure would require removal prior to conducting large detonations to avoid damage. The proposed action is to construct a new test circle north and east of the current circle. The new test circle would be cleared of vegetation to mitigate the potential for fire caused by explosives and hot, fragmented metal. An access road would be constructed from the current safety observation point to the new test circle. The new road would be constructed in a similar manner as the existing road on the NSTR and be considered a (priority 2) graveled access road. The two test circles would not be directly connected to one another by a road. The limit of 20,000 Net Explosives Weight (NEW) would be retained and would include both locations. Table 1 identifies the frequency of explosives use identified in the 2007 EA and the use in the proposed action.

Table 1. Proposed operational changes

Operational Activities from DOE/EA-1557	Proposed Operational Activities
Large explosive events (11,000-20,000 lb NEW) are expected to occur once every five years.	No change
Mid-test range events (3,000-11,000 lb NEW) are expected to occur once or twice a year.	5 times per year
Small events (100-3,000 lb NEW) could occur once per month.	5-8 times per month
Very small events (less than 100 lb NEW) could occur weekly.	Daily
Not specifically addressed.	RPGs and other live warheads may be fired 24 days annually on the original test pad and at the downrange target area.
Small scale projectiles (30 mm or less) would probably be fired on a bi-weekly basis	10 days per month
Large projectiles (>30 mm to 120 mm) would probably be fired three or four times per year.	Increase maximum projectile size to 155 mm. 24 days annually

Cartridge fired weapons would not be tested or used on the new test pad/circle. RPGs or other warheads would not be fired on the new test pad/circle. Soil sampling will be conducted on this pad every 5 years similar to the requirements established in DOE/EA-1557. Sampling would determine soil concentrations of explosives, explosive residues and radionuclides/decay products.

Firing RPGs and other warheads on the current test pad

In addition to firing live RPGs and other warheads on the new downrange target area, these items would be fired on the current test pad. They would be flown at targets placed in front of the berm, pointed toward the administrative buffer area but not leaving the current test pad.

Move the administrative buffer area

It will be necessary to move the north perimeter arch of the administrative buffer area approximately 450 yards (411 m) to the north to ensure the safety of non-NSTR personnel in the area. The west side of the administrative buffer area will be moved to the west to encompass the new firing range surface danger zone. The danger signs will be placed after a survey of the area has been conducted so that all culturally sensitive areas can be avoided. See Figure 2.

Installation of Support Infrastructure

The NSTR has utilized portable and mobile generators for electricity, an 18-wheeler trailer as an office, portable sanitary facilities and bottled water. This approach is inconsistent with personnel protection during inclement weather, training activities, and satisfactory sanitary practices. Proposed infrastructure improvements include permanent office and work buildings, connection to commercial power, potable water and waste water disposal, e.g., septic system. Commercial electrical power would be supplied by the MFC substation via a new 13.8 kV line and new poles from MFC to the NSTR. Data cables (telephone, fiber, etc.) may also be routed along the new power poles. The new poles would be installed parallel to and approximately 50 feet (15 m) to the west of the existing 138 kV line from MFC to the NSTR. Office and work buildings may be erected at one or both of the lay-down areas. The size of the lay-down area may be increased to accommodate infrastructure improvements. The buildings would include permanent foundation-based buildings and/or portable and mobile trailer-based units. Water wells, storage tanks and well houses would also be installed at one or both locations. The wells would serve a non-transient, non-community potable water system and would be the source for fire suppression systems, potable water and sanitary facilities. Waste water would be discharged to a sanitary system such as a septic system in one or both laydown areas. It is not anticipated that a building larger than 10,000-15,000 square feet (3,048-4,572 sq. m) will be constructed. Buildings may contain offices, classrooms/conference rooms, kitchens, restrooms/locker room facilities, laboratories, machine shops and or high bays. Sleeping facilities/bunk rooms will not be provided. Power may be routed to the second laydown area, either or both test pads, or along the downrange target area. Should power be routed past the first laydown area it will need to be buried.

Signal cables may also be buried from either or both pads and/or the downrange target area to the new building(s). To the greatest extent possible, power and signal cables will be buried along the existing road and new roads proposed in this EA.

Build a Downrange Target Area within the Current Administrative Buffer Area

Current range operations allow firing non-explosive and non-incendiary ballistic rounds and non-explosive rocket-propelled rounds across the range and into an earthen berm. Rounds that accidentally miss the berm enter an 8,749 yard (8,000 m) administrative buffer area. The proposed action would install a 3,281 yard (3,000 m) firing range within the administrative buffer area south of the observation point. Requirements identified in the Department of Energy (DOE) *Range Design Criteria*, June 2012, will be followed. Engineering controls will be used when the

ammunition/projectile being fired exceeds the surface danger zone. A shooting “bunker” (protective shelter) will be placed at the observation point. A trenched/below grade firing position may also be installed at this location.

The new range would include several target locations. A new road, which will be cleared of vegetation and may be graveled, will provide access to the target locations. This road, which will be routed through each of the target locations, may also serve as a flight path as deemed appropriate. The new downrange target area would allow testing of ballistic and rocket-propelled incendiary and explosive rounds with a maximum effective range of 3,281 yards (3,000 m). The first 300 yard (274 m) down range section (150 feet (46 m) wide) will be cleared of vegetation and may be graveled. Most grenades would be fired in this cleared area. However, some grenade launchers can fire up to 1,640 yards (1500 m). To allow for testing of yet to be developed weapons, warheads may be shot out to the full 3,281 yards (3,000 m). It should be noted that there is a 100% accountability requirement for all explosive ordnance. Should an item fail to initiate LI-438, *Clearing Explosive Items that Failed to Function as Designed on the NSTR and RRTR* will be followed. Target areas will be placed at approximately 100 yards (91 m), 200 yards (183 m), 300 yards (274 m), 400 yards (366 m), 500 yards (457 m), 750 yards (686 m), 1,000 yards (914 m), 1,610 yards (1,472 m), 2,260 yards (2,067 m), 2,760 yards (2,524 m), and 3,281 yards (3,000 m). Each target area, excluding the two southernmost, will be 150 feet (46 m) x 50 feet (15 m). (It should be noted that the first few target areas will be within the cleared area.) The southernmost target area will be a 500-foot (152 m) diameter circular pad. Radiological response training activities, including explosive dispersal of radioactive material, discussed below, may be conducted on this pad. The second southernmost target area, at 2,760 yards (2,524 m), will be 150 feet (46 m) by 150 feet (46 m) and may also be used as a command area for radiological response training activities. If needed, the target areas may be cleared of vegetation and graveled. Concrete pads, a rail/track, and a variety of targets may be placed at each of the target locations. Conex containers and other equipment associated with the radiological response training may be temporarily placed at the target areas. In addition, an 80 ft x 80 ft (24 m x 24 m) storage pad, cleared of vegetation and possibly graveled, will be placed along the road between the 2,760 yards (2,524 m) and 3,281 yards (3,000 m) target locations (final location TBD). Digging will take place as necessary to facilitate target construction or mechanism protection. Berms or other mitigation measures may be placed in the target areas as needed to meet safety requirements for specific types of ammunition. (These will be addressed in Laboratory Instructions (LIs).) Consistent with the 2007 EA, no depleted uranium (DU) rounds would be fired. No DU containing targets will be damaged to the extent that DU is released to the environment. Non-explosive projectiles not caught in the target will not be collected as there would be no way to locate them. Power and/or signal cables may be buried alongside of the road/target areas down the entire length of the range 3,281 yards (3,000 m). Mitigations will be put in place to address items with a high fire danger, like tracer rounds. An example of a mitigation would be to limit the use of tracer rounds to periods when the fire danger is very low, such as during winter months.

Explosive Dispersal of Radioactive Materials and Additional Training Activities at the NSTR

Portions of work described in DOE/EA-1776, Idaho National Laboratory Radiological Response Training Range Environmental (RRTR) Assessment, would also be conducted at the NSTR at the proposed new 900 ft (274 m) diameter pad and at the proposed downrange location. This work would include explosive dispersal of short-lived radionuclides for the purpose of training

personnel responsible for response to radioactive dispersal and improvised nuclear devices. The proposed modification would allow explosive dispersal of short-lived radionuclides, such as KBr, and others not analyzed in DOE/EA-1776 including, KO, LaBr, Cu-64 and Zr-97 for personnel response training. There will be a maximum of twelve dispersals per compound/isotope per year. Managing explosives at the designated RRTR locations has been shown to limit some training activities. For example, explosives must be transported the day of use which causes reduced training time for that day. In addition, the RRTR site is limited to 1 lb TNT equivalent. Incorporation of radioactive material dispersal at the NSTR would improve the quality and quantity of training. This training is expected to take place no more than 12 times per year.

Additional training activities would include use of sealed radioactive sources, X-ray radiography, explosive disablement of simulated improvised devices, and release of short-lived radionuclides at indoor locations, e.g., inside a cargo container. This training has been performed at the NSTR under Environmental Checklist INL-12-106 (OA 17) and subsequent revisions. Training activities would include the use of sealed radiological sources for creation of radiation fields and X-ray radiography training using an assortment of different packages, containers and training aids.

The proposed exercises include contamination control techniques utilizing short-lived radioisotopes. When sealed radiological sources are used in training aids for radiography training purposes, these sources will be removed prior to executing a render-safe procedure such as a Percussion Actuated Non-Electric (PAN) disrupter shot or explosive charge. Render-safe procedures for exercises involving radioactive contamination would be limited to hands-on techniques (i.e., no disruption with a PAN or explosive). During contamination control training, contamination would only be dispersed indoors at the NSTR. Indoor radioactive contamination areas would be created utilizing a short-lived medical isotope (e.g., Ga-67, Tc-99m, etc.).

INL supports training personnel, technology evaluation and demonstration for federal agencies responsible for the U. S. nuclear forensics mission. To maintain this capability, national security agencies need to conduct exercises in controlled radiological environments. Responders to any major radiological incident must be able to use a variety of specialized equipment in an effective, timely and integrated manner to characterize the event.

The following activities are proposed in support of radiological response training at the NSTR. The NSTR site will be used to train personnel, test sensors, and develop detection capabilities (both aerial and ground-based) under a variety of scenarios using sealed and unsealed radioactive sources and dispersed radioactive material. Training would include evaluation of command and control protocols, site characterization with ground and aerial surveys and remote radiation measurements.

1. Use of sealed radioactive sources and radiation emitting devices.
 - a. Perform radiography measurements on targets using x-ray and gamma ray radiation producing equipment such as portable x-ray generators, Betatrons and sealed radioisotope sources.
 - b. Produce radiation fields for training and exercise that emulate pre and post radiological dispersal device and improvised nuclear device radiation environments.

- Sealed sources include ^{137}Cs , ^{60}Co , ^{192}Ir , ^{75}Se , ^{226}Ra , and isotopes of U, Pu, Am, and Th. Source strengths will vary from micro-curies to approximately 200 Ci depending on the isotope.
- c. General handling of radioactive sources to establish training scenarios.
2. The use of sol-gels at indoor and outdoor locations. Sol-gel is described in the RRTR section (see Page 13).
 3. Dispersal of short-lived isotopes.
 - a. Large area dispersal will take place using up to 5.0 lbs of high explosives (HE), liquid spray using a mechanical sprayer and dry spreading using a mechanical spreader. Exercises will be conducted by personnel to test their methods and protocols to locate and establish radiological boundaries, identify dispersed radionuclides, collect samples of dispersed radionuclides distributed within the training range areas, transport collected material to field analysis stations, assay of materials and donning and doffing of PPE. Ground dispersal of up to 100 yards (91 m) from the detonation site would be useful for ground-based detection. The following activities per compound/isotope will be dispersed for any one exercise. It should be noted that the use of two sources during a single training evolution may occur. Actual sources that these surrogates represent come in many material forms. A dual-source dispersal represents a realistic RDD scenario. One example would be a dual-source dispersal using KBr and Cu-64 pellets.
 - 5 curies of KBr
 - 7 curies of KO
 - 1 curie of LaBr
 - 3 curies of Cu-64
 - 10 curies of Zr-97
 - 5 curies of F-18
 - b. Use of aerial detection capabilities; helicopters and unmanned drones. Aerial assets will be outfitted with detection capabilities to map radioactive ground dispersal following large area dispersals. Ground dispersals of up to 167 yards (153 m) from the detonation site would be useful for aerial detection systems.
 - c. Containment training utilizing foam or gel-block containment as a method of minimizing dispersal of radioactive material and projectiles during disablement activities. A maximum of 100 gel blocks 8"x9"x16" (0.203 m x 0.229 m x 0.406 m) in size may be used for a single training event. In addition, foam containment may include the use of 8-foot (2.4 m) per side fabric cubes or 16 feet (4.9 m) and 30 feet (9.1 m) diameter fabric domes filled with foam. Teams will investigate the radioactive dispersal device (RDD) and devise a method of disablement. Sealed radioactive sources will be removed from the RDD prior to disablement exercises. Dispersible radioactive isotopes may be left within the RDD as part of the exercise. The RDD will then be covered with either gel-blocks or foam containment and the disablement will be carried out. Once disablement activities have been completed, surveys of the external area will be evaluated. If foam containment is used, the remaining RDD will be evaluated after the foam has been allowed to dissipate (typically 1-3 days). The following activities per isotope will be dispersed for any one

containment exercise. (It should be noted that clients may request the use of two sources to be used during a single training event. However, this is very unlikely.)

- 5 curies of KBr
 - 7 curies of KO
 - 1 curie of LaBr
 - 3 curies of Cu-64
 - 10 curies of Zr-97
 - 5 curies of F-18
- i. Use of disablement tools such as shaped charges “Stingrays” or EOD PAN Disrupters during containment training exercise.
- d. Use of radioactive ballistic particles. Exercises would be conducted to mimic radiological fragmentation. Of particular interest to medical first responders is fragmentation that has entered gel-dummies (surrogate human bodies). The dispersion will be ballistic and not a radioactive plume as with KBr. Ballistic particles have a defined range, on the order of hundreds of yards or less. A maximum of three curies of Cu-64 pellets will be dispersed for any one exercise. This activity may occur up to 12 times per year.

For all activities listed above, support equipment may include items such as radios, generators, and cargo containers. Command tents may also be erected as required. Some items, such as cargo containers for radioactive debris, may remain in this area. In addition, each training exercise could include up to approximately 100 people and 15 - 20 vehicles.

A command area will be constructed to support these activities. This will be a (approximately) 150 feet (46 m) by 150 feet (46 m) pad cleared of vegetation and possibly graveled. The pad will be approximately 400 yards (366 m) south of the new explosives pad along the new access road. See Figure 1. Overflow parking is available at the observation point or at each of the laydown areas.

Additional Ballistic Testing

Testing of ballistic projectiles is currently allowed on the 900-ft (274 m) test range. The proposed action would allow testing of projectiles up to 30 mm at the 2nd laydown area. Pre-fabricated concrete culverts, or similar, would enclose a new firing line so testing could be conducted during inclement weather. It is estimated that the ballistic tunnel will be approximately 13 feet x 197 feet (4 m x 60 m) but this is subject to change provided other requirements (i.e., fire break) are met. The far end of the culvert would be covered with an earthen berm to collect projectiles. The earthen berm would be located within the current administrative buffer area.

Use of UAVs

Vulnerability testing of critical infrastructure components is an important part of protecting critical infrastructure. UAV operations would consist of flights with sensors and/or cameras (i.e., data collection devices), inert materials, chemicals, and explosive or flammable materials.

Each chemical will be evaluated with quantities limited to less than that which would require a Clean Air Act (CAA) Permit to Construct. (Projects will be assessed and air and water modeling

will be conducted as needed prior to testing.) In addition, chemical dispersal will not exceed CERCLA reportable quantities.

UAVs capable of delivering explosive or flammable material to ground-based targets would be tested at the NSTR. UAVs carrying explosive or flammable material will be tethered to prevent them from leaving the test pad. (Other control mechanisms, yet to be developed/identified, may be used as an alternative to tethering if proven equally as effective.)

UAVs with explosive or flammable material would only be flown if a thorough analysis indicates that the work can be performed safely within the controls identified. Safety considerations associated with this work would be addressed in the work control process.

Alternative access to T-25

Transient testing at the TREAT facility, scheduled to begin in FY 2018, initially required an 833-yard (762 m) radius exclusion zone around the reactor. This exclusion zone included a portion of T-25, see Figure 4. This testing had the potential to impact NSTR operations and access to T-25 by other organizations. Improving approximately one mile (1,609 m) of an existing two-track around the exclusion area appeared to be the best option to ensure work could be conducted by all parties. SAR-420, “Transient Reactor Test (TREAT) Facility FSAR,” was approved reducing the exclusion area. While there are no immediate plans to utilize this alternate route, future TREAT operations may impact T-25 so maintaining this alternate route in the analysis is still appropriate.

Creation of a ballistic firing point on the access road to the new test pad/circle

The surface danger zone (maximum range of the projectile plus a safety margin) for some ammunition may exceed 8,749 yards (8,000 m). If that situation occurs, the hazards will be analyzed and mitigations will be put in place via the LI process, to ensure personnel safety. Mitigations would be situation dependent and could include the construction of baffles or berms (in disturbed areas), the placement of other barriers, and/or using frames to limit the range of motion of the weapon. Alternatively, additional distance could be gained by moving the firing point north. A firing point may be established on the road to the new test pad. This would be a temporary firing point, i.e., no permanent construction. A firing point at this location would necessitate other personal safety requirements, which would be addressed in a LI.

Additional information on weapons used

While all weapons/devices used at the NSTR now and in the future cannot be identified additional information is being provided to improve clarity. For example, while not specifically listed, hand-thrown grenades will be used. Personnel safety requirements will be addressed in the LI process. Simulated explosives and weapons, like flashbangs and marking cartridges, in addition to blank rounds will be used. Non-lethal (or less than lethal) weapons may also be tested at the NSTR.

Upkeep of the Range Safety (Danger) Signs

Evaluate the NSTR safety (danger) signs annually to ensure that they remain in good condition. This will be done by driving a pick-up truck around the perimeter of the administrative buffer area in the spring (once the ground has dried out, before significant vegetation growth). In addition, the safety signs will be evaluated and replaced as needed after a wildland fire. The

pick-up truck may also be used to move the signs should this action be approved.

Changing the Priority of T-25

T-25 is designated as a Priority 3 unpaved road in environmental checklist INEL-02-024, *Maintaining Unpaved Roads on the INEEL*. “Priority 3 roads are two-track roads that provide access to wildland fires. Maintaining Priority 3 roads consists of filling pot holes by dumping gravel fill material in hole and/or rut and using the dump vehicle to level and compact fill by driving back and forth over new material, and using a hand rake or shovel, if necessary.”

DOE/EA-1557 allowed the project to “Widen and gravel road T-25 from MFC to the Test Range (6.7 miles) to accommodate the increase in traffic and make maintenance easier to complete.” As the NSTR will remain operational for the foreseeable future and other organizations utilize this road, Facilities and Site Services is seeking to change T-25 to at least a Priority 2 road regardless of the outcome of this EA. Priority 2 unpaved roads are project access roads that are maintained as passable, graveled and graded as needed.

Incorporation of the Annual NSTR Project Led Sage-grouse Survey into the Annual INL-wide Sage-grouse Population Survey

The current NSTR EA requires an annual sage grouse population survey. These surveys have been conducted for nine consecutive years and show no impact on sage grouse populations in the vicinity of the range. The proposed action would remove requirements for the annual NSTR survey and would supplant it with the annual INL-wide sage grouse population survey.

1.2.1 Facilities

The R&D Range will be located at about 5 mi (8.0 km.) north of MFC at approximately 112° 41’ 44”W and 43° 41’ 40”N (Figure 1). Access to the NSTRX will be from MFC on T-25 and will include the following:

New Explosives Test Circle/Pad

- Remove vegetation from the new 900-ft (274 m) diameter test circle/pad.

New Access Road and Command Area

- Construct a new gravel road from the observation point to the new test circle/pad; following land contours to the extent practicable.
- Clear the vegetation from and gravel an area approximately 150 feet (46 m) x 150 feet (46 m) a minimum of 400 yards (366 m) south of the new test circle/pad.

Modify Administrative Buffer Area

- Relocate the warning signs along the north safety perimeter arch approximately 450 yards (411 m) further north.
- Relocate the signs along the western perimeter to the west.
- Add additional signs as needed to ensure that the signs are no more than 300 yards (274 m) apart.

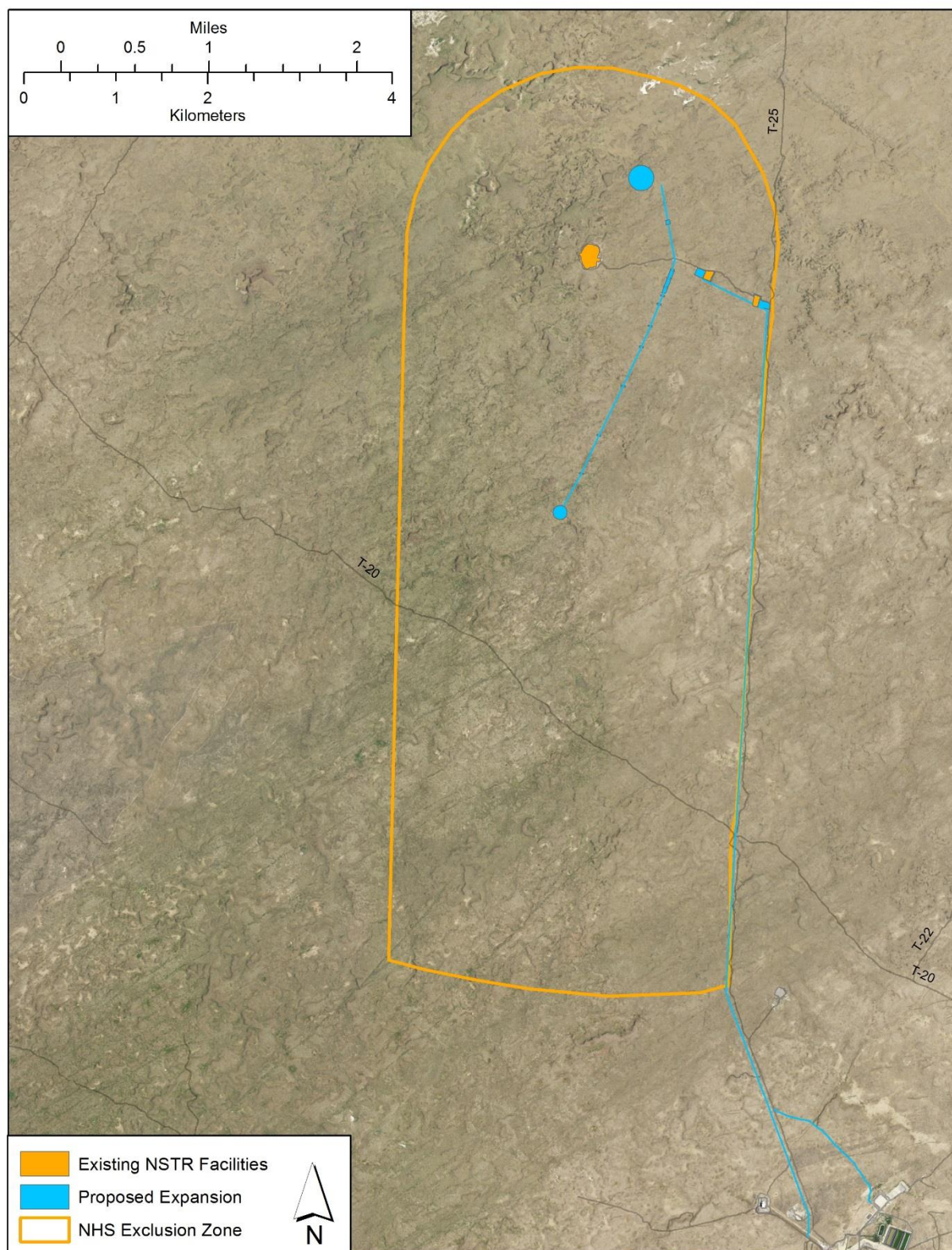


Figure 1. Location of National Security Test Range expansion in relation to existing structures.

Install Utilities

- Install a new above-ground 13.8 kV power line from the MFC substation to the first laydown area at the NSTR. The new poles would be parallel to and approximately 50 feet (15 m) to the west of the existing 138 kV line.
- Install electrical equipment, i.e., transformer, as needed in the first laydown area.
- Bury power cables immediately adjacent to the existing and new roads, when possible, to route power to the various locations (second laydown area, observation point, command area, either or both test pads, and to each of the target locations).
- Drill a well at either or both of the laydown areas.
- Route water to the building(s).
- Determine if water should be piped from one laydown area to the other. If so, bury the pipe immediately adjacent to the road.
- Install a septic system at either or both of the laydown areas based on the location of the new buildings.

Construct or Install New Buildings

- Construct new buildings or place manufactured buildings in either or both laydown areas.

Downrange Target Area

- Clear the vegetation from and possibly gravel a (approximate) 300-yard (274 m) by 150 feet (46 m) area south of the observation point.
- Construct a new gravel road from the observation point generally south southwest 3,281 yards (3,000 m); following land contours to the extent practicable. The road will pass through or be immediately adjacent to the target areas.
- Identify 150 feet (46 m) x 50 feet (15 m) target areas at:
 - 100 yards (91 m)
 - 200 yards (183 m)
 - 300 yards (274 m)
 - 400 yards (366 m)
 - 500 yards (457 m)
 - 750 yards (686 m)
 - 1,000 yards (914 m)
 - 1,610 yards (1,472 m)
 - 2,260 yards (2,067 m)
 - 2,760 yards (2,524 m)
 - 3,281 yards (3,000 m)
- As needed, clear target areas of vegetation and gravel or pave.

Construct a Ballistic Tunnel in the Second Laydown Area

- Construct a ballistic tunnel approximately 13 feet x 197 feet (4 m x 60 m) at the second laydown area. The rear of the tunnel will be pointed into the administrative buffer area. The rear of the tunnel will be blocked to prevent projectiles from traveling down range.

- Remove vegetation as necessary to create a fire break, 30 feet (9.1 m), around the tunnel.

Alternative Access to T-25

- Blade and gravel the existing two track from approximately 467 yards (427 m) north of MFC North West to T-25.

1.2.2 Operations

General Activities

- Coordinating all testing with INL Site personnel and activities that could be affected
- Notifications to state and local law enforcement and surrounding communities for tests of 3,000 lb NEW or larger.

Testing Activities

- Testing may include explosive effects, ballistic penetration, and explosive detection at the following levels of use:
 - The test range would be used most working days from March through November.
 - Use between December and February is expected to be sporadic.
 - Large explosive events, 11,000 – 20,000 lb NEW, are expected to occur once every five years.
 - Mid-test range events (3,000 – 11,000 lb NEW) are expected to occur five times a year.
 - Small events (100 – 3,000 lb NEW) could occur five to eight times per month.
 - Very small events (less than 100 lb NEW) could occur daily.
 - RPGs and other live warheads will be fired approximately 24 days annually.
 - Small scale projectiles (30 mm or less) would probably be fired ten days per month.
 - Large projectiles (>30 mm to 155 mm) would probably be fired approximately 24 days annually.
 - UAV flights may be conducted ten days per month. (Note that not all UAV flights will be explosive laden.)

RRTR

In October 2010, work described in DOE/EA-1776, “Idaho National Laboratory Radiological Response Training Range Environmental Assessment,” was approved. The requirements of the EA were implemented in EC INL-12-106 and four revisions to the EC as well as EC INL-16-038 which modified the allowable wind speed and added the use of foam and gel blocks.

The RRTR has two locations a north training area, encompassing the area around the T-28 gravel pit north of SMC and the south training area which is located south of RWMC (Figure 2).

Alternatives:

The action proposes to enhance capabilities at the same locations.

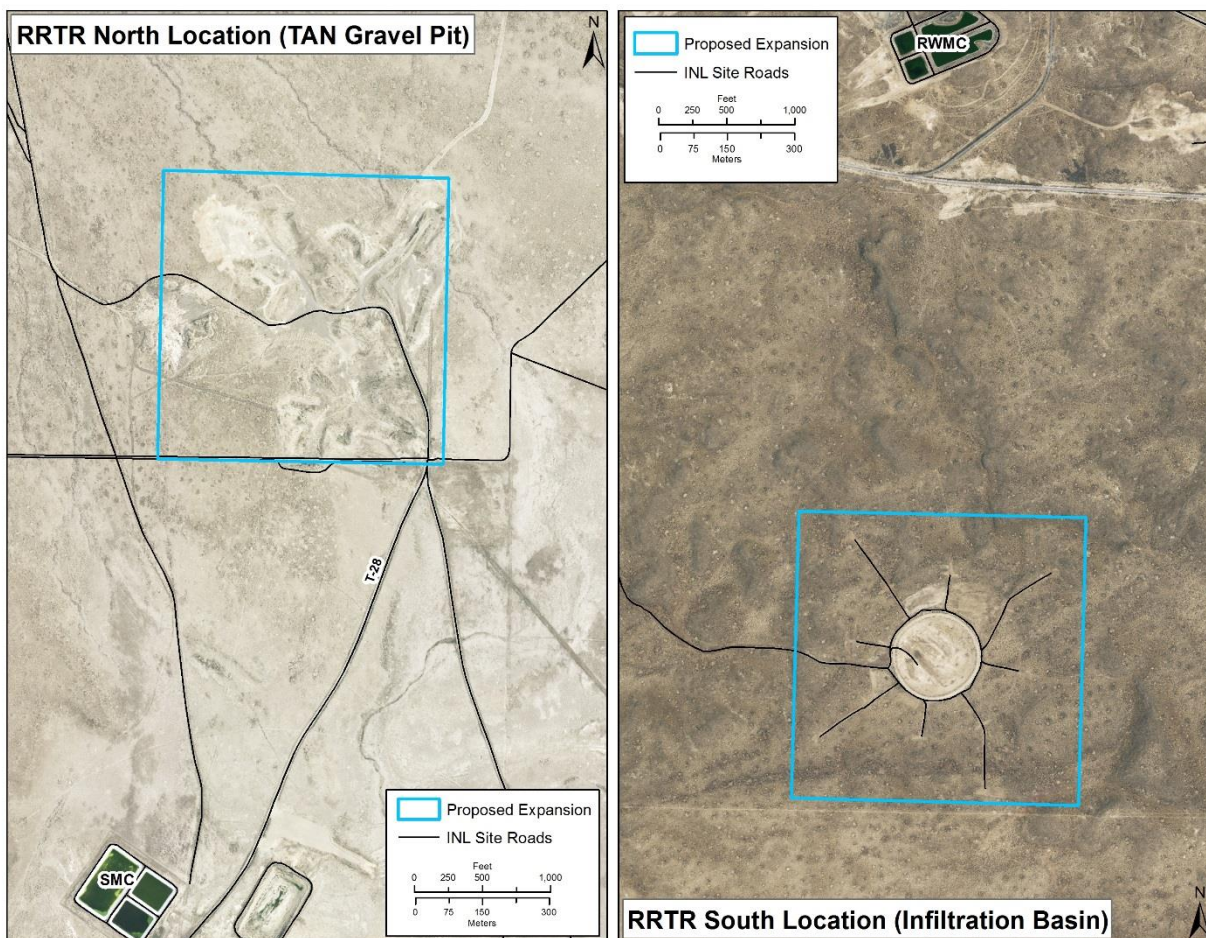


Figure 2. Location of Radiological Response Training Range in relation to existing structures.

The following activities form the proposed action for adding capabilities at RRTR, and are discussed in greater detail later in the document:

1. The addition of new short-lived radionuclides.
2. The use of sol-gels.
3. Installation of a fence around the north and south training ranges.

Current Operational Activities	Proposed Operational Activities
12 dispersals annually using KBr at north and south range	Multiple dispersals annually at north and south range of short-lived radionuclides (KBr, KO, LaBr, Cu-64, Zr-97), more than one radionuclide may be used at a time – includes ballistic particle dispersals. The total Curie levels will not be exceeded no matter how many dispersals are done.
Use of sealed sources	No change
Addressed in EC 16-038	Use of foam and gel blocks for render safe training 12 times per year
Not currently addressed	12 non-explosively dispersed sol-gel materials containing short-lived radionuclides (Sc-44m, Te-132, Ba-140) annually
Not currently addressed	Non-explosively dispersed sol-gel materials containing long-lived radionuclides (Zr-95, Ce-141, Ce-143, Th-227, Mo-99, Nd-147) within an enclosed contained structure.

The addition of new short-lived radionuclides

DOE/EA-1776 analyzed potential radionuclide dose to the public due to 12 releases per year with each release consisting of a total of 1Ci of isotopes found in irradiated KBr salt. This proposed action adds short-lived nuclides KO, La-140, Cu-64, Zr-97 and F-18. In addition, it increases the KBr to a maximum of 5 Ci. Each isotope may be released up to 12 times per year. Modeling, similar to that done for the isotopes released at the NSTR, will use actual meteorological data regarding wind speed and direction as provided by nearby meteorological towers. More than one nuclide may be dispersed at the same time or during the same training exercise. Dispersal of all nuclides may take place through direct deposition or use of explosives as described in the EA.

- 5 curies of KBr
- 7 curies of KO
- 1 curie of LaBr
- 3 curies of Cu-64
- 10 curies of Zr-97
- 5 curies of F-18

The use of sol-gels

An important aspect of U.S. national security is to develop and maintain an effective response capability for major radiological/nuclear incidents. Developing and maintaining the capability to collect and identify the origin of material in response to one of these incidents is a national priority. Idaho National Laboratory has the unique capability to provide a large outdoor testing and training range where short-lived radioactive materials can be dispersed to create a realistic and challenging training environment.

Radioactive sources in multiple chemical forms with multiple physical properties provide trainees a wide range of assets in which they can test their survey equipment and sampling techniques. Many such sources are not available commercially and will need to be manufactured by the INL. These radioactive sources are produced by preparing specialty oxide glasses, sol-gels, by hydrolyzing the chemical precursor that passes sequentially through a solution state and a gel state before being dehydrated to a glass or ceramic. The particles are formed by forcing the wet gel through sieves and allowing them to air dry before sintering. Particle size can be well controlled using this method. The primary use of the radioactive particles encapsulated in a glass matrix will be for the evaluation of varying indoor and outdoor environmental sampling techniques. The evaluation of various hand vacuums (Sirchie, Dyson, and Dustbuster with HEPA filters) will be performed. The radioactive particle accumulation within the internal parts and filters will be measured by NaI gamma counting. This evaluation will be used to aid in the development of new field collection methods. Another use includes glass encapsulated Th-227 as an alpha emitting source material. The first responder community has requested an alpha emitting source in which they can train staff and test alpha detection equipment without fear of internal uptake and contamination.

Short-lived and long-lived isotopes used in this glass form include: Sc-44m, Zr-95, Te-132, Ba-140, Ce-141, Ce-143, Th-227, Mo-99 and Nd-147. These isotopes will be produced in particle sizes ranging from 20-50 micron. It should be noted that particle sizes will not be produced in the respirable range of 10 micron or less. The total mass of material will be no greater than 100 grams for each given dispersal.

Sol-gels of the short-lived isotopes, Sc-44m, Te-132, and Ba-140, may be dispersed outdoors or indoors. Dispersals of these short-lived isotopes within sol-gels may be conducted using single or multiple isotopes. In the case of multiple isotope dispersals, the combined curie content will be no greater than 1 curie. An activity of 1 curie will also be maintained for single isotope dispersals. Sol-gels containing short-lived isotopes of Sc-44m, Te-132, and Ba-140 can be conducted outdoors without containment. Dispersal of short-lived isotopes will be performed up to 12 times/year. Dispersal methods include pouring, dry spreading or by mechanical methods such as a mechanical spreader or pressurized air. Dispersals using explosives will not be performed.

Sol-gels of long-lived isotopes or isotopes with long lived daughters (Zr-95, Ce-141, Ce-143, Th-227, Mo-99 and Nd-147) will be dispersed within an enclosed structure fitted with a plastic spill containment flooring (or similar) to prevent spread of the dispersed material to the environment. Construction and use of temporary structures is discussed and analyzed in the EA. This arrangement will allow for the containment flooring to be disposed of between exercises. In addition, there will be no limit applied to the number of indoor sol-gel dispersals, as the contaminated flooring will be removed following each test. In the case where short-lived isotopes are dispersed with longer lived isotopes, an enclosed structure fitted with a plastic spill containment flooring (or similar) will be used. Once again, dispersal methods include pouring, dry spreading or by mechanical methods such as a mechanical spreader or pressurized air. Dispersals using explosives will not be performed.

Fence Installation

A chain-link fence would be constructed around the north and south RRTR. (See Figures 7 and 8.) The fence would be used to control access to radiological training areas from time of dispersal and during times of decay. The fence will be roughly square approximately 2,100 feet (607 m) on each side and will range from 6 to 8 foot tall. The arrangement will allow for radiological access control (to personnel and larger wildlife) while providing a sufficient training area to conduct long distance surveys (NSA 10-point). See Figures 7 and 8 for the proposed fence locations. When referring to the north RRTR, an existing fence at the southern boundary would be modified to match the proposed fencing material. Consistent with current practice, access to the north and south RRTR would be restricted during training exercises. At other times access would be open to traffic on T-28 at the north RRTR, to bird survey routes, and USGS well sampling activities. These activities will be coordinated with Wastren and USGS personnel.

Fence maintenance would consist of driving around the perimeter and removing debris (primarily blowing weeds), maintaining signage and making fence repairs as necessary. Fence maintenance may result in the creation of a "road." A portion of the west side of the new perimeter fence road may be used to connect T-53 with T-28 allowing for a way to navigate around the restricted area. If this option for bypassing the test area is unpractical, the project will seek to utilize an existing two-track.

Approximate corner locations:

North Range

<u>Lat</u>	<u>Long</u>
43.87546	-112.73200
43.87542	-112.72405
43.86965	-112.73200
43.86966	-112.72404

South Range

<u>Lat</u>	<u>Long</u>
43.48433	-113.04226
43.48434	-113.03431
43.47856	-113.04227
43.47855	-113.03433

1.3 INL Site Natural Resource Management Objectives

Under DOE Order 430.1B (Real Property Asset Management, February 2008), “Land-use plans should be tailored based on local site condition and must consider the National Environmental Policy Act, site planning and asset management, LTS plans, institutional control plans, stakeholder public participation, economic development under community reuse organizations, privatization of assets, environmental law, cultural asset management, historic preservation, and natural resource management.”

Further, DOE along with thirteen other Federal agencies signed a Memorandum of Understanding (MOU) to Foster the Ecosystem Approach (December 15, 1995). As stated in the MOU, “An ecosystem is an interconnected community of living things, including humans, and the physical environment within they interact. The ecosystem approach is a method for sustaining or restoring ecological systems and their functions and values. It is goal driven, and it is based on a collaboratively developed vision of desired future conditions that integrates ecological, economic, and social factors. It is applied within a geographic framework defined primarily by ecological boundaries. The goal of the ecosystem approach is to restore and sustain the health, productivity, and biological diversity of ecosystems and the overall quality of life through a natural resource management approach that is fully integrated with social and economic goals”.

The Federal Government should provide leadership in and cooperate with activities that foster the ecosystem approach to natural resource management, protection, and assistance. Federal agencies should ensure that they utilize their authorities in a way that facilitates, and does not pose barriers to, the ecosystem approach. Consistent with their assigned missions, Federal agencies should administer their programs in a manner that is sensitive to the needs and rights of landowners, local communities, and the public, and should work with them to achieve common goals.

The INL Site represents one of the largest remnants of undeveloped, ungrazed sagebrush steppe ecosystem in the Intermountain West (INL 2016). This ecosystem has been listed as critically endangered with less than two percent remaining (Noss et al. 1995, Saab and Rich

1997). The INL Site is also home to the Idaho National Environmental Research Park (NERP). The NERP is an outdoor laboratory for evaluating the environmental consequences of energy use and development as well as strategies to mitigate these effects. A portion of the INL Site has been designated as the Sagebrush Steppe Ecosystem Reserve that has a mission of conducting research on and preserving sagebrush steppe.

In 2007, DOE began working with the U.S. Fish and Wildlife Service (USFWS) to establish a Candidate Conservation Agreement (CCA) for the protection of Greater sage-grouse (*Centrocercus urophasianus*) on the INL Site (DOE-ID & USFWS, 2014). At that time, the sage-grouse had been considered multiple times for listing under the Endangered Species Act (ESA), and DOE-ID was concerned that an ESA listing would jeopardize its ability to carry out its mission expeditiously. In 2010, the sage-grouse was listed as a Candidate species, meaning it warranted ESA protection, but a lack of FWS resources precluded the listing to occur at that time. In 2014, DOE-ID completed and DOE-ID and the USFWS signed the sage-grouse CCA. The purpose of the CCA was to identify actions that DOE-ID would implement to minimize threats to sage-grouse on the INL Site. Having an agreement in place provided a high level of certainty for DOE-ID, because if the sage-grouse became listed, the CCA could easily be converted into a Biological Opinion—a required document for any INL Site activities that might harm or disturb sage-grouse. In 2015, the USFWS reversed its previous decision, finding that sage-grouse no longer warranted protection under the ESA. However, DOE has continued to work with the USFWS recently completed a Conference Opinion based on the CCA (a Conference Opinion is the equivalent of a Biological Opinion, but for non-listed species). Because of DOE's proactivity in signing the CCA, it has had and continues to have a large measure of certainty and flexibility as it pursues its mission, while fulfilling its stewardship to preserve the ecological resources at the INL Site.

A number of environmental factors/resources at the INL Site need to be considered during planning because of the potential for impacts to these resources from actions that may result from planning. The types of factors that are considered include the following: regional considerations such as population, land uses, and socioeconomic conditions; sitewide area infrastructure such as transportation routes, power distribution systems, communication systems, utility systems, and other land uses; resources such as soils, water resources, biota, and cultural resources; and natural hazards at the INL Site such as wildland fire, seismic hazards, and floods (INL 2016).

As stated in the Idaho National Laboratory Comprehensive Land Use and Environmental Stewardship Report (INL 2016), several considerations form the basis for current INL Site land use planning assumptions. These include prior land use planning assumptions from the original Comprehensive and Facility Land Use Plan, public input from the INL Site Environmental Management Citizens Advisory Board and the Environmental Management Site-Specific Advisory Board, and incorporation of DOE and the INL Site management team's strategic vision for the INL Site. The following planning assumptions are based on planning assumptions developed in the original Comprehensive and Facility Land Use Plan:

- INL will achieve its vision of becoming the preeminent nuclear research, development, and demonstration laboratory, a major center for national security technology development and demonstration, and remain a multi-program national laboratory.

- The INL Site and its associated 889 mi² (2,303 km²) will remain under federal government management and control through at least the year 2095.
- Portions of the INL Site will remain under federal government management and control in perpetuity.
- The DOE-EM footprint will be reduced at the INL Site as the DOE-EM cleanup mission continues to completion in the year 2035.
- New buildings will be constructed to provide state-of-the-art research capabilities that are necessary to fulfill the INL Site mission.
- New building construction may include structures in existing facility areas and construction of new facility areas.
- To the extent practical, new building construction will be encouraged in existing facility areas (i.e., the Research and Education Campus [REC] in Idaho Falls and the Advanced Test Reactor [ATR] Complex and the Materials and Fuels Complex [MFC] at the INL Site) to take advantage of existing infrastructure.
- Construction of new facility areas should occur in the identified core infrastructure areas.
- As the INL Site implements its mission, R&D advancements will result in obsolescence of existing buildings.
- As contaminated facility areas become obsolete, environmental remediation, decommissioning, and decontamination will be required.
- The environmental remediation, decommissioning, and decontamination process will be completed in accordance with the existing regulatory structure.
- The federal government will authorize and appropriate sufficient funds to provide adequate controls (i.e., institutional controls or engineered barriers) for areas that pose a significant health or safety risk to the public and workers until the risk diminishes to an acceptable level for the intended purpose.
- Regional economic development is closely related to the activities of the INL Site. The significance of the INL's Site influence on the region depends on the diversity and strength of the regional economy.
- Cooperative partnerships between the public and private sectors may be developed to support modernization and expansion of the INL Site R&D facilities.
- In accordance with DOE Order 144.1, Administrative Change 1, "Department of Energy American Indian Tribal Government Interactions and Policy," DOE recognizes that a trust relationship exists between federally recognized tribes and DOE. DOE will consult with tribal governments to ensure that tribal rights and concerns are considered prior to DOE taking actions, making decisions, or implementing programs that may affect the tribes.
- No residential development will occur within INL Site boundaries, although potential development may occur in Idaho Falls.
- Grazing will be allowed to continue on the INL Site in designated areas.

- DOE-ID has a Candidate Conservation Agreement with the U.S. Fish and Wildlife Service (USFWS) to protect greater sage-grouse and its habitats on the INL Site.
- To protect human health and the environment, INL Site operations, including onsite disposal, will remain in full compliance with applicable environmental laws, regulations, and other requirements.

1.4 Background

Because the proposed NSTR facilities will utilize T-25, which was upgraded for the original NSTR Project, an increase in traffic will likely occur but will not be a substantial change in the amount of vehicle traffic already in the project and access areas. However, the impacts of roads on terrestrial ecosystems, such as the sagebrush steppe on the INL Site, include direct habitat loss; facilitated invasion of weeds, pests, and pathogens, many of which are exotic (alien); and a variety of edge effects. Roads themselves essentially preempt wildlife habitat. Road construction or improvement also kills animals and plants directly, and may limit long-term site productivity of roadsides by exposing low nutrient subsoils, reducing soil water holding capacity, and compacting surface materials (Noss 1996).

The roads used to access the RRTR ranges are primarily gravel and maintained to some extent. However, it is reasonable to assume that the short stretch of road into the Infiltration Basin will be upgraded marginally even if just due to added traffic during testing. Both the north and south facilities will have fences as part of this EA and each fence will also have a perimeter road around the edges which will amount to roughly ~3 miles (4.8 kilometers) of new road on the INL Site.

Some species thrive on roadsides, but most of these are weedy species. In the Great Basin, rabbitbrush (*Chrysothamnus viscidiflorus*) is usually more abundant and vigorous along hard-surfaced roads than anywhere else, because it takes advantage of the runoff water channeled to the shoulders. Many of the weedy plants that dominate and disperse along roadsides are non-native. In some cases, these species spread from roadsides into adjacent native communities. In much of the west, spotted knapweed (*Centaurea stoebe*) has become a serious agricultural pest. This Eurasian weed invades native communities from roadsides (Noss 1996).

1.4.1 General Effects of Roads

Trombulak and Frisell (2000) identified seven general effects of roads. Some of these include modified animal behavior, such as altered reproductive rates and displacement, changes in physical geography, such as changes in surface runoff, erosion and sedimentation which effect aquatic and terrestrial animals, changes in populations due to direct kills, the spread of exotic species and increases in human ecological impacts.

Effects of roads can be immediate and localized or long-term and geographically widespread. Roads negatively impact a wide-variety of species but these impacts may not be noticed for eight to thirty years after the road has been built (Findlay and Bourdages 2000, Findlay and Houlahan 1997). In the long-term, roads tend to favor some species and discourage others, which can lead to a change in species composition of ecosystems (Forman and Alexander 1998). Intricately connected to roads are the vehicles that travel them. Noise from vehicles has been shown to disturb wildlife, leading to relocation of wildlife populations (U.S. EPA 1971).

Roads often facilitate the dispersal of exotic species. Forcella and Harvey (1983) surveyed exotic species in Montana and related their abundance to frequency of road use. Parendes and Jones (2000) describe similar results, showing a higher abundance of exotic species along high and low use roads than abandoned roads. Many species such as spotted knapweed not only take advantage of the disturbed ground found alongside roadways, but are also dispersed by tires, mud and crevices in the undercarriage of vehicles (Marcus et al. 1998). Roads also affect the distribution and occurrence of insect species such as gypsy moths and tent caterpillars (Bellinger et al. 1989).

Roads impact wildlife in a variety of ways. Animals die in collisions with vehicles, change behavior to avoid disturbance, possibly abandoning preferred habitats. Roads spread noxious weeds, which displace native forage. Roads consume land so there is less range for animals to use. Roads also fragment habitat by breaking it up into smaller and smaller units of secure habitat (Thomson et al 2005).

To summarize from Trombulak and Frissell (2000), roads cause the following impacts:

Mortality from road construction. The actual construction of a road, from clearing to paving, will often result in the death of any sessile or slow-moving organisms in the path of the road. Obviously, vegetation will be removed, as well as any organisms living in that vegetation.

Mortality from collisions with vehicles. Road kill is the greatest directly human-caused source of wildlife mortality throughout the U.S. More than a million vertebrates are killed on our roadways every day.

Modification of animal behavior. The presence of a road may cause wildlife to shift home ranges, and alter their movement pattern, reproductive behavior, escape response and physiological state. When roads act as barriers to movement, they also bar gene flow where individuals are reluctant to cross for breeding.

Alteration of the physical environment. A road transforms the physical conditions on and adjacent to it, creating edge effects with consequences that extend beyond the white lines. Roads alter the following physical characteristics of the environment:

- Soil density - Soil becomes compacted and remains so long after a road is in use.
- Soil water content - Porosity of soil is reduced, allowing for less absorption of water.
- Dust - Passing cars will stir up dust from the road. Dust will settle on nearby plants, blocking photosynthesis. Amphibians are also affected by traffic dust.
- Pattern of run-off - Roads are often built with parallel ditching, which diverts rainwater run-off along roadways, rather than the natural flow pattern.

Alteration of the chemical environment. Maintenance and use of roads contribute at least five different general classes of chemicals to the environment:

- Heavy metals - gasoline additives.
- Salt - de-icing.
- Organic molecules - dioxins, hydrocarbons.
- Ozone - produced by vehicles.
- Nutrients – nitrogen.

Spread of exotics. Roads provide opportunities for invasive species by:

- Providing habitat by altering conditions;
- Stressing or removing native species; and
- Allowing easier movement by wild or human vectors.

Increased use of areas by humans. Roads facilitate increased human access to formerly remote areas. In addition to the disturbance and pollution often associated with roads, roads increase the likelihood of additional, unplanned activities in the area.

Increased potential for additional development. Building and improving roads on the INL Site can provide a conduit for additional development along this new corridor increasing the impacts associated with habitat fragmentation, transportation, and facility development. Increased development also amplifies all aspects of human activity providing an additional source of adverse impacts to habitat, plants and wildlife.

1.4.2 Effects of Roads on Individual Species

While the effects of roads and vehicles are wide-ranging, many of the scientific studies conducted have dealt with their effects on single populations. The effects of roads on wildlife range from extremely detrimental to neutral to beneficial.

Ungulates have varying levels of tolerance to roads. While elk and deer can adapt fairly well to busy highways, roads with continuous, slow moving traffic caused displacement and changes in range use (Burbridge and Neff 1976, Gruell et al. 1976, Edge and Marcum 1991). While larger animals tend to be displaced by roads, smaller animals tend to suffer different effects. Because smaller animals are less noticeable and slower-moving, direct kills from motorized vehicles are extremely common. For example, kills of desert tortoises and rattlesnakes by motorized vehicles are significant (Bury 1978, Berish 1998). In addition, even small roads block movement of small animals and populations are more easily cut off from each other (herpetofauna - DeMaynadier and Hunter 2000, DeMaynadier and Hunter 1995; small rodents - Oxley, et al. 1974, Wilkins 1982).

Birds are often used as indicators of ecological health due to the prominence of population records. Many studies have linked declines in bird populations to habitat fragmentation caused by roads (Keyser et al 1997, Jones et al. 2000, Boren et al 1999). Roads displace certain species of birds while attracting others (Kuitunen et al. 1998). For example, raptors may benefit from roads as they provide good hunting habitat (Dijak and Thompson 2000).

Some effects of roads such as soil compaction, changes in composition due to imported road surfaces, disturbed ground, and exhaust emissions and dustings greatly affect soil organisms. Haskell (2000) examined the occurrence of macroinvertebrates essential to soil nutrition processes and found them to decrease in areas adjacent to roads.

Mycorrhizae and other soil organisms eliminated through soil compaction are essential for protection against pathogens, and nutrient and water uptake (Amaranthus and Perry 1994). Changes at the soil community level are extremely important because they cause changes in essential processes that can propagate throughout an ecosystem, eventually altering other animal and plant communities. For example, changes in soil compaction, composition and soil flora and fauna have been shown to contribute to the alteration of plant communities alongside roads (Angold 1997, Sharifi et al. 1999, Adams et al. 1982).

1.4.3 Effects of Roads on Abiotic Functioning of Ecosystems

As noted above, roads can significantly affect abiotic processes in ecosystems. Roads can cause changes to soil structure, aridity, erosion, and hydrology. Road construction often results in an increase in surface water flows that can lead to erosion of soil surfaces (Harr et al. 1975, Jones et al. 2000, Jones and Grant 1996).

1.5 Survey Methods

We separated our survey methods to cover both vegetation and wildlife. The sensitive species and wildlife surveys were more opportunistic while the plant community data was done by systematically selecting plot locations across the entire project area.

NSTRX

We focused our surveys to the areas of expected disturbance with some additional buffer. We generally surveyed each area for signs of wildlife, invasive species, and sensitive plants. Suspect areas were searched with greater detail. The plant community surveys occurred systematically every 100 meters in areas in and adjacent to the new facilities. A total of 227 points were surveyed for vegetation classification. The specific point count for each section of the survey: powerline adjacent to T-25 – 110, alternate route to T-25 – 15, original downrange target area – 30, final downrange target area – 31, and the new explosives test pad and road – 41. All vegetation plot locations are shown on Figure 3.

We conducted a more random survey of general area all the way from MFC to the new Test Bed. These surveys were guided by reviewing aerial photos, topographic maps and previously collected data to determine areas that might contain habitat for sensitive species and/or wildlife.

RRTR

We focused our surveys on the areas of expected disturbance based on the project description. As the fence is unlikely to change in placement, we did not add a very large additional buffer to the specific road and fence areas, however, we did take into account a general area and focused on areas more likely to have invasive or sensitive species within the fence boundaries and a select number of random areas outside the fence boundaries as well.

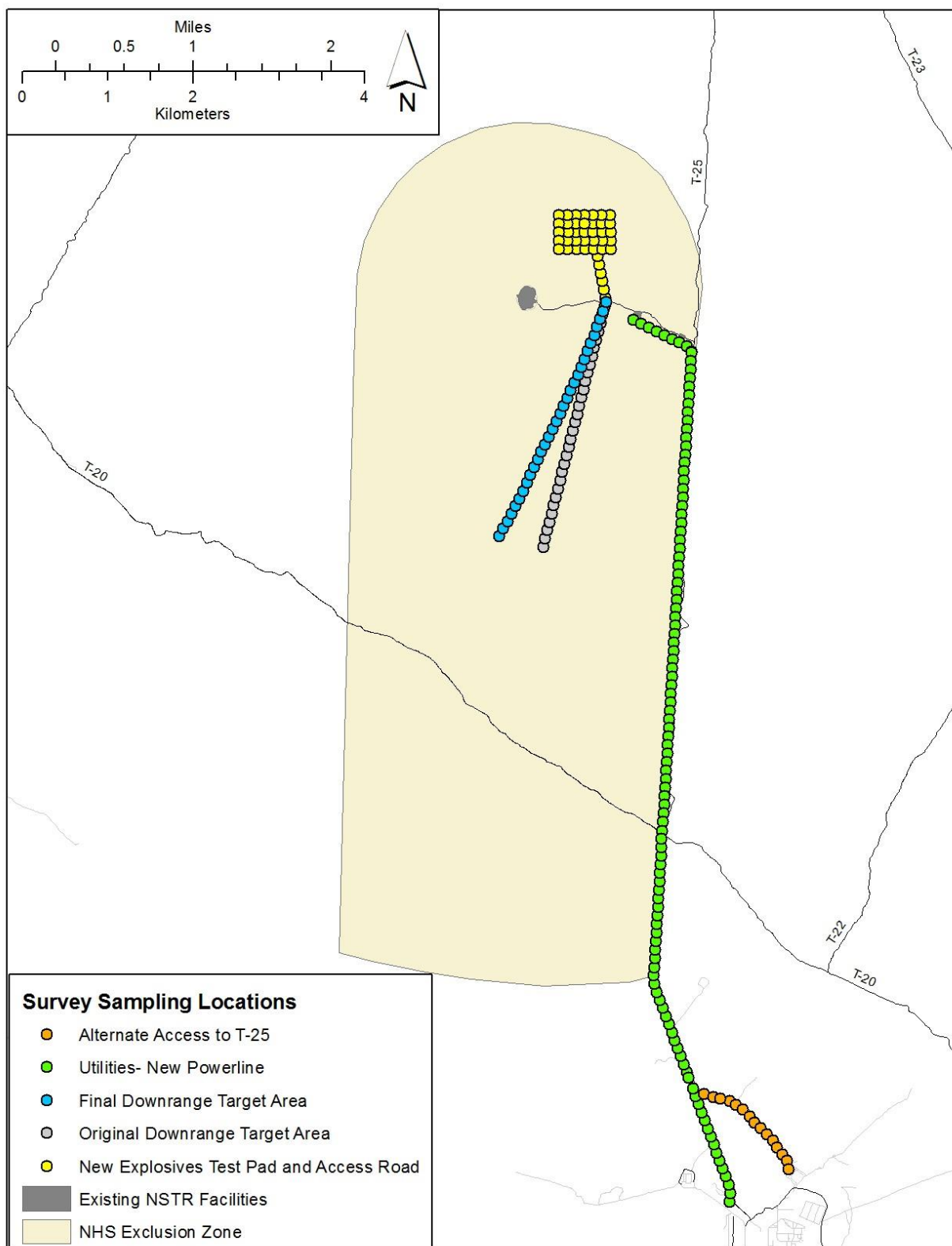


Figure 3. NSTRX survey sampling locations.

2. Affected Environment

2.1 Plant Communities

2.1.1 General Description and Distribution

NSTRX

Four wildland fires have burned through various plant communities on and around the proposed NSTR expansion site between 1995 and 2011. With the exception of a few unburned islands, vegetation across most of NSTRX has burned at least once and many locations have burned multiple times over the past twenty years. Plant community composition in the area reflects wildland fire activity over the past few decades.

Much of NSTRX is dominated by native, perennial grasses. Resprouting shrubs (primarily green rabbitbrush) are abundant in large patches throughout the area. A few small islands of mature unburned and recovering juvenile sagebrush (*Artemisia tridentata*) occur sporadically throughout the area. Although most post-fire plant communities lack sagebrush, they are generally in good ecological condition with an abundant and diverse herbaceous stratum. Non-native annuals like cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola kali*) can be abundant in localized patches and often occupy shallow rocky soils on basalt outcroppings.

The most recent vegetation classification for the INL Site was completed in 2008 (Shive et al. 2011). Multivariate classification models were used to identify and define plant communities in accordance with the Federal Geographic Data Committee (FGDC) National Vegetation Classification Standard (NVCS; FGDC 2008). A total of 26 plant communities were identified across the INL Site and a dichotomous key to those communities was developed to facilitate plant community characterization for future assessments, like this one. The dichotomous key was used to sample plant communities on NSTRX in July (Explosives Test Pad and Access Road, New Powerline, and Alternate Access to T-25) and October (Downrange Target Area) of 2016. Sample locations are shown in Figure 2. A total of twelve plant communities were identified on the proposed project area in 2016 (Table 2). The general descriptions of those plant communities are from Shive et al. 2011 and are included in Appendix A.

Generally, topographical relief and the sandy component of the local soils are greater on the NSTRX site than they are across much of the INL Site. Therefore, the local diversity of plant communities is higher on and around the NSTRX site and the fine-scale heterogeneity of plant community distribution is greater. Plant communities that favor sandy soils, like those dominated by needle-and-thread, are also more common in this area than they are elsewhere on the INL Site. The only part of the proposed project area with great enough sagebrush cover to be characterized as a sagebrush shrubland is along the Alternate Access to T-25. See Table 3 for a summary of the frequency of occurrence of plant communities across proposed project site.

Table 2. Vegetation classes documented on the proposed project area. Class numbers reflect multivariate classifications (see Shive et al. 2011). Class names are consistent with NVCS nomenclature (FGDC 2008) and the species composition criteria defining each class are consistent with those provided in the NVC (NatureServe 2010), though INL Site classes don't always crosswalk directly with NVC classes.

Class #	Scientific Class Name	Colloquial Class Name
1/9	<i>Chrysothamnus viscidiflorus</i> / <i>Elymus lanceolatus</i> (<i>Pascopyrum smithii</i>) Shrub Herbaceous Vegetation	Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation
2	<i>Artemisia tridentata</i> Shrubland	Big Sagebrush Shrubland
3	<i>Hesperostipa comata</i> Herbaceous Vegetation	Needle and Thread Herbaceous Vegetation
4a	<i>Chrysothamnus viscidiflorus</i> Shrubland	Green Rabbitbrush Shrubland
7	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland	Wyoming Big Sagebrush Shrubland
8	<i>Chrysothamnus viscidiflorus</i> / <i>Alyssum desertorum</i> Herbaceous Vegetation	Green Rabbitbrush/Desert Alyssum Shrub Herbaceous Vegetation
10	<i>Agropyron cristatum</i> (<i>Agropyron desertorum</i>) Semi- natural Herbaceous Vegetation	Crested Wheatgrass Semi-natural Herbaceous Vegetation
12	<i>Achnatherum hymenoides</i> Herbaceous Vegetation	Indian Ricegrass Herbaceous Vegetation
13	<i>Bromus tectorum</i> Semi-natural Herbaceous Vegetation	Cheatgrass Semi-natural Herbaceous Vegetation
14	<i>Leymus cinereus</i> Herbaceous Vegetation	Great Basin Wildrye Herbaceous Vegetation
16a	<i>Poa secunda</i> Herbaceous Vegetation	Sandberg Bluegrass Herbaceous Vegetation
21	<i>Ericameria nana</i> Dwarf Shrubland	Dwarf Goldenbush Dwarf Shrubland

Table 3. Vegetation class distribution across the NSTRX. Class numbers reflect multivariate classifications (see Shive et al. 2011). Class names are consistent with NVCS nomenclature (FGDC 2008). Frequency is the percentage of the sample plots of each vegetation class within each survey area.

Class #	Class Colloquial Name	Frequency (%)
Explosives Test Pad and Access Road		
1/9	Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation	34
3	Needle and Thread Herbaceous Vegetation	15
4a	Green Rabbitbrush Shrubland	24
8	Green Rabbitbrush/Desert Alyssum Shrub Herbaceous Vegetation	2
12	Indian Ricegrass Herbaceous Vegetation	12
13	Cheatgrass Semi-natural Herbaceous Vegetation	10
21	Dwarf Goldenbush Dwarf Shrubland	2
Downrange Target Area		
1/9	Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation	40
3	Needle and Thread Herbaceous Vegetation	13
4a	Green Rabbitbrush Shrubland	30
12	Indian Ricegrass Herbaceous Vegetation	13
13	Cheatgrass Semi-natural Herbaceous Vegetation	3
New Powerline		
1/9	Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation	30
3	Needle and Thread Herbaceous Vegetation	12
4a	Green Rabbitbrush Shrubland	25
7	Wyoming Big Sagebrush Shrubland	1
10	Crested Wheatgrass Semi-natural Herbaceous Vegetation	6
12	Indian Ricegrass Herbaceous Vegetation	16
13	Cheatgrass Semi-natural Herbaceous Vegetation	4
14	Great Basin Wildrye Herbaceous Vegetation	1
16a	Sandberg Bluegrass Herbaceous Vegetation	4
21	Dwarf Goldenbush Dwarf Shrubland	3
Alternate Access to T-25		
2	Big Sagebrush Shrubland	20
7	Wyoming Big Sagebrush Shrubland	60
13	Cheatgrass Semi-natural Herbaceous Vegetation	7
4a	Green Rabbitbrush Shrubland	13

RRTR

The vegetation associated with the RRTR locations is very different from that found around the NSTRX locations. However, neither location has experienced vegetation changing events, such as fire, since the completion of the INL vegetation classification in 2008. The communities are primarily native and tend to be sagebrush dominated (Figure 4, Table 4).

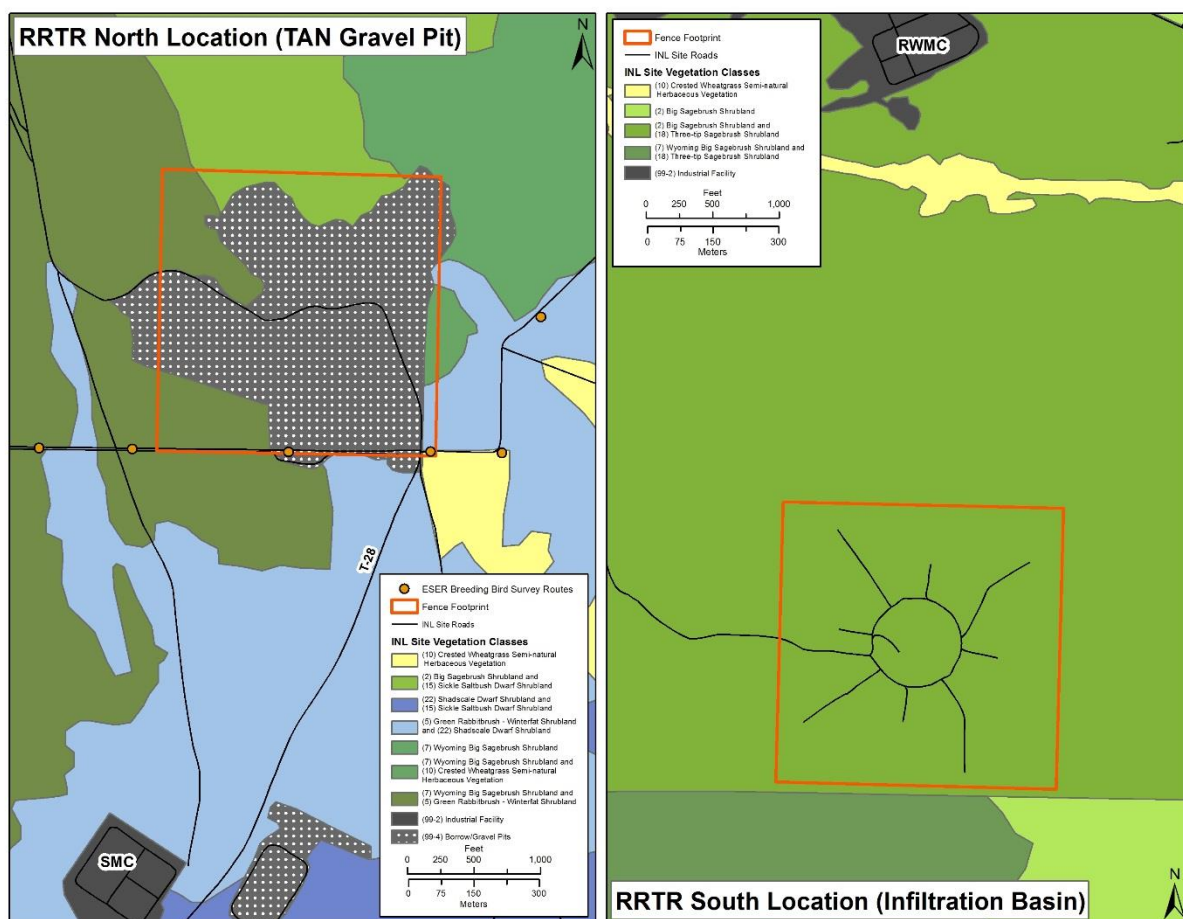


Figure 4. INL Site vegetation classes at the RRTR facilities.

The RRTR North (TAN gravel pit) is made up of sagebrush with various understory components. The gravel pit itself is devoid of vegetation and will continue to be maintained as such to prevent the spread of undesirable species. The soils tend toward alkalinity, so there are more salt tolerant species found at the north end of the INL site, such as shadscale saltbush (*Atriplex confertifolia*) and sickle saltbush (*Atriplex falcata*) as well as winterfat (*Krascheninnikovia lanata*). Various grasses are found in the area and full descriptions of the community types can be found in Appendix A.

The Infiltration Basin (RRTR South) is surrounded by Wyoming Big Sagebrush Shrubland which is dominated by sagebrush and consists of a wide range of other shrub and grass species. The basin itself and the berm around the basin have been mowed in the past and have less shrub composition than the surrounding areas. And since the berm is raised, the soils tend to be very dry and cover is typically low and what species do grow are often weedy or invasive.

Table 4. Vegetation map classes present on or adjacent to the proposed RRTR and Infiltration Basin project areas. Class numbers reflect multivariate classifications (see Shive et al. 2011). Class names are consistent with NVCS nomenclature (FGDC 2008) and the species composition criteria defining each class are consistent with those provided in the NVC (NatureServe 2010), though INL Site classes don't always crosswalk directly with NVC classes.

Class #	Scientific Class Name	Colloquial Class Name
2-15	<i>Artemisia tridentata</i> Shrubland - <i>Atriplex falcata</i> Dwarf Shrubland	Big Sagebrush Shrubland - Sickie Saltbush Dwarf Shrubland
2-18	<i>Artemisia tridentata</i> Shrubland - <i>Artemisia tripartita</i> Shrubland	Big Sagebrush Shrubland - Three-tip Sagebrush Shrubland
5-22	<i>Chrysothamnus viscidiflorus</i> – <i>Krascheninnikovia lanata</i> Shrubland - <i>Atriplex confertifolia</i> Dwarf Shrubland	Green Rabbitbrush - Winterfat Shrubland - Shadscale Dwarf Shrubland
7	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland	Wyoming Big Sagebrush Shrubland
7-5	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland - <i>Chrysothamnus viscidiflorus</i> – <i>Krascheninnikovia lanata</i> Shrubland	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland - Green Rabbitbrush - Winterfat Shrubland
7-10	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland - <i>Agropyron cristatum</i> (<i>Agropyron desertorum</i>) Semi-natural Herbaceous Vegetation	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland - Crested Wheatgrass Semi-natural Herbaceous Vegetation
10	<i>Agropyron cristatum</i> (<i>Agropyron desertorum</i>) Semi-natural Herbaceous Vegetation	Crested Wheatgrass Semi-natural Herbaceous Vegetation
22-15	<i>Atriplex confertifolia</i> Dwarf Shrubland - <i>Atriplex falcata</i> Dwarf Shrubland	Shadscale Dwarf Shrubland - Sickie Saltbush Dwarf Shrubland

2.2 Conservation Status

Most vegetation classes represented in the NVC have been assigned global conservation status rankings, or “G” ranks. These rankings are used to describe the conservation status, including rarity and risk of loss, for each vegetation class listed in the NVC. The “G” designation for each class is ranked on a 1 to 5 scale denoting its current status (Table 5), ranging from secure to imperiled.

Table 5. Standardized conservation status ranks summarized from NatureServe (2016).

Rank	Definition
G1	Critically Imperiled
G2	Imperiled
G3	Vulnerable
G4	Apparently Secure
G5	Secure
GNR	Not Yet Ranked

NSTRX

The INL Site vegetation classes do not always crosswalk directly to NVC classes in a one-to-one relationship so, the conservation status of the NVC classes cannot be directly applied to the INL Site vegetation classes. In most cases, more than one NVC Association-level class can be cross walked to an INL Site vegetation class. Therefore, the combined conservation status ranks of cross walked NVC classes should be interpreted as the best indication of the Conservation status of an INL Site vegetation class. The INL Site vegetation classes documented on the proposed project site and their cross walked NVC Association-level classes can be found in Table 6.

Table 6. Cross-walk of vegetation classes on the proposed project site with NVC Association-level classes and their Conservation Status Ranks. Class numbers reflect multivariate classifications (see Shive et al. 2011). Class names are consistent with NVCS nomenclature (FGDC 2008).

Class #	Colloquial Class Name	Related NVC Associations	Database Code	Conservation Rank
1/9	Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation	Streambank Wheatgrass Herbaceous Vegetation	CEGL002588	GNR
		Western Wheatgrass Herbaceous Vegetation	CEGL001577	G4
		Streambank Wheatgrass - Needle-and-Thread Herbaceous Vegetation	CEGL001746	G1
2	Big Sagebrush Shrubland	Basin Big Sagebrush Shrubland	CEGL000991	G5
		Basin Big Sagebrush / Indian Ricegrass Shrubland	CEGL001006	G4
		Basin Big Sagebrush / Green Bluegrass Shrubland	CEGL000999	G5
		Basin Big Sagebrush / Squirreltail Shrubland	CEGL001001	G5
3	Needle and Thread Herbaceous Vegetation	Needle-and-Thread Great Basin Herbaceous Vegetation	CEGL001705	G3
		Streambank Wheatgrass – Needle-and-Thread Herbaceous Vegetation	CEGL001746	G1
		Needle-and-Thread - Indian Ricegrass Herbaceous Vegetation	CEGL001703	G2
4a	Green Rabbitbrush Shrubland	Yellow Rabbitbrush / Needle-and-Thread Shrubland	CEGL002799	GNR
		Yellow Rabbitbrush Talus Shrubland	CEGL002347	GNR
7	Wyoming Big Sagebrush Shrubland	Wyoming Big Sagebrush / Indian Ricegrass Shrubland	CEGL001046	G5
		Wyoming Big Sagebrush / Squirreltail Shrubland	CEGL001043	G4
		Wyoming Big Sagebrush / Needle-and-Thread Shrubland	CEGL001051	G2
		Wyoming Big Sagebrush / Sandberg Bluegrass Shrubland	CEGL001049	G4
		Wyoming Big Sagebrush / Sparse Understory Shrubland	CEGL002768	GNR
		Wyoming Big Sagebrush / Mixed Grasses Shrub Herbaceous Vegetation	CEGL001534	G5
		Wyoming Big Sagebrush / Western Wheatgrass Shrub Herbaceous Vegetation	CEGL001047	G4
8	Green Rabbitbrush/Desert Alyssum Shrub Herbaceous Vegetation	Yellow Rabbitbrush / Needle-and-Thread Shrubland	CEGL002799	GNR
10	Crested Wheatgrass Semi-natural Herbaceous Vegetation	N/A	N/A	N/A
12	Indian Ricegrass Herbaceous	Needle-and-Thread - Indian	CEGL001703	G2

Class #	Colloquial Class Name	Related NVC Associations	Database Code	Conservation Rank
	Vegetation	Ricegrass Herbaceous Vegetation		
13	Cheatgrass Semi-natural Herbaceous Vegetation	N/A	N/A	N/A
14	Great Basin Wildrye Herbaceous Vegetation	Great Basin Wildrye Herbaceous Vegetation	CEGL001479	G2
		Great Basin Wildrye - Western Wheatgrass Herbaceous Vegetation	CEGL001483	G3
16a	Sandberg Bluegrass Herbaceous Vegetation	Sandberg Bluegrass Herbaceous Vegetation	CEGL001657	G4
21	Dwarf Goldenbush Dwarf Shrubland	Black Sagebrush – Dwarf Goldenbush Shrubland	GEGL1002773	G3

Vulnerable and imperiled vegetation classes, or plant communities, are typically associated with unique soils and landforms. On the NSTRX site, these plant communities are found in sandy soils, on basalt outcroppings, and in poorly-drained playas. Needle-and-thread dominated and co-dominated communities represented at least 10% of the area surveyed on the Explosives Test pad and Access Road, Downrange Target Area, and New Powerline. These communities also have conservation status rankings ranging from G1 to G3 because they are rare and at risk of cheatgrass dominance (NatureServe 2016). Prior to recent wildland fires, the NSTRX site was dominated by big sagebrush plant communities and over the next century or so, they will likely begin transitioning back to sagebrush-dominated communities through natural recruitment and recovery. However, the sandy soils and needle-and-thread herbaceous stratum, regardless of sagebrush overstory, will continue to present a conservation concern.

RRTR

As mentioned in the NSTRX description above, the INL Site vegetation classes do not always crosswalk directly to NVC classes in a one-to-one relationship so, the conservation status of the NVC classes cannot be directly applied to the INL Site vegetation classes. The INL Site vegetation classes documented on the proposed project site and their cross walked NVC Association-level classes can be found in Table 7.

At the TAN gravel pit, the NVC vegetation class of the greatest conservation concern, with a conservation of G3, is dominated by winterfat with abundant Sandberg bluegrass in the understory. Though vegetation classes dominated by winterfat are ubiquitous in the project area, the Association differentiated by abundant Sandberg bluegrass is very limited in its distribution. At the Infiltration Basin, the vegetation class that is comprised of three-tip sagebrush in the canopy and bluebunch wheatgrass in the understory is the vegetation class of greatest concern. It occurs sporadically throughout the project site, and tends to be somewhat weedy where it occurs.

Table 7. Cross-walk of vegetation classes on the proposed RRTR project sites with NVC Association-level classes and their Conservation Status Ranks. Class numbers reflect multivariate classifications (see Shive et al. 2011). Class names are consistent with NVCS nomenclature (FGDC 2008).

Class #	Colloquial Class Name	Related NVC Associations	Database Code	Conservation Rank
2	Big Sagebrush Shrubland	Basin Big Sagebrush Shrubland	CEGL000991	G5
		Basin Big Sagebrush / Indian Ricegrass Shrubland	CEGL001006	G4
		Basin Big Sagebrush / Green Rabbitbrush / Sandberg Bluegrass Shrubland	CEGL000999	G5
		Basin Big Sagebrush / Squirreltail Shrubland	CEGL001001	G5
5	Green Rabbitbrush - Winterfat Shrubland	Winterfat Dwarf-shrubland	CEGL001320	G5
		Winterfat / Indian Ricegrass Dwarf-shrubland	CEGL001323	G4
		Winterfat / Sandberg Bluegrass Dwarf-shrubland	CEGL001326	G3
7	Wyoming Big Sagebrush Shrubland	Wyoming Big Sagebrush / Indian Ricegrass Shrubland	CEGL001046	G5
		Wyoming Big Sagebrush / Squirreltail Shrubland	CEGL001043	G4
		Wyoming Big Sagebrush / Needle-and-Thread Shrubland	CEGL001051	G2
		Wyoming Big Sagebrush / Sandberg Bluegrass Shrubland	CEGL001049	G4
		Wyoming Big Sagebrush / Sparse Understory Shrubland	CEGL002768	GNR
		Wyoming Big Sagebrush / Mixed Grasses Shrub Herbaceous Vegetation	CEGL001534	G5
10	Crested Wheatgrass Semi-natural Herbaceous Vegetation	Wyoming Big Sagebrush / Western Wheatgrass Shrub Herbaceous Vegetation	CEGL001047	G4
		N/A	N/A	N/A
15	Sickle Saltbush Dwarf Shrubland	N/A	N/A	N/A
18	Three-tip Sagebrush Shrubland	Threetip Sagebrush / Bluebunch Wheatgrass Shrub Herbaceous Vegetation	CEGL001538	G2
22	Shadscale Dwarf Shrubland	Shadscale / Indian Ricegrass Shrubland	CEGL001311	G3

2.3 Soils

NSTRX

The soils in the area of the proposed test site are generally described as sands over basalt. Olson et al (1995) mapped the soils at the R&D Range as the Grassy Butte-Rock Outcrop Complex (Figure 5). This complex of soils includes a number of soil mapping units. Grassy Butte very stony loamy sand makes up about 30 % and the Rock Outcrop makes up about 20% of the area in this soil complex. The remaining 50 % of this soil complex is made up of about equal parts of

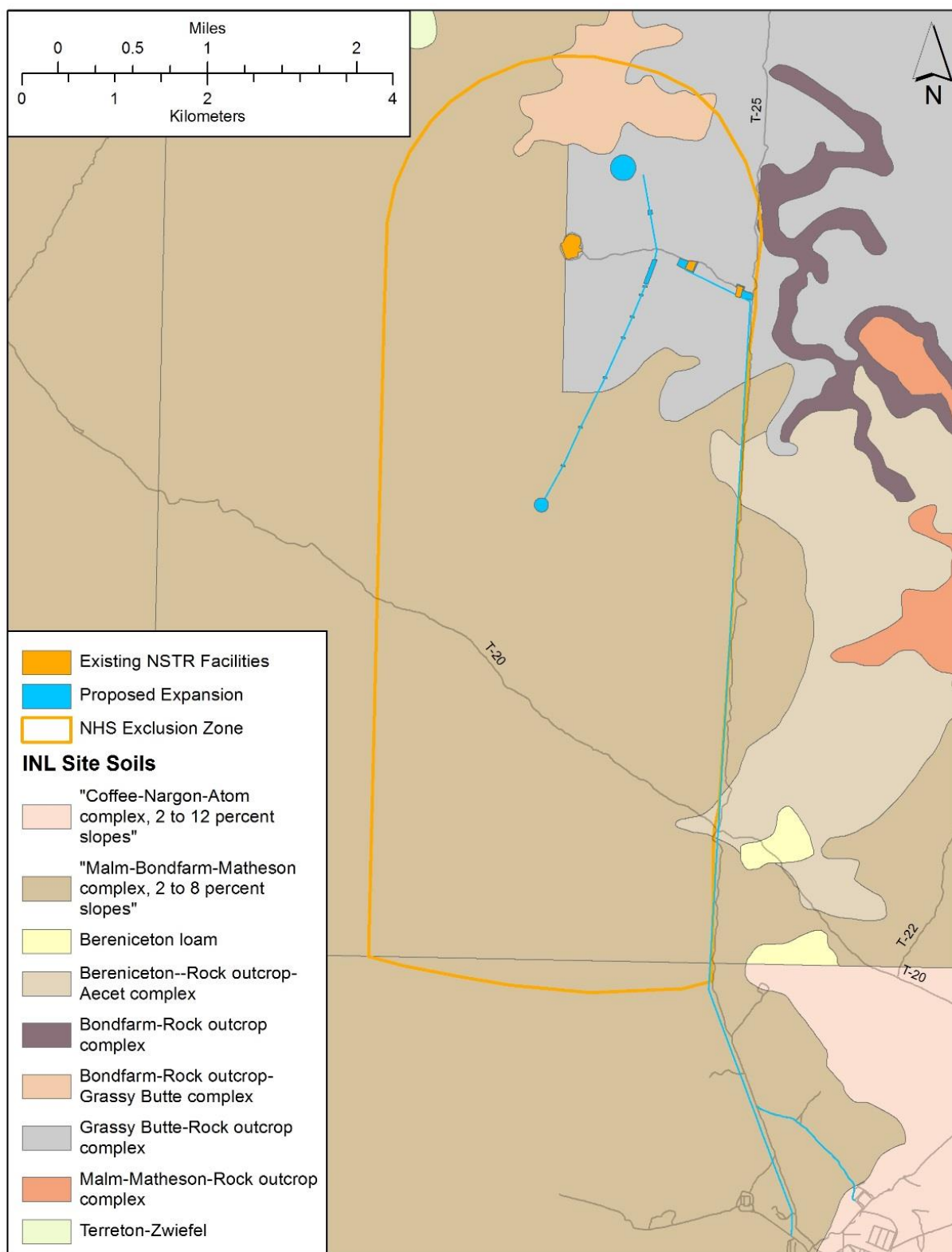


Figure 5. Soils in the vicinity of the NSTRX R&D Range.

Grassy Butte 10 – 40 inches (25 – 102 cm) deep to bedrock, Grassy Butte 40 – 60 inches (102 – 152 cm) deep to bedrock, Matheson loamy sand, Bondfarm sandy loam, and Grassy Butte loamy sand. The soil at the new explosive range is likely the Grassy Butte series. The down range target area likely intersects areas of Grassy Butte and Rock Outcrop and Bondfarm sandy loam.

Both the Grassy Butte and the Bondfarm sandy loam have a very high hazard of soil blowing (wind erosion). The very high hazard of soil blowing imparts certain limitations to use of these soils (Olson et al, 1995). They are not suited to mechanical rangeland management treatments including seeding. These soils are classified as Land Capability Class VIIe and have very severe limitations that make them unsuitable for cultivation due to erosion. For example, the Grassy Butte soil may require that one-half of the area be replanted each year. This becomes important when considering restoration or long-term erosion control measures. Also, these soils have impaired trafficability (the capability of the terrain to bear traffic).

RRTR

The soils at the RRTR North location are very different from the soil found at the RRTR South location. The Tan Gravel pit is predominately the Terreton silty clay loam. This very deep, well-drained soil is found in areas of old lake beds. Typical this soil is suitable for crops and native vegetation is usually in excellent condition. However, it is likely that this particular location is heavily inundated with coarser materials, making it suitable for extraction and use as a borrow source. A large portion of the area to be fenced has already been used as a gravel source and is devoid of vegetation completely.

Whiteknob gravelly loam can be seen on the soil map (Figure 6) in the northwest corner of the fenced area. This particular soil is deep, and well drained and the underlying mixture is often gravelly or very gravelly sand. It is possible that this soil ranges farther south which made the area suitable for use as a gravel source.

The Infiltration Basin is made up of one soil type entirely, the Coffee-Nargon-Atom complex, 2 to 12 percent slopes. This soil is described as a moderate to very deep, typically well drained soil that formed in alluvium from loess that are deposited on basalt. This soil is typically found at elevations between 4500 ft and 5500 ft (1372 m and 1676 m) and receive an average of 10 inches (25.4 cm) of precipitation over a year. These soils are moderately extensive throughout southeast Idaho and are dominated by sagebrush (Olsen, et al, 1995).

Although the soils at both locations of the RRTR are considered well developed and stable, any disruptions to the surface can cause detrimental effects to the soil structure which can make revegetation difficult, especially in areas of low yearly precipitation, such as the INL Site.

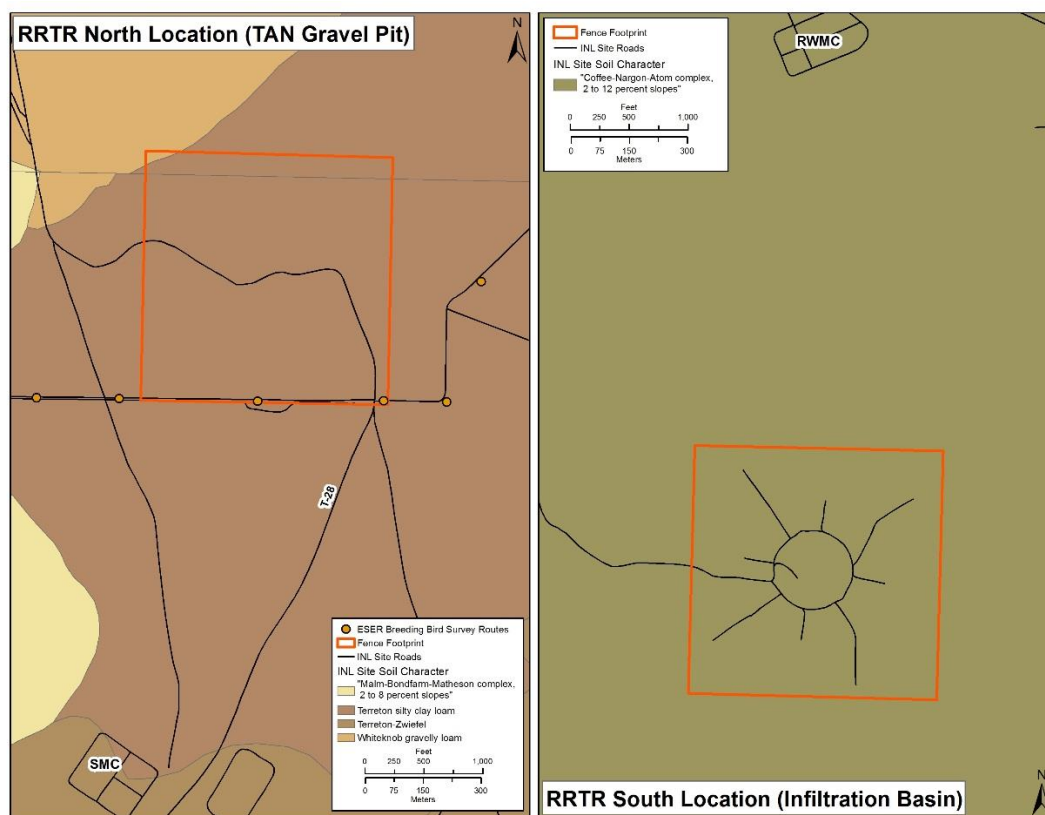


Figure 6. Soils in the vicinity of the RRTR locations.

2.4 Invasive and Non-Native Species

A total of eleven Idaho Noxious Weeds have been identified on the INL Site. In a literature survey, Pyke (1999) identified 46 exotic species that are weeds capable of invading sagebrush steppe ecosystems, with as many as 20 of these classed as highly invasive and competitive.

Other significant non-native and/or invasive plants found on or near the proposed road corridors include cheatgrass, Russian thistle (*Salsola kali*), halogeton (*Halogeton glomeratus*), tumble mustard and crested wheatgrass.

NSTRX

Of the eleven noxious weeds found on the INL Site, only musk thistle (*Carduus nutans*) was documented in the project area (Figure 7). Musk thistle and Canada thistle are both very common noxious weeds on the INL Site. Although Canada thistle was not documented during this survey, it was found during the surveys done for the original NSTR project. Canada thistle is extremely difficult to control in that it reproduces from both seed and rootstock (Sheley and Petroff 1999). Musk thistle is more readily controlled as it only reproduces from seed, but may require persistent management. However, in areas with abundant elk, musk thistle is rarely a long-term issue as elk eat the mature flowers before they go to seed and spread. Musk thistle was found primarily along T-25 (new powerline) and along the alternate access to T-25 in addition to one location on the original downrange target area.

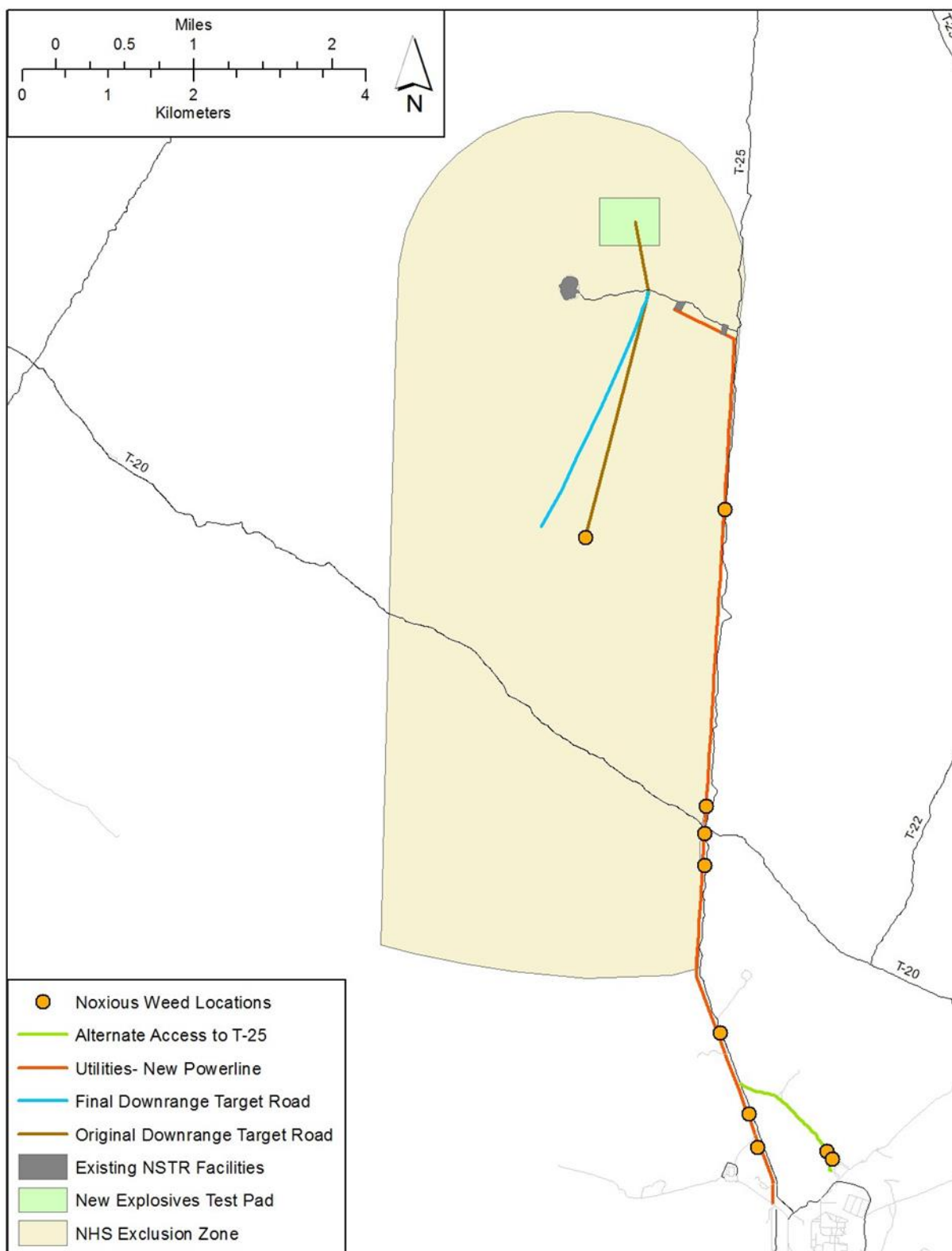


Figure 7. Noxious weed observations in the proposed NSTRX project area.

Non-native species also present a challenge in disturbed areas. They establish very quickly and successfully compete with the native species. Cheatgrass is present to dominant in most of the vegetation survey plots. Halogeton is present on many of the survey points, although never dominant. These non-native annual species are very quick to colonize any new disturbance and are very difficult to eradicate once they are present. Most non-native annuals produce large amounts of seed every year and the seeds remain viable for long periods of time.

RRTR

The surveys associated with the fence and road around the RRTR facilities yielded no noxious weeds sightings. However, in years past, various thistle species have been present in the bottom of the Infiltration Basin. During this survey, no thistles were found, but the Infiltration Basin itself was not surveyed. It is likely that some of these species do still exist in that area.

Although there were no noxious weeds, there are many areas dominated by non-native species such as halogeton and cheat grass as well as various introduced mustards and desert alyssum. Any time there is disturbance to an area, these species have the opportunity and are likely to spread. At both locations, a fence and road are already present on the south side. It would be beneficial to use existing road ways even if it increases the size of the fence in order to minimize the soil disturbance.

2.5 Sensitive Plant Species

Forman (2015) recently completed a review of sensitive plant species on the INL Site. That report was used as a basis for determining which special status plant species have the potential to occur on the NSTRX and RRTR sites. A species was considered to be rare or sensitive if it had a global or state conservation status ranking of “3” or less. NatureServe maintains an extensive database of species-specific information and it assigns each species an applicable global or “G” rank, and state or “S” rank. The “G” and “S” designation for each species is ranked on a 1 to 5 scale denoting its current status (Table 8), ranging from secure to extinct. Occasionally a species will receive a range of ranks (e.g., G2G3).

Table 8. Standardized conservation status ranks summarized from NatureServe (2015).

Rank	Definition
X	Presumed Extinct – Species not located despite extensive searches.
H	Possibly Extinct – Known from only historical occurrences, but with the possibility of rediscovery.
1	Critically Imperiled – At very high risk of extinction due to extreme rarity and/or very steep population declines.
2	Imperiled – At high risk of extinction due to very restricted range, very few populations, or population declines.
3	Vulnerable – At moderate risk of extinction due to restricted range, relatively few populations, or recent and widespread population declines.
4	Apparently Secure – Uncommon but not rare; some cause for long-term concern due to population declines or other factors.
5	Secure – Common; widespread and abundant.

NSTRX

Four species were identified as having the potential to occur in the survey area, based primarily on habitat requirements of the sensitive species and the availability of such habitat on and around NSTRX (Table 9). Although it wasn't identified as a sensitive species in Forman 2015, painted milkvetch (*Astragalus ceramicus* var. *apus*) was also considered in the review of potentially occurring sensitive species for this project because the variety that is known to occur on and around NSTR (Blew et al. 2006) is ranked as vulnerable (3) due to a highly restricted distribution in sand dune habitat (NatureServe 2016). This species is of particular concern because it was once considered a candidate species through the Endangered Species Act (ESA), but was removed from further consideration, partly because the INL Site supported healthy and productive populations (Cholewa and Henderson 1984).

Table 9. Special status plant species with the potential for occurrence on the proposed project site. Information is summarized from Forman 2015 and NatureServe 2015. Species nomenclature follows the National PLANTS Database (USDA – NRCS 2015).

Scientific Name	Common Name	G Rank	S Rank	Habitat
<i>Astragalus oniciformis</i>	Picabo milkvetch	G3	S3	Sagebrush communities in sandy basins with exposed
<i>Cuscuta denticulata</i>	desert dodder	G4G5	S1	Grows on shrubs in dry sandy, gravelly, and rocky
<i>Eriogonum hookeri</i>	Hooker's buckwheat	G5	S1	Sandy soils in sagebrush and juniper communities
<i>Oenothera psammophila</i>	St. Anthony Dunes evening primrose	G3	S3	Interface between lava reefs and sand dunes

Surveys were completed for all five species on the Explosives Test Pad and Access Road, New Powerline, and Alternate Access to T-25 in July of 2016. Several of the sensitive species with potential habitat on or around the NSTRX site are most accurately identified while in seed, making July an optimal phenological window for surveys. The Downrange Target Area was moved in September and it was too late in the season to resurvey for sensitive species in that part of the project area.

Of the five species surveyed, only painted milkvetch was positively identified on the NSTRX site (Figure 8). Three small populations, each with ten or fewer individuals, were located along the proposed New Powerline. Several additional small populations of this species were observed adjacent to, but not directly within the proposed Explosives Test Pad and Access Road. The Downrange Target Area contains appropriate habitat for painted milkvetch and this species is present in similar adjacent habitats, so it is not unreasonable to assume that it is also present in this area, though the Downrange Target Area location was moved too late in the season to complete new sensitive species surveys. Because painted milkvetch is a short-lived perennial and local population persistence is annually variable (NatureServe 2016), populations may more detectable in some years than others, so the known distribution of painted milkvetch in 2016 may not reflect population distribution in other years. It is possible for painted milkvetch to occur anywhere in the proposed project area, with appropriate habitat, during any given year.

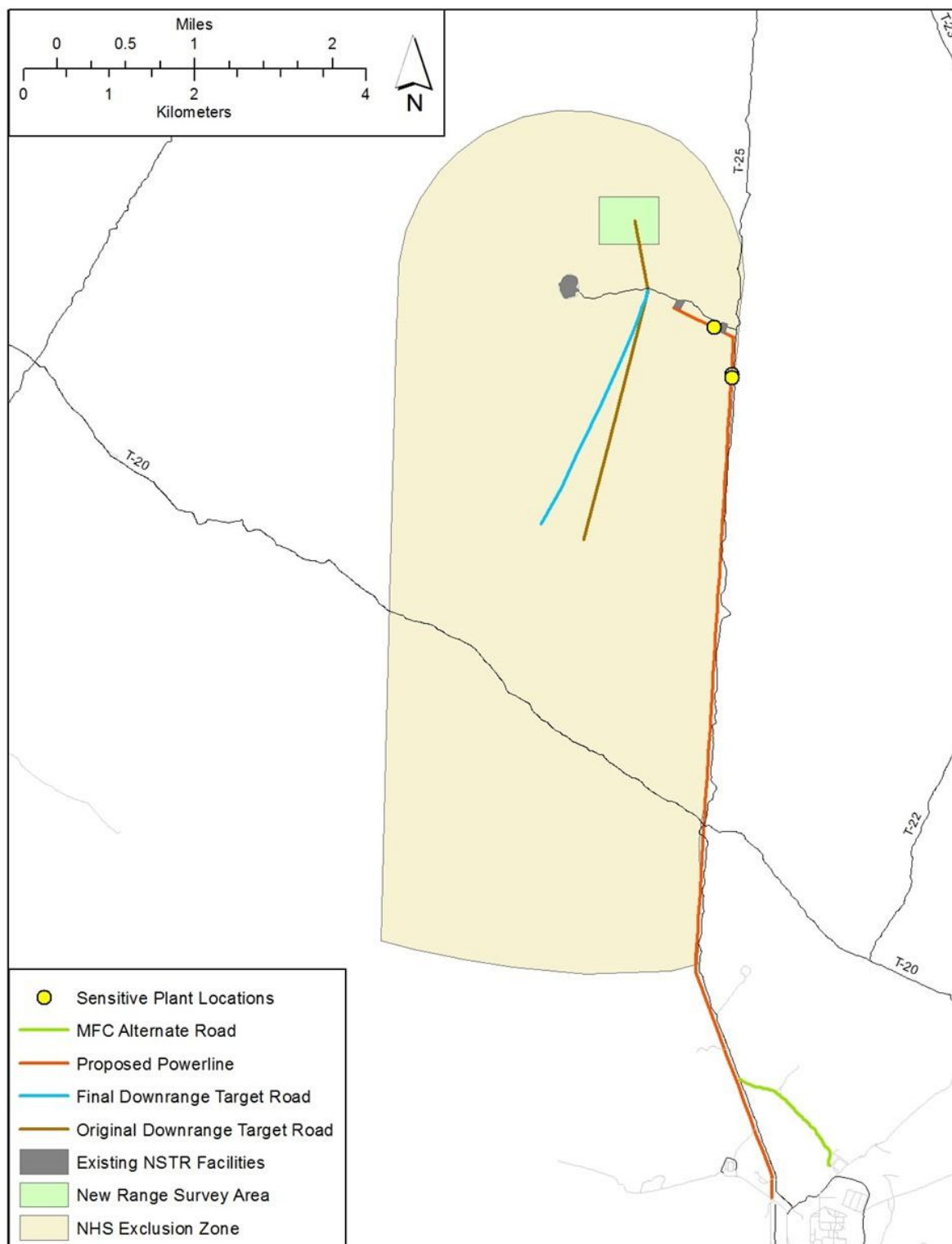


Figure 8. Locations of *Astragalus ceramicus* var. *apus* populations documented during sensitive species surveys conducted on the proposed NSTRX project site during July of 2016.

RRTR

Three sensitive plant species were identified as having the potential to occur on the RRTR North project site (Table 10). The habitat requirements of these species, saline and/or alkaline soils combined with closed playas or basins, are consistent with the habitat available on the project site. A survey for these species was completed on June 27th, 2017. The survey area included the proposed fence location and approximately 10 ft. on either side of the proposed fence to allow for vehicle access during fence building. There were no observations of sensitive species made during the surveys.

Table 10. Special status plant species with the potential for occurrence on the proposed RRTR North project site (TAN gravel pit). Information is summarized from Forman 2015 and NatureServe 2015. Species nomenclature follows the National PLANTS Database (USDA – NRCS 2015).

Scientific Name	Common Name	G Rank	S Rank	Habitat
<i>Allenrolfea occidentalis</i>	iodinebush	G4	S1	Alkali flats, saline playas
<i>Astragalus diversifolius</i>	meadow milkvetch	G2	S2	Moist alkaline meadows, closed drainage basins with sagebrush
<i>Primula incana</i>	silvery primrose	G4G5	S1	Herbaceous communities in alkaline soils

Two sensitive plant species were identified as having the potential to occur on the RRTR South project site based on the habitat requirements of those species. The habitat available on the RRTR South project site is characterized by gravelly loam soils and Wyoming big sagebrush/three-tip sagebrush plant communities. A survey for these species was completed on June 27th, 2017. The survey area included the proposed fence location and approximately 10+ ft. on either side of the proposed fence to allow for vehicle access during fence building. There were no observations of sensitive species made during the surveys.

Table 11. Special status plant species with the potential for occurrence on the proposed RRTR South project site (Infiltration Basin). Information is summarized from Forman 2015 and NatureServe 2015. Species nomenclature follows the National PLANTS Database (USDA – NRCS 2015).

Scientific Name	Common Name	G Rank	S Rank	Habitat
<i>Allium anceps</i>	twinleaf onion	G4	S2	Rocky, fine soils in sagebrush scrub
<i>Cuscuta denticulata</i>	desert dodder	G4G5	S1	Grows on shrubs in dry sandy, gravelly, and rocky soils

2.6 Ethnobotany

Several species of ethnobotanical importance are known to occur on and around the NSTRX and RRTR site locations. A list of species thought to be of historical importance to local tribes was compiled from *Plant Communities, Ethnoecology, and Flora of the Idaho National Engineering Laboratory* by Anderson et al. (1996). The list includes those species documented to have been used by “indigenous groups of the eastern Snake River Plain,” (Anderson et al. 1996). As plant community and sensitive plant surveys were completed, species from the list of ethnobotanical importance were noted throughout the project area (Table 12). Many of the species are abundant and widespread throughout the area and across much of the rest of the INL Site as well.

Table 12. Species of ethnobotanical importance noted on the NSTRX/RRTR locations during vegetation surveys in July and September of 2016 and June of 2017. Species nomenclature follows the National PLANTS Database (USDA – NRCS 2016). Species uses are from Anderson et al. 1996.

Scientific Name	Common Name	Uses
<i>Achnatherum hymenoides</i>	Indian ricegrass	food
<i>Allium textile</i>	textile onion	food, medicine, flavoring, dye
<i>Artemisia tridentate</i>	big sagebrush	food, medicine, cordage, clothing, shelter, fuel, dye
<i>Bromus techorum</i>	cheatgrass	food
<i>Carex douglasii</i>	Douglas' sedge	food, medicine
<i>Chaenactis douglasii</i>	Douglas' dustymaiden	food, medicine
<i>Chenopodium fremontii</i>	Fremont's goosefoot	food
<i>Chenopodium leptophyllum</i>	narrowleaf goosefoot	food
<i>Chrysothamnus viscidiflorus</i>	green rabbitbrush	medicine, gum
<i>Crepis acuminata</i>	tapertip hawksbeard	food
<i>Delphinium andersonii</i>	Anderson's larkspur	medicine, dye
<i>Descurainia pinnata</i>	western tansymustard	food, medicine
<i>Descurainia Sophia</i>	herb sophia	food, medicine
<i>Ericameria nauseosus</i>	rubber rabbitbrush	medicine, gum
<i>Elymus elymoides</i>	bottlebrush squirreltail	food
<i>Elymus lanceolatus</i>	streambank wheatgrass	food
<i>Eriogonum ovalifolium</i>	cushion buckwheat	medicine
<i>Erigeron pumilus</i>	shaggy fleabane	medicine, arrow tip poison
<i>Gutierrezia sarothrae</i>	broom snakeweed	medicine
<i>Hesperostipa comata</i>	needle-and-threads	food
<i>Lappula occidentalis</i>	flatspine stickseed	food
<i>Lactuca serriola</i>	prickly lettuce	food, medicine
<i>Leyms cineris</i>	basin wildrye	food, manufacture
<i>Lomatium dissectum</i>	fernleaf biscuitroot	food, medicine
<i>Lomatium foeniculaceum</i>	desert biscuitroot	food, medicine
<i>Lygodesmia grandiflora</i>	largeflower skeletonplant	food, gum
<i>Mentzelia albicaulis</i>	whitestern blazingstar	food
<i>Oenothera caespitosa</i>	tufted evening-primrose	food, medicine
<i>Opuntia polyacantha</i>	pricklypear	food
<i>Phacelia hastate</i>	silverleaf phacelia	food
<i>Pleiocanthus spinosus</i>	Thorn skeletonweed	food, gum
<i>Poa secunda</i>	sandberg bluegrass	food, medicine
<i>Pteryxia terebinthina</i>	turpentine wavewing	food
<i>Rumex venosus</i>	veiny dock	food, medicine
<i>Salsola kali</i>	russian thistle	food
<i>Sisymbrium altissimum</i>	tall tumbledmustard	food
<i>Sphaeralcea munroana</i>	white-stemmed globe-mallow	food, medicine, manufacture
<i>Taraxacum officinale</i>	common dandelion	food, medicine
<i>Tragopogon dubius</i>	Yellow salsify	food, medicine

2.7 Wildlife Use

For more than 40 years, scientists on the INL Site have collected data on wildlife data and conducted wildlife research. A total of 219 vertebrate species have been recorded as occurring (Reynolds et al. 1986). Many of these species are directly associated with sagebrush steppe habitat or are considered shrub-obligates. Recent fires (most recently the T-17 and Jefferson fires), have transformed habitats from predominantly sagebrush to extensively grassland habitats with isolated and widely scattered sagebrush patches and individual plants. This habitat change

has altered wildlife communities and wildlife use within the approved administrative buffer area and surroundings. Where once sagebrush-associated species such as the pygmy rabbit (*Brachylagus idahoensis*), sage sparrow (*Amphispiza bilineata*), and Brewer's sparrow (*Spizella breweri*) occurred, now species that thrive in grasslands such as elk (*Cervus elaphus*), mountain cottontail (*Sylvilagus nuttallii*), horned larks (*Eremophila alpestris*), and vesper sparrows (*Pooecetes gramineus*) predominate. Sagebrush dependent species, such as the sage-grouse, continue to flourish in the surrounding sagebrush habitats outside burned areas and thus may occasionally occur in adjacent grasslands.

NSTRX

Wildlife communities that occur in the NSTRX area include habitat generalists and those species common to disturbed areas and habitats recovering from fire. Resident species include small and medium sized mammals [e.g., bushy-tailed woodrat (*Neotoma cinerea*), Ord's kangaroo rat (*Dipodomys ordii*), black-tail jackrabbit (*Lepus californicus*), mountain cottontail, long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*)], and reptiles [sagebrush lizard (*Sceloporus graciosus*) and gopher snake (*Pituophis catenifer*)]. These species have small home ranges, limited mobility, or a social structure that restricts movement.

During previous surveys and surveys conducted for Proposed Action, western rattlesnake (*Crotalus viridis*), gopher snake (*Pituophis catenifer*), northern sagebrush lizard (*Sceloporus graciosus graciosus*), short-horned lizard (*Phrynosoma douglasii*) were observed near exposed basalt outcrops along the eastern site of the NSTRX area. Great Basin rattlesnakes are listed as protected non-game wildlife by the State of Idaho (Idaho CDC 2005). Great Basin rattlesnakes require winter habitats that allow them to go underground to depths below the frost line. On the INL Site these habitats are typically associated with volcanic features such as craters, cones, and lava tubes. The presence of rattlesnakes and gopher snakes suggests that a snake hibernaculum (wintering area) is present in the general area; however, no evidence of a communal hibernation site was identified during surveys. Two species considered uncommon on the INL Site, leopard lizards (*Gambelia wislizenii*) and desert striped whipsnakes (*Masticophis taeniatus*) have only been found in this general area of the INL Site (Linder and Sehman 1978) and were not observed during our survey. All Idaho reptiles and amphibians (except bullfrog) are classified as protected non-game species. This designation is held at the state level to help protect populations (IDFG 2005).

In many desert ecosystems, small mammals create a prey base for larger predators. During surveys, several species of small mammals or their sign were observed using the NSTRX area. These include, black-tailed jackrabbit, mountain cottontail, Townsend's ground squirrel (*Spermophilus townsendii*), bushy-tailed woodrat, Ord's kangaroo rat, deer mouse (*Peromyscus maniculatus*), and montane vole (*Microtus montanus*). Although these species are not listed on any sensitive list, they do provide a food resource for many species such as prairie falcon (*Falco mexicanus*), ferruginous hawk (*Buteo regalis*), bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*). These small mammal species also provide a major prey base for coyotes (*Canis latrans*) and bobcats (*Lynx rufus*) using the area.

Many species use the NSTRX area in a transitory manner. Species that use the area in this manner are in search of prey or forage, areas to reproduce, shelter from the elements or are moving between seasonal use habitats. Bird species observed using the area include horned lark,

western meadowlark (*Sturnella neglecta*), vesper sparrow, grasshopper sparrow (*Ammodramus savannarum*), loggerhead shrike (*Lanius ludovicianus*), rock wren (*Salpinctes obsoletus*), common nighthawk (*Chordeiles minor*), red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk, prairie falcon, and common raven (*Corvus corax*). All bird species are protected under the Migratory Bird Treaty Act. Although only one abandoned raptor nest was observed during surveys, isolated live junipers and skeletons of burned junipers near lava outcrops may provide nesting substrate for ferruginous hawks and other raptor species. Bald eagles have been observed using the general area during the winter and golden eagles have been observed using the area throughout the year. Lek surveys conducted since 2014 indicate the presence of sage-grouse in areas surrounding the NSTRX facilities.

Big game species utilize most of the INL Site, including the NSTRX area. During previous surveys in conjunction with environmental analysis for the establishment of NSTR, both elk and pronghorn (*Antilocapra americana*) were observed using the NSTR area. Current surveys conducted for the NSTRX site detected pronghorn adults and fawns utilizing the southern portions of the area. Big game surveys conducted winter and summer until 2012 indicated that all big game species use the area throughout the year. Elk and pronghorn have benefited from fires due to the increased grass and herbaceous vegetation in grassland habitats. Research conducted on the INL Site (Comer 2000) found that elk used the general area that includes the NSTRX area for calving purposes. Also, pronghorn have been observed using the area for fawning. The INL Site provides critical winter range for both elk and pronghorn with numbers reaching 1,000 and >3,000, respectively. It is estimated that more than 100 elk and approximately 500 pronghorn summer on the INL Site. Large herds numbering more than 130 individuals have been observed using the area during different times of the year.

To support the expansion of NSTR, bat acoustic surveys were conducted near lava outcrops along the eastern margin in areas with apparent deep fissures and vertical extent most likely to support bat summer roosts. A total of six detector nights of data were collected in three locations during midsummer when resident bat species should have established maternity roosts (Figure 9). Of 341 call files collected, all identifiable bat call sequences appeared to be from western small-footed myotis (*Myotis ciliolabrum*) except for one big brown bat (*Eptesicus fuscus*). Timing and level of activity did not suggest the presence of significant summer roosts in the NSTRX area surveyed. Western small-footed myotis is considered the most abundant bat on the INL Site during the spring and summer roosting in sagebrush, junipers, buildings, and rocky outcroppings. Townsend's big eared bat (*Corynorhinus townsendii*), a BLM sensitive species (BLM 2003) has been documented roosting in caves and lava tubes throughout the INL Site but was not detected during surveys for the NSTRX.

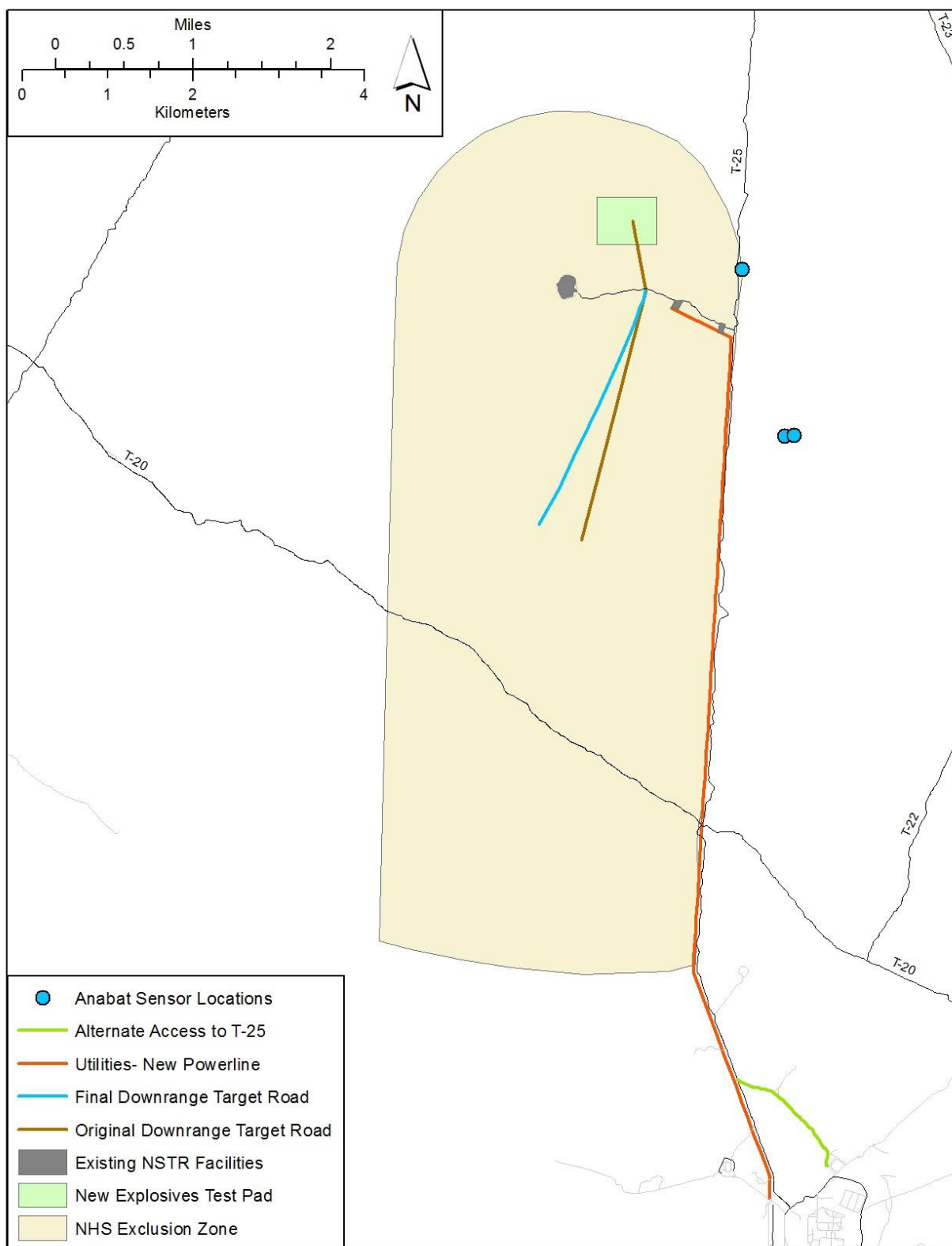


Figure 9. Anabat detector locations at NSTRX.

RRTR

Species associated the RRTR areas include sagebrush obligates, species often associated with sagebrush dominated habitats for at least portions of their lives, and habitat generalists common on the INL Site. Species likely residing within and around the North and South RRTR areas include small and medium-sized mammals (e.g., deer mouse [*Peromyscus maniculatus*], bushy-tailed woodrat [*Neotoma cinerea*], Ord's kangaroo rat [*Dipodomys ordii*], black-tail jackrabbit [*Lepus californicus*], long-tailed weasel [*Mustela frenata*], badger [*Taxidea taxus*]), and reptiles (sagebrush lizard [*Sceloporus graciosus*] and gopher snake [*Pituophis catenifer*]). These species generally have small home ranges and limited mobility. Previous surveys indicated the presence of the sagebrush obligate pygmy rabbit [*Brachylagus idahoensis*] in the vicinity of the North RRTR area. With the exception of pygmy rabbit, each of these species can be found in both sagebrush and grassland habitats. Birds (horned lark [*Eremophila alpestris*], sage sparrow [*Amphispiza bilineata*], rough-legged hawk [*Buteo lagopus*], northern harrier and red-tailed hawk [*Buteo jamaicensis*]) and large mammals (elk [*Cervus elaphus*], mule deer [*Odocoileus hemionus*], and pronghorn [*Antilocapra americana*]) use the areas in a seasonally transitory manner. Coyotes (*Canus latrans*) are wide-ranging and may be found anywhere on the INL Site. Much of the species discussion above for NSTRX is applicable to RRTR portions of the Proposed Action.

Species identified at the North RRTR area during previous surveys include: badger, coyote, antelope, elk, mule deer, sagebrush lizard, horned lizard, ground squirrel, mountain cottontail (*Sylvilagus nuttallii*), black-tailed jack rabbit, least chipmunk (*Tamias minimus*), kangaroo rat, and pygmy rabbit. Signs of elk, mule deer, and pronghorn use of the area were observed during previous surveys with both pronghorn and elk considered common to the area. Recent (2016) breeding bird survey results indicate the presence of barn swallow, sage thrasher, western meadowlark, and sagebrush sparrow in the vicinity (Bybee and Shurtliff 2016). A single golden eagle (*Aquila chrysaetos*) was observed during these surveys. During winter, golden eagles may be common on the northern side of the INL Site. No historical greater sage-grouse (*Centrocercus urophasianus*), leks have been reported in the vicinity.

Pygmy rabbits are sagebrush steppe obligate species and under consideration for protection under the Endangered Species Act. Pygmy rabbits depend on sagebrush for cover and forage. Once sagebrush is removed from an area, pygmy rabbits disappear (Green and Flinders 1980, Katzner et al. 1997). Populations of pygmy rabbits on the INL Site may be relatively stable because much of the area remains undisturbed. Pygmy rabbits or their sign have been observed at the North RRTR area. Pygmy rabbit habitat is extensive in sagebrush steppe in the vicinity with both burrow systems and scat documented.

At the South RRTR area, pronghorn, elk, and coyote are present in the vicinity as well as various small mammals. Signs of elk, mule deer, and pronghorn use of the areas were observed during previous surveys. Pronghorn sign was most common. Breeding bird survey results indicate horned lark, sage thrasher, sagebrush sparrow, Brewer's sparrow, mourning dove, and western meadowlark are common to the area (Bybee and Shurtliff 2016). No historical greater sage-grouse leks have been reported in the vicinity. Greater sage-grouse scat was observed during

previous surveys; egg shell fragments were observed during surveys conducted for the current analysis along proposed fence lines (Figure 10).

Wildlife species of concern include species protected under the Migratory Bird Treaty Act (including raptors), greater sage-grouse, pygmy rabbits and big game species.

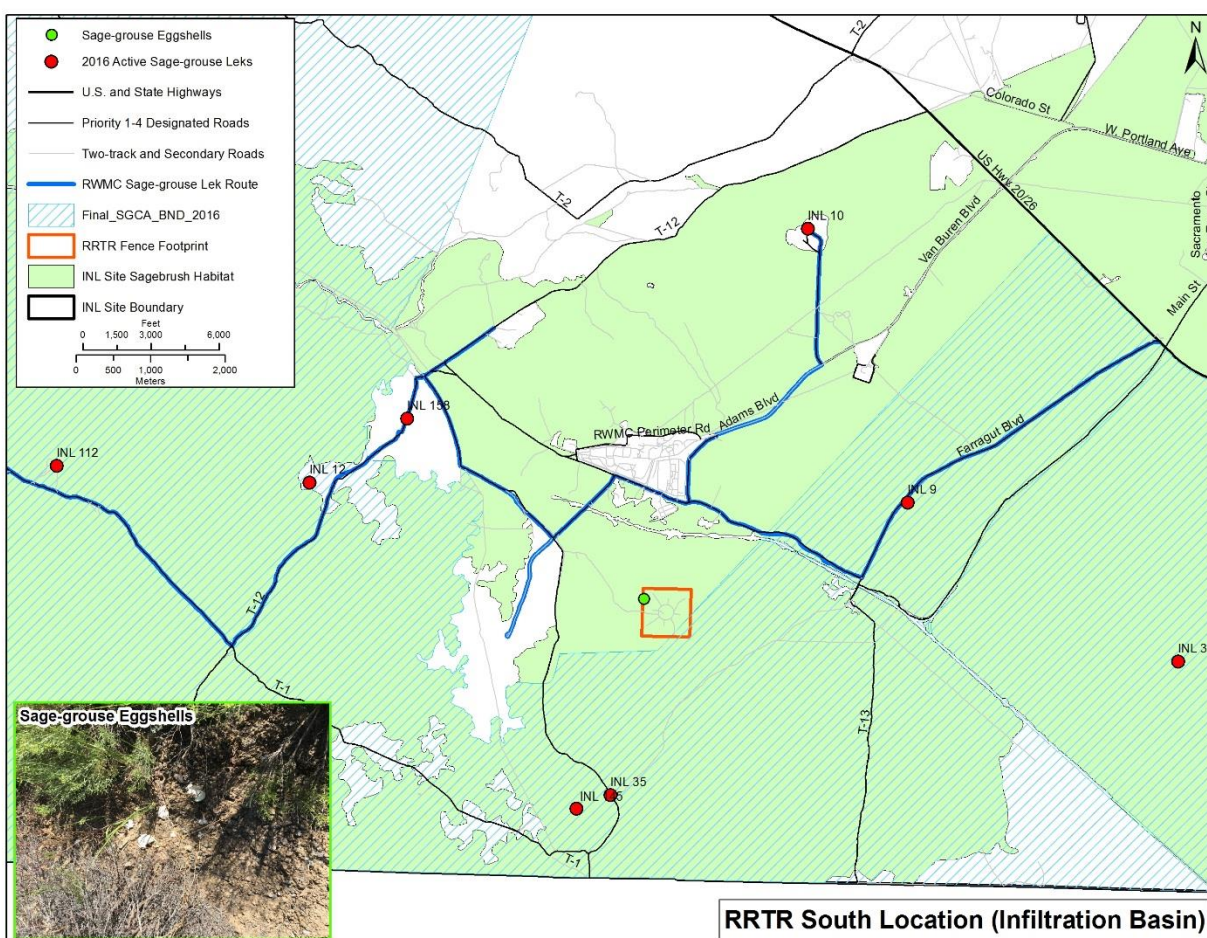


Figure 10. South RRTR location showing proximity of leks and SGCA boundary.

The U.S. Fish and Wildlife Service recently released a finding that sage-grouse warrant protection under the Endangered Species Act but are precluded due to other listing priorities (DOI-FWS 2010). As a result, DOE developed cooperative agreements with state and federal resources agencies and prepared a Candidate Conservation Agreement (CCA). Breeding habitats, primarily leks, have become a focal point for managing this species. Lyon (2000) estimated the average nest distances to the nearest lek varies from 0.6-3.9 mi (1.0 to 6.3 km) but may be as great as 12.5 mi (20 km). The INL Site greater sage-grouse CCA committed DOE to protecting sagebrush habitat within 0.6 mi (1 km) of known leks and established a sage grouse conservation area (SGCA) outside the core development area of the INL Site to protect nesting, brood rearing and wintering habitat (DOE and USFWS 2014).

2.8 Biota Dose Assessment

NSTRX and RRTR

To determine all possible impacts on the environment, the dose from radioactive materials to plant and animal populations in the affected area were evaluated. The maximum predicted soil concentrations in the top 5 cm of soil after 15 years of testing (assuming a density of 1.5 g/cc and a moisture content of 0.3) within a 16-ft diameter circle were used for this assessment (Table 13).

Table 13. Maximum radionuclide concentrations in soil after 15 years of testing.

Nuclide	Maximum Soil Concentration (pCi/g)
Be-10	2.78E-12
C-14	5.00E-03
Cl-36	1.67E-02
K-40	4.64E+01
Ni-63	2.11E-06
Zn-65	6.67E-02
Se-79	6.07E-04
Rb-87	2.37E-03
Pd-107	1.46E-13
Cd-109	1.54E-10
Ag-110m	1.34E-02
Cs-135	3.01E-11
Cs-137	1.76E-11
La-137	1.39E-06
La-138	1.15E-02

The impact on nonhuman biota can be assessed using *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2019) and the associated software, RESRAD-Biota 1.8 (<http://resrad.evs.anl.gov/codes/resrad-biota/>). The graded approach begins the evaluation using conservative default assumptions and maximum values for all currently available data. This general screening level (Level 1 in RESRAD-Biota) provides generic limiting concentrations of radionuclides in environmental media termed Biota Concentration Guides (BCGs). Each Biota Concentration Guide is the environmental concentration of a given radionuclide in soil or water that, under the assumptions of the model, would result in a dose rate 1 rad/d (10 mGy/d) to terrestrial plants or 0.1 rad/d (1 mGy/d) to terrestrial animals. Dose limits of 1.0 rad/day for terrestrial plants and 0.1 rad/day for terrestrial animals are intended to provide protection from chronic exposure of whole populations of individual species rather than individual members of the population. If the estimated ratio is below 1.0, the dose to the receptor is below the biota dose limit and the general screening evaluation has been passed.

Carbon-14, Cl-36, Cs-135, Cs-137, K-40, and Zn-65 are the only radionuclides shown in Table 13 that are included in the RESRAD-Biota 1.8 radionuclide library. The results of the screening analysis for these radionuclides are presented in Table 14. As shown in the table, terrestrial

animals are the limiting organism and the final ratio is 0.39 (the primary contributor being K-40.) The dose to terrestrial animals is thus below the biota dose limit for C-14, Cl-36, Cs-135, Cs-137, K-40, and Zn-65.

Table 14. Terrestrial BCG Report for RESRAD-Biota 1.8 Level 1 Analysis.

Terrestrial Animal					
Soil				TOTAL	
Nuclide	Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism	Ratio
C-14	0.005	4.76E+03	1.05E-06	Yes	1.05E-06
Cl-36	0.0167	2.89E+02	5.78E-05	Yes	5.78E-05
Cs-135	3.01E-11	2.62E+02	1.15E-13	Yes	1.15E-13
Cs-137	1.76E-11	2.08E+01	8.48E-13	Yes	8.48E-13
K-40	46.4	1.19E+02	3.90E-01	Yes	3.90E-01
Zn-65	0.0667	4.13E+02	1.62E-04	Yes	1.62E-04
Summed	-	-	3.90E-01	-	3.90E-01
Terrestrial Plant					
Soil				TOTAL	
Nuclide	Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism	Ratio
C-14	0.005	6.07E+04	8.24E-08	No	8.24E-08
Cl-36	0.0167	3.36E+03	4.98E-06	No	4.98E-06
Cs-135	3.01E-11	2.81E+04	1.07E-15	No	1.07E-15
Cs-137	1.76E-11	2.21E+03	7.98E-15	No	7.98E-15
K-40	46.4	1.38E+03	3.36E-02	No	3.36E-02
Zn-65	0.0667	2.47E+04	2.70E-06	No	2.70E-06
Summed	-	-	3.36E-02	-	3.36E-02

ERICA 1.2.1 (<http://www.ERICA-tool.com/>), a software system similar to RESRAD-Biota 1.8, was employed to assess the impact of some of the remaining radionuclides on terrestrial biota. The ERICA Tool has a structure based upon the tiered [ERICA Integrated Approach](#) to assessing the radiological risk to terrestrial, freshwater and marine biota (Brown et al 2015). The initial step is a screening process in which media activity concentrations are compared with concentration limits, derived from exposure levels at which detrimental effects are known to occur. The Terrestrial Environmental Media Concentration Limit used for terrestrial environments is analogous to the BCG used in RESRAD-Biota for terrestrial animals. The limit is based on a dose level of 40 μ Gy/hr, which is approximately equivalent to 1 mGy/da, the DOE standard for terrestrial animals. ERICA was used to assess the risk quotient (analogous to the BCG/concentration ratio shown in Table 14) for Ni-63, Se-79, Cd-109, and Ag-110m. As shown in Table 15, the final risk quotient sum (3.52E-05) was well below 1.0 and four orders of magnitude below the summed BCG/concentration ratios (0.42) calculated using RESRAD-Biota for the radionuclides shown in Table 14.

Table 15. Risk quotient and limiting reference organisms for ERICA 1.2.1 screening analysis.

Nuclide	Concentration (pCi/g)	Concentration (Bq/kg)	Terrestrial Environmental Media Concentration Limit (Bq/kg) ¹	Risk Quotient	Limiting Reference Organism
Ni-63	2.11E-06	7.81E-11	5.11E+06	4.13E-13	Reptile
Se-79	6.07E-04	2.25E-08	2.20E+05	2.75E-09	Annelid
Cd-109	1.54E-10	5.70E-15	6.38E+04	2.41E-15	Arthropod - detritivorous
Ag-110m	1.34E-02	4.96E-07	2.35E+04	5.69E-11	Mammal - large
Σ Risk Quotients				2.72E-07	
1. Dose screening rate value is 40 μGy/hr for terrestrial animals, birds, amphibians and reptiles, and 400 μGy/hr for plants and other aquatic organisms. It has previously been suggested that below these values (of chronic exposure) no measurable population effects would occur (IAEA 1992; DOE 2019; UNSCEAR 1996). 40 μGy/hr is approximately equivalent to 1 mGy/da, which is the DOE dose rate limit for terrestrial animals.					

The sum of the BCG/concentration ratios for C-14, Cl-36, Cs-135, Cs-137, K-40, and Zn-65 (Table 14) and the risk quotients for Ni-63, Se-79, Cd-109, and Ag-110m (Table 15) is 0.39. The dose to terrestrial animals is therefore below the DOE dose limit (1 mGy/da or 40 μGy/hr) indicating no detrimental impact to terrestrial biota from these radionuclides.

The remaining radionuclides (Be-10, Rb-87, Pd-107, La-137, and La-138) are not available in either RESRAD-Biota 1.8 or ERICA 1.2.1. They are all long-lived beta emitters and two of them (Rb-87 and La-138) have half-lives long enough (49.2 billion and 102 billion years, respectively) to be considered primordial. The shortest half-life (60 thousand years) belongs to La-137. Palladium-107 (half-life of 6.5 million years) is a pure beta emitter. Be-10 (half-life of 1.39 million years) is also a naturally-occurring radionuclide formed in the Earth's atmosphere mainly by cosmic ray spallation of nitrogen and oxygen.

These radionuclides are beta emitters and consequently the doses received by terrestrial animals due to external exposure would be negligible. A small burrowing mammal would more likely receive a dose from inhalation of suspended contaminated soil particles and/or ingestion of soil (it is doubtful that vegetation would be growing on the test site). Because there are no known published dose conversion factors for biota for Be-10, Rb-87, Pd-107, La-137, and La-138, dose conversion factors for inhalation and ingestion for human receptors (EPA 2002) were used to compare the potential impact of these radionuclides with the those assessed using RESRAD-Biota and ERICA. The comparison of the combination of dose conversion factors and soil concentrations indicates that the doses that would be received by biota from these remaining radionuclides would be bounded by doses previously calculated by RESRAD-Biota and ERICA. For example, the concentration of La-138 in soil (1.15E-2 pCi/g) is similar to that of Cl-36 (1.67E-2 pCi/g). The ingestion dose conversion factor for La-138 (4.05E-03 rem/Ci) is also similar that that for Cl-36 (3.44E03 rem/Ci). The inhalation dose conversion factor for La-138 (5.77E-05 rem/Ci) is slightly higher than for Cl-36 (1.40E-05 rem/Ci). However, given that the BCG ratio estimated for Cl-36 is 5.78E-5 (Table 14), it is logical to assume that the ratio for La-138 would also be orders of magnitude below 1.0 and would not affect the final summed ratios. Using the same approach, the remaining radionuclides were likewise dismissed as trivial contributors to the total dose to terrestrial animals. For this reason, it can reasonably be

concluded that the impact of the NSTR/RTTR testing would not exceed any of the DOE standards for protection of biota.

2.9 National Environmental Research Park

The INL Site is also the site of the Idaho National Environmental Research Park (NERP). The NERP program was established by Congress in the early 1970s. The Idaho NERP was chartered in 1975. The National Environmental Research Parks are field laboratories set aside for ecological research, for study of the environmental impacts of energy developments, and for informing the public of the environmental and land-use options open to them. According to the NERP Charter, those goals have been articulated in the National Environmental Policy Act, the Energy Reorganization Act, the Department of Energy Organization Act, and the Non-nuclear Energy Research and Development Act. The public's concern about environmental quality was translated through NEPA into environmental goals and the NERP provides a land resource for the research needed to achieve those goals. The NERP Charter allows that while execution of the program missions of DOE sites must be ensured, ongoing environmental research projects and protected natural areas must be given careful consideration in any site-use decisions.

The primary objectives for research on the NERP are to develop methods for assessing the environmental impact of energy development activities, to develop methods for predicting and mitigating those impacts. The NERP achieves these objectives by facilitating use of this outdoor laboratory by university and government researchers. Several research and monitoring projects have study sites in the vicinity of the proposed facility and roads (Figure 8).

The Long-Term Vegetation Transects (LTV) were established in the 1950's and have been read on a regular basis since then. The data from these transects represents one of the longest rangeland vegetation databases in the western U.S. The plots were last surveyed in 2016. There are no LTV plots located near the area of direct impact of the existing or updated NSTR or RRTR areas.

NSTRX

A recent research project studying vegetation recovery following wildland fire established plots near the proposed road corridors. The plots were established with the expectation of being used as a long-term monitoring plot for assessing vegetation recovery following fire. Some of these plots are very near T-25 north of MFC.

In addition to the NERP activities described above, additional DOE-sponsored ecological monitoring is conducted near the proposed test site (Figure 12). Two Breeding Bird Survey routes on the INL Site are in the vicinity of the proposed project. One route follows the fence line around MFC, and the other follows T-17 from PBF to Highway 28. These routes are surveyed during June each year.

Surveys for large mammals, primarily elk, pronghorn and mule deer are infrequent, although 58 cow elk were radio-collared during the winters of 2010, 2011 and 2012 for real time movement information associated with resident populations (Long 2013). In addition, radio collar surveys of coyotes have been done on the INL Site in this area in the past, although not within 15 years.

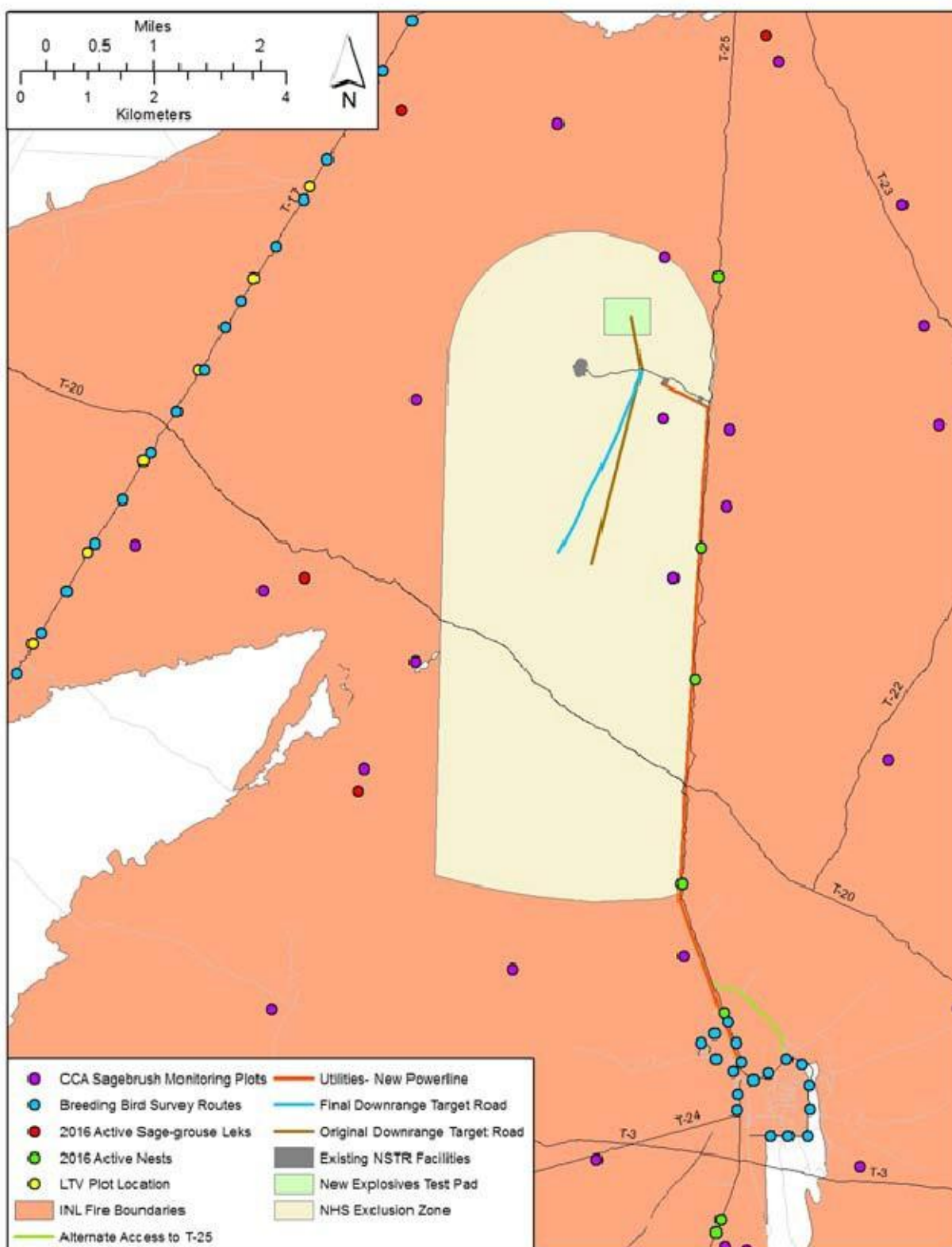


Figure 12. Ecological research, monitoring plots, and other study areas in the vicinity of NSTRX.

The five-mile (eight-kilometer) exclusion area designated by the original NSTR range includes a portion of the Sagebrush Steppe Ecosystem Reserve (SSER). The SSER was established in 1999 by Secretary of Energy Bill Richardson for the purpose of conservation of native plant communities and to provide for the study of an undisturbed sagebrush steppe ecosystem.

RRTR

There are almost no NERP related or other DOE sponsored ecological monitoring plots found near the RRTR locations. The only active survey is one Breeding Bird Survey Route which follows the perimeter fence around the TAN facility (RRTR North). This survey occurs once a year in in June and should not be affected by the proposed changes for the area.

3. Environmental Consequences and Mitigative Measures

3.1 Vegetation

NSTRX

Soil disturbance, such as blading larger proposed project site areas like the Explosives Test Pad and Downrange Target Areas, will result in the direct loss of vegetation. Fragmentation of plant communities and reduction to the habitat value of those communities is also a direct environmental consequence of soil disturbance. Indirectly, soil disturbance increases the risk of invasion by non-native weeds and may act as a vector for introducing those weeds into adjacent undisturbed plant communities. Regular traffic and mowing, even in areas not proposed for blading, may also lead to the eventual loss of native plant communities and/or invasion of weedy non-natives.

The sandy soils and sensitive needle-and-thread dominated communities present across much of the NSTRX site are particularly susceptible to weed invasion, which is one of the primary reasons their conservation ranks range from vulnerable to critically imperiled. The direct loss of these plant communities can be mitigated to the extent possible by reducing soil disturbance as much as feasible while still accomplishing project missions. Restricting unnecessary off-road traffic and repetitive mowing will also reduce the direct loss and indirect increase in invasibility by weedy annuals on and around the NSTRX site. Revegetation of areas that have been disturbed once, but where ongoing disturbance is not critical (ex., leach field) to project missions, will reduce impacts of soil disturbance and risk of invasion. Weed control is also recommended as a mitigate measure, especially on and adjacent to areas where soil disturbance and vegetation removal is recurring.

RRTR

All methods of direct or indirect vegetation removal and disturbance, cause the reduction of habitat in the project areas. This is a greater issue in good condition sage brush habitat such as found at the RRTR South location. In the CCA, a general “no net loss” of sagebrush idea has been implemented across the INL Site, not just inside the SGCA. By fencing areas of sagebrush, that habitat becomes a facility/infrastructure and is no longer considered habitat. The approximate fenced area at the RRTR facilities is 91 acres (0.37 km²) each. A direct loss of 91 acres (0.37 km²) is substantial when considering that the footprint of most of the existing INL facilities is between 1 acre (0.004 km²) and 300 acres (1.2 km²). For example, MFC is

approximately 117 acres (0.47 km²) while NRF is approximately 97 acres (0.39 km²) (inside the fenced boundaries). In order to mitigate the loss of sagebrush, the project would have to consider planting an equal amount of sagebrush seedlings in an area that would be beneficial habitat to sage grouse in a different location. In addition, all roads and disturbance are vectors for the spread of undesirable species. Weed control will be necessary around both perimeter roads as well as any other disturbed areas.

3.2 Sensitive Plant Species

NSTRX

Painted milkvetch populations will be removed where soils are disturbed and will be impacted by habitat fragmentation and increased risk of weed invasion across the entire NSTRX area. Disturbance to populations of painted milkvetch should be carefully considered because it is narrowly endemic to the region and it occupies specific habitat in semi-stabilized sand dunes. Current population numbers and trends are unknown (NatureServe 2016), so it would be difficult to determine the impact of removing some populations on the NSTRX site to the persistence of the species overall. Removal of additional populations on the INL Site (some were removed with the original NSTR project), may eventually affect the regulatory status of the species because it was originally removed from listing consideration due to the stability of several populations on the INL Site (Cholewa and Henderson 1984).

RRTR

There were no sensitive plants observed on either of the RRTR project sites, though appropriate habitat for some sensitive plant species occurs on both project sites. Soil disturbance associated with fence-building and driving along the fence during construction will disturb this habitat directly and will increase the risk of weed invasion in the project area. Weeds compete directly with native plants and lower the habitat value for potentially occurring sensitive species.

3.3 Ethnobotany

NSTRX and RRTR

Most of the species of ethnobotanical importance documented on the NSTRX and RRTR site locations are common across the INL Site. The impacts of the proposed activities would likely be greater on less common species than they would be on abundant species. Removing several individuals from large populations will not greatly affect the species persistence as a whole. It will, however, affect the potential use of an area for harvesting seeds or vegetative structures. Because the soil disturbance and risk of non-native species invasion will impact populations of species of ethnobotanical concern, the most effective mitigative measure to protect those populations is to minimize the amount of soil disturbed. Potential impacts to populations of plant species of ethnobotanical concern may also be mitigated through revegetation of areas impacted by soil disturbance.

3.4 Soils

NSTRX

Soil disturbance will result in a direct loss of native vegetation and will provide opportunities for invasive and other non-native plants to become established. In the proposed project expansion, soil would be disturbed in an area approximately 60 ft (18 m) in radius and 4-6 ft (1.2-1.8 m)

deep after each large test and to a lesser degree for all explosives testing.

Soil disturbance should also be anticipated due to vehicle traffic to and on the proposed test site, including the down range target area. This is due to the limited trafficability attributed to these particular soil types (Olson et al. 1995). These soils, and the potential for impact by vehicles, exist at the proposed test area and along a substantial portion of the route to the proposed site (Figure 3). ATVs can have similar impacts on these sand soils. Limiting the amount of traffic to the project site and restricting traffic to the project site itself will reduce the size of the area of disturbed soil.

Planning and site preparation that minimizes soil disturbance will limit the impacts to soil and vegetation, and greatly reduce the efforts required for revegetation and weed management. Management practices that should be used include:

- Designation of roadways, parking and laydown areas and restricting traffic to those areas.
- Limiting the amount of traffic allowed access to, and on, the project site.
- Limiting re-grading of soil to the areas that will be maintained as sterile or otherwise free of vegetation.

Limit travel to 1x/year on areas that are secondary to the project such as the safety fan. Because of the high hazard for wind erosion in these soils, a plan should be developed and implemented to provide some sort of cover on all areas with disturbed soil. Fugitive dust and blowing sand can be expected otherwise and cause potential off-site impacts downwind of disturbed areas.

Much of the proposed route for the new road segments (down range target and explosives range) passes through highly erodible soils. It is likely that these portions of the road will erode and down-cut under certain types of precipitation events such as that associated with significant thunderstorms and rain-on-snow events. It is advisable to expect instances of needed road repair such as gravel or grading.

RRTR

The above information also applies at RRTR, however, there will be much less ground disturbance other than the fence construction and subsequent perimeter road. Although road use would increase for testing, the roads won't need to be upgraded. Some mowing may occur to facilitate parking areas and tests at the Infiltration Basin depending on conditions inside the basin. Those activities could require an additional EC. There will be no off-road driving at the RRTR facilities.

3.5 Invasive and Non-Native Species

NSTRX

Soil disturbance is a primary contributor to the spread of invasive plants. Invasive and non-native plants are present on much of T-25, as well as around the edges of the existing ranges and laydown areas, and could be spread by mowing, blading, and any other means used to remove the vegetation to support construction of the new roads and facilities. Seed dispersal may be minimized in a number of ways. First seed dispersal may be minimized by disturbing as little area as possible along the road corridors and on the ranges, whether that disturbance is mowing,

blading, etc. Second, the timing is critical to seed dispersal. Most invasive and non-native species produce large numbers of seed. If the disturbance does not occur during peak seed dispersal, it will help reduce the number of viable seed on the ground. This will limit spread of weeds into areas presently not infested. Failure to limit seed dispersal from these areas will likely increase the level of effort necessary for revegetation and weed management. Given the proposed schedule for activity to begin in summer, the probability for seed dispersal onto the project site and roads is high, as is the likelihood of off-site transport of weed seeds.

RRTR

Although there were no noxious weed species found during the RRTR area surveys, invasions may occur at any time especially during soil disturbance events. Seed dispersal issues as mentioned above at the NSTRX location also apply to both RRTR locations.

A plan should be developed and implemented to prevent weed invasions on new disturbance areas. See PLN-611 (*Sitewide Noxious Weed Management*) and ICP/EXT-04-00654 (*Balance of INL Cleanup Integrated Weed Management Plan*) for guidance.

3.6 Wildlife Impacts and Mitigation

NSTRX

During establishment of the NSTRX facility, environmental analysis identified sources of potential direct and indirect impacts to wildlife including:

1. Permanent and temporary loss of habitat and associated wildlife species resulting from construction-related ground disturbance and vegetation clearing,
2. Displacement or nest abandonment of certain wildlife species resulting from operation-related activities at the cleared area (e.g., equipment, materials, and procedures testing and explosive detonations),
3. Fragmentation of remaining habitats resulting from project developments (i.e., buildings, test areas and roads), increased fire frequency, and weed invasion,
4. Increased disturbance and direct mortality risk to wildlife resulting from increased motor vehicle activity along the road between MFC and NSTR/X,
5. And increased direct human disturbance to wildlife resulting from increased interactions between wildlife and project personnel.

With the incorporation of institutional controls and other project features, potential impacts to wildlife were minimized or avoided to the extent practical without jeopardizing mission effectiveness. Measures implemented as part of the project can avoid and lessen the potential impacts on wildlife and include, but are not limited to, seasonal timing of specific testing activities to avoid critical times for wildlife and minimize wildland fire risk, reduced speed limits on access roads, wildlife exclusion fencing, managing potential wildlife attractants such as disturbed soils and trash, weed management planning, keeping work areas neat, warning signs (to alert personnel as to the presence of wildlife), reflectors, ultrasonic warning whistles on vehicles, habitat alteration, hazing animals from the road and Test Bed, and worker awareness programs. For wildlife, impacts would be considered significant if they resulted in loss of individuals of protected or sensitive species or loss of local populations of wildlife through high

levels of direct mortality or diminished survivorship. No such impacts were identified previously.

The majority of proposed activities and associated potential impacts under the Proposed Action and very similar to those already analyzed for NSTR and may fall within ranges previously analyzed or are of greater magnitude, frequency, or duration, as NSTR expands its capacity to support customer use of the facility. Construction activities under Proposed Action would result in increased ground disturbance and habitat loss within the previously analyzed boundaries of the administrative buffer area. Increased permanent infrastructure (offices and work buildings) would be established in areas previously disturbed or adjacent to disturbed areas. New access roads connecting NSTR facilities (new test circle and downrange target area), improvements to existing T-25 and a new alternate route to T-25 would increase linear features, weed species penetration and potential fragmentation of wildlife habitat. Consistent implementation of previously identified measures and controls should minimize and avoid potential impacts to wildlife species in the NSTRX area.

Proposed activities unique to the NSTRX site include the installation of a new 13.8 kV distribution line to bring electric power from a substation near MFC to the NSTR facilities area, UAV testing at testing pads, ballistic projectile training outside the current test range, and training using radioactive sources including the release of short-lived radionuclides in confined locations. Among these only the new distribution line has the potential to affect wildlife. However, the new line would be located within 50 feet of a long established 138 kV transmission line and be sited close to the existing T-25 road; little increased fragmentation would be associated with the new line and limited new access would be required for construction and maintenance. No significant impacts from the new powerline are expected.

Under the Proposed Action the frequency of explosive detonations would increase concomitant with increased customer use of the improved facility. However, the limit of 20,000 lbs NEW would not increase. Thus, single event noise levels would not be expected to change. Anthropogenic noise affects wildlife differently from humans and the effects of noise on wildlife vary from serious to nonexistent in different species and situations (Larkin 1996). Noise can cause a variety of impacts including increased stress hormones, fleeing behavior, permanent and temporary hearing threshold shifts, masking the ability to hear predators, and interference with communication (Francis and Barber 2013). However, few studies address the significance of these impacts to wild populations of animals. The potential for large blasts to displace wildlife from the area would be expected to be similar to baseline operational conditions at the current NSTR facility.

Greater sage grouse – Although the recent burns resulted in a significant long-term impact on nesting habitat, sage grouse still occupy areas of dominant sagebrush adjacent to the NSTR during winter and spring. In 2014, a spring lek survey route was established around the NSTR area. This route consists of three leks and is monitored annually. It continues to record active leks near NSTR. Increased disturbances associated with the NSTRX have the potential to temporarily displace sage grouse during winter and spring. Winter and spring are critical survival and reproductive periods, respectively, for sage grouse. Potential impacts of the expansion on sage grouse that use the area can be minimized by maintaining vehicular speeds of less than 15 mph (24 kph) on all access roads to the NSTR facility and conducting activities outside of the critical winter and spring seasons. Finally, clearing vegetation on the explosives and downrange

target area within 2 mi (3.2 km) of nesting habitat may increase use of the area by breeding sage grouse by inadvertently providing them an ideal area for breeding displays during the spring. If this occurs on new areas cleared under the Proposed Action, time-of-day and seasonal restrictions will need to continue to be implemented.

Ferruginous hawk – Ferruginous hawks are highly sensitive to human-induced disturbance during incubation (Bechard and Schmutz 1995) and nest abandonment from human disturbance documented in several areas (e.g., Fitzner et al 1977, Smith and Murphy 1973, Smith and Murphy 1978). In Idaho, White and Thurow (1985) found a significant difference in nest desertion between nests with created disturbance designed to simulate human activities and control, undisturbed nests. The Bureau of Land Management has documented nest abandonment after a single visit by researchers and consider nest abandonment a potentially "severe population limiting factor" (Snow 1974). Based on habitat requirements for this species and the presence of nests, the potential exists for them to occur in the NSTRX area. Increased human activity associated with increased customer use in spring has the potential to displace nesting ferruginous hawks. These impacts can be minimized by temporal avoidance (controlling human activity and blasting during the nesting period if ferruginous hawks are confirmed nesting). As was directed in the environmental analysis for the establishment of the NSTR facility, surveys for nesting ferruginous hawks should be conducted late May to early June to determine nesting activity.

This measure should continue to be implemented.

Elk and pronghorn – The general elk hunt for unit 63 (which includes 0.8 km (0.5 mi) within the INL Site boundary) occurs from August 1 through December 31. Controlled hunt for pronghorn occurs from September 25 through October 24. The hunting season causes increased movement of game resulting in increased potential for vehicular collisions. To avoid vehicular collisions with these species, particularly during this period, speed limits should continue to remain less than 15 mph (24 kph) on all access roads. There is also the potential of these animals moving onto surrounding agricultural areas as a result of noise and human activity, increasing depredation issues. These impacts can be minimized through close coordination with Idaho Department of Fish and Game.

General breeding seasons - The existing NSTR area provides important breeding habitat for many species during the spring. Avoiding these sensitive times is a means of minimizing potential impacts to breeding populations. The following are times when specific animals are breeding, nesting, or birthing.

- Sage Grouse - February 15 - June 30
- Passerines - April 1 - June 30 (a few nest until Sept 1)
- Raptors - February 1 - July 1
- Snakes - August - September
- Pygmy rabbits - February - July
- Big Game - May - June

The Migratory Bird Treaty Act protects migratory birds, their nests and eggs. If any activity

having the potential to disturb nests, including mowing, is to occur between March 1 and September 1, a nesting bird survey will need to be conducted before the activity begins. Work could be delayed or work limits placed if nests are discovered.

Activities outlines under the NSTRX (including new access and test areas, downrange target, T-25 improvements, and T-25 alternate access) will increase wildlife habitat fragmentation already occurring within the NSTR area. Fragmentation effects may be both direct and indirect. The physical presence of roads and disturbances in the landscape creates new habitat edges, alters hydrological dynamics, and disrupts other ecosystem processes and habitats. In addition, infrastructure and traffic impose dispersal barriers to most non-flying terrestrial animals. The various biotic and abiotic factors operate in a synergetic way across several scales, and cause an overall loss and isolation of wildlife habitat (Seiler 2001).

RRTR

Direct and indirect impacts to wildlife from the RRTR portions of the Proposed Action are similar to those for NSTRX and are addressed in the above section. Construction activities, additional roads, new fencing, vegetation alteration or removal and soil disturbance would have common unavoidable impacts to wildlife, including disturbance caused by increased human presence, loss of certain ground-dwelling wildlife species and associated habitat, and displacement of certain wildlife species due to increased habitat fragmentation. These impacts can be minimized by proper micro-siting of project elements, limiting disturbance footprints, managing weeds, revegetating temporary disturbance areas. For MBTA compliance, any activity potentially disturbing vegetation or soils would require a nesting bird survey prior to disturbance during the nesting season as described above. Additionally, installation of 8400 linear feet (2560 m) of six to eight-foot fencing in both the North RRTR area and the South RRTR area would create an intermittent barrier for big game species but would prevent inadvertent radiological exposure to these species. New fencing would enclose approximately 101 acres around each test area. Without safeguards, big game species could potentially enter testing areas prior to training events and then become trapped. The probability of this occurring is presumed to be low. Fencing would not prevent movements of small or fossorial animals or birds.

Although suitable habitat for greater sage-grouse occurs in the vicinity of RRTR test areas, minimal direct impacts to greater sage-grouse are anticipated due to the limited amount of disturbance planned in the areas with habitat and the distance from known leks to development areas. Portions of the new perimeter fence for the South RRTR area fall within the SGCA. The CCA includes fencing in its definition of infrastructure and construction of fencing within the SGCA would constitute a loss of sagebrush habitat (DOE and USFWS 2014). Additionally, infrastructure such as fencing presents a collision risk to sage-grouse. Fence development area would be well below the amount of habitat loss tripping the habitat adaptive management trigger identified in the CCA (20% of existing habitat within the SGCA or 194,922 acres). However, with the CCA, DOE committed to no net loss of sagebrush habitat and avoiding constructing new infrastructure unless there are no feasible alternatives for accomplishing its mission objectives. As stated in the CCA:

“If DOE determines that a project cannot reasonably be accomplished without being located

within a Lek Buffer or the SGCA, DOE will contact USFWS early in the planning process and provide its staff with sufficient information to allow them to determine if the proposed project is sited to minimize impacts to sage-grouse within these areas. Depending on the scope and potential impact of the proposed project and the status of the sage-grouse population and its habitat, USFWS will determine whether an amendment to the CCA and/or associated Conference Opinion is necessary. If USFWS determines that a proposed action requires a minor amendment, it will complete the procedure within 60 days. However, a major amendment may take longer. Inherent in this process is the need for DOE to communicate with USFWS early in the project planning process to ensure that impacts to sage-grouse and its habitats are avoided, minimized, or mitigated appropriately. USFWS may also recommend other measures that would allow DOE to accomplish its mission while preserving the effectiveness of the CCA to successfully conserve sage-grouse and its habitat on the INL Site.” (DOE and USFWS 2014 page iv).

Also, “New infrastructure development outside of a facility footprint will be designed, sited, and constructed to avoid or minimize adverse impacts to sage-grouse or its habitats.” BMPs that apply to the proposed fence include (pp. 54-55):

- a. Avoid fragmenting contiguous tracts of sagebrush habitat...
- b. Where practical, co-locate new infrastructure with existing infrastructure...
- c. Areas dominated by non-native grasses and other exotic species are preferred sites...
- d. May consider putting anti-perch devices on the top of fence posts if that is going to provide a hunting perch for raptors and ravens.

The fence at the Infiltration Basin is in direct opposition to a number of the BMP’s. It is in the middle of contiguous sage brush habitat, it is not co-located with existing infrastructure, it is not dominated by non-native or invasive species, and it is centrally located in good sage brush habitat as noted by the eggs found during the survey (Figure 10).

3.7 Habitat Fragmentation

NSTRX and RRTR

Habitat fragmentation leads to increasing edge effects, resulting in loss of species diversity, alterations in natural disturbance regimes, and alterations in ecosystem functioning (Caling and Adams 1999). Habitat fragments differ from original habitat in two important ways: 1) fragments have a greater amount of edge for the area of habitat, and 2) the center of each fragment is closer to the edge (Primack 1998). Some of the more important edge effects include microclimate changes in light, temperature, wind, humidity, decreased soil moisture, and incidence of fire (Shelhas and Greenberg 1996; Laurance and Bierregaard 1997; Reed et al. 1996). Each of these edge effects can have a significant impact upon the vitality and composition of species in the fragment and increased wind, lower humidity, and higher temperatures make fires more likely (Primack 1998). Edges produced by roads can also increase nest parasitism by brown-headed cowbirds (*Molothrus ater*). Brown-headed cowbirds, the only obligate brood parasite in North America, feed primarily in open areas, but use perches to watch for nest building activities. Edge habitats are perfect for their needs (Brittingham and Temple 1983) and it has been demonstrated

on the INL Site that brood parasitism increases on edges and in fragmented habitats (Belthoff and Rideout 2000).

Fragmentation affects animal populations in a variety of additional ways, including decreased species diversity and lower densities of some species in the resulting smaller patches (Reed et al. 1996). Some species of animals refuse to cross barriers as wide as a road. For these species, a road or fire line (or fence) effectively cuts the population in half. A network of roads or fire lines fragments the population even further (Noss 1996). For example, fragmentation of sagebrush communities poses a threat to populations of pygmy rabbits (*Brachylagus idahoensis*) because dispersal potential is limited (Weiss and Verts 1984).

Linear features, such as roads and fences, have the potential to fragment plant populations through the spread of invasive animals, insects and plants. Many of the weedy plants that dominate and disperse along roadsides are exotics. In some cases, these species, such as cheatgrass, spread from roadsides into adjacent native communities (Noss 1996). Exotic species disrupt natural ecosystem processes and the species that depend on them. Exotic plants have been shown to replace native understory vegetation, inhibit seed regeneration, and change soil nutrient cycling. Some weeds can cause higher erosion rates or change fire regimes.

Studies concerning roads and their influence on habitat fragmentation offer sufficient reason for adopting a precautionary stance toward road issues (Brittingham and Temple 1983). Roads precipitate fragmentation by dissecting previously large habitats into smaller ones. As the density of roads in landscapes increases, these effects increase as well. Even though roads occupy a small fraction of the landscape in terms of land area, their influence extends far beyond their immediate boundaries (Reed et al. 1996).

3.8 Biota Dose Assessment

There is potential for impact to biota from radiation due to contamination of soil from explosives containing radioactive sources. The maximum predicted radionuclide concentrations in soil were used for the biotic dose assessment. Radionuclides assessed were beryllium-10, carbon-14, chlorine-36, potassium-40, nickel-63, zinc-65, selenium-79, rubidium-87, palladium-107, cadmium-109, silver-110m, cesium (Cs)-135, Cs-137, lanthanum (La)-137, and La-138. The projected soil concentrations are assumed to be in the top 5 cm of soil (density 1.5 g/cc, moisture content 0.3) in a 16-ft diameter circle. The projections are based on transient infiltration including the extra water from foam mixtures during 15 years of testing (annual average of 0.49 cm/yr), 10 cm/yr for 10 years after testing, and 1 cm/yr beginning 10 years after testing.

Screening analyses were performed to determine if the radionuclides in soil will exceed biota dose limits of 10 mGy/da (1.0 rad/day) for terrestrial plants and 1 mGy/da (0.1 rad/da) for terrestrial animals which have been established by DOE to provide protection from chronic exposure of whole populations of individual species. It is not likely animals would spend extended time in these areas due to poor habitat conditions, however the screening calculations were conducted to provide conservative bounds to the potential impacts on biota.

Using RESRAD-Biota 1.8 (<http://resrad.evs.anl.gov/codes/resrad-biota/>) and ERICA 1.2.1 (<http://www.ERICA-tool.com/>) as screening tools, it was determined that the doses to the limiting

organism (terrestrial animals) is below the DOE dose limit [1 mGy/da (0.1 rad/da)]. The primary contributor to the calculated dose is potassium-40.

Based on the screening calculations, the environmental consequences of the proposed actions of NSTRX and RRTR would not cause significant radiological consequences to native plants and animals making mitigative measures unnecessary.

3.9 Ecological Monitoring and NERP Research Activities

There is the potential for impact to other research and monitoring activities in the vicinity of the proposed project sites. This includes ongoing ecological monitoring and research conducted by the ESER Program and academic researchers. The potential for impact may be in the form of direct damage to plots, alteration of natural animal behaviors being investigated, and/or potential loss of access to the area for data collection.

Most of these potential impacts can be avoided by implementing a few administrative controls. Travel should be strictly limited to the designated areas. Project managers should coordinate their activities with ESER personnel to avoid conflicts with long-term scheduled monitoring activities such as the Breeding Bird Survey, Long-Term Vegetation Survey, Sage Grouse Surveys, and other data collection activities related to NERP.

There is the potential for ESER field workers to be in or near the area at the time of the proposed explosives activities. Notification of field workers about explosives activity on the INL Site can be improved by utilizing the INL Site Field Worker Notification process prior to each test to warn field workers.

3.10 Cumulative Impacts

Historically, cumulative impacts have not been addressed in INL Site NEPA documents. However, NEPA indicates these impacts should be considered and there is extensive literature discussing the potential short-term and long-term impacts of road building. In addition to the direct impacts from the road, the existence of a new road would likely increase the need for infrastructure and will encourage future development, thus creating additional cumulative impacts.

While NEPA does not explicitly mention indirect and cumulative impacts, NEPA makes it the responsibility of the Federal government to "include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on the environmental impact of the proposed action [and] adverse environmental effects which cannot be avoided should the proposal be implemented." [42 U.S.C. 4332(C)].

The Council of Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA [40 CFR 1500-1508] clarify the requirements by defining direct effects, indirect effects, and cumulative effects.

- **Direct Effects.** Those effects caused by the action and occurring at the same time and place. [40 CFR 1508.8].

- **Indirect Effects.** Those effects caused by the action and occurring later in time or farther removed in distance, but still reasonably foreseeable. Indirect effects may include effects related to induced changes in the pattern of land use and related effects on air and water and other natural systems, including ecosystems. [40 CFR 1508.8].
- **Cumulative Impacts.** Those impacts on the environment, which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. [40 CFR 1508.7].

NSTRX

Even though it is not possible to quantify the potential cumulative impacts to ecological resources, it is possible to do a qualitative assessment of what those impacts might be. The new explosives ranges will at least double the area already impacted by the existing range. All of the NSTRX and existing NSTR facilities are located near the center of what remains of the large, undisturbed central core area of the INL Site. The southern boundary of that undisturbed core area is now, arguably, set by the Haul Road that connects MFC with CITRC. The boundary on the west is generally marked by Lincoln Boulevard, INTEC, CFA and CITRC. Recent activities associated with the increasing development of the CITRC have strengthened the effectiveness of the boundary in that area. The expansion of NSTR, especially the Down Range Target Area will decrease the connectivity of that undisturbed core area.

It is reasonable to expect that the construction of an additional powerline along T-25 north from MFC and the upgrade of T-25 and the alternative access road, proposed in this project will result in increased future activities along that road. These activities will continue to bring new disturbances along the road, strengthening the impacts of that road on habitat fragmentation and loss. It is also reasonable to expect more habitat loss and fragmentation by construction of new facilities along the route.

RRTR

By fencing the perimeter of the RRTR facilities, approximately 3 miles of new road will be created in addition to the direct habitat fragmentation cause by both the fence and the road. This division in continuous habitat will have direct effects on small mammals as well as indirect effects on other species.

As stated previously, the resources to develop a quantitative assessment of cumulative impacts to ecological resources are not yet available at the INL Site. However, as new developments occur on the INL Site, as good condition sagebrush steppe habitat and populations of sagebrush obligate species continue to decline all across the West, and as the risk of being required to manage for those species continues to increase, it will become increasingly more important that cumulative impacts on the INL Site be quantified. Being able to quantify cumulative impacts and plan INL Site developments to minimize those impacts will reduce the likelihood of impacts to the INL Site mission due to requirements for conservation management of ecological resources.

3.11 Mitigation Strategy

Throughout this report, a number of mitigative actions have been suggested. The following list summarizes those suggested actions.

- Limit the size of areas where vegetation will be removed and soil disturbed.
- Limit increased risk of wildland fire.
- Provide some sort of ground cover on all areas soil has been disturbed.
- Restore and revegetate impacted areas.
- Implement a weed management plan.
- Re-align new road to limit soil erosion due to runoff.
- Set speed limits on access roads.
- Set time-of-day and seasonal restrictions as necessary.
- Annual surveys for nesting birds, especially ferruginous hawks and burrowing owls.

3.12 Effects on INL Site Natural Resource Management Objectives

To summarize the evaluation of consequences of the proposed activity on ecological resources, we have analyzed the impact of the action on each of the INL Site natural resource management objectives. To do this, we prepared a narrative synthesis of the data collected in the field surveys related to each of the resources as described above and of information regarding the status of those resources on the INL Site collected as part of other research or monitoring programs as they relate to the natural resource management objectives.

Under DOE Order 430.1B (Real Property Asset Management, February 2008), “Land-use plans should be tailored based on local site condition and must consider the National Environmental Policy Act, site planning and asset management, LTS plans, institutional control plans, stakeholder public participation, economic development under community reuse organizations, privatization of assets, environmental law, cultural asset management, historic preservation, and natural resource management.” "

Further, DOE along with thirteen other Federal agencies signed a Memorandum of Understanding (MOU) to Foster the Ecosystem Approach (December 15, 1995). As stated in the MOU, "An ecosystem is an interconnected community of living things, including humans, and the physical environment within they interact. The ecosystem approach is a method for sustaining or restoring ecological systems and their functions and values. It is goal driven, and it is based on a collaboratively developed vision of desired future conditions that integrates ecological, economic, and social factors. It is applied within a geographic framework defined primarily by ecological boundaries. The goal of the ecosystem approach is to restore and sustain the health, productivity, and biological diversity of ecosystems and the overall quality of life through a natural resource management approach that is fully integrated with social and economic goals.

The Federal Government should provide leadership in and cooperate with activities that foster the ecosystem approach to natural resource management, protection, and assistance. Federal agencies should ensure that they utilize their authorities in a way that facilitates, and does not

pose barriers to, the ecosystem approach. Consistent with their assigned missions, Federal agencies should administer their programs in a manner that is sensitive to the needs and rights of landowners, local communities, and the public, and should work with them to achieve common goals.

The INL Site represents one of the largest remnants of undeveloped, ungrazed sagebrush steppe ecosystem in the Intermountain West (INL 2016). This ecosystem has been listed as critically endangered with less than two percent remaining (Noss et al. 1995, Saab and Rich 1997). The INL Site is also home to the Idaho National Environmental Research Park (NERP). The NERP is an outdoor laboratory for evaluating the environmental consequences of energy use and development as well as strategies to mitigate these effects. A portion of the INL Site has been designated as the Sagebrush Steppe Ecosystem Reserve that has a mission of conducting research on and preserving sagebrush steppe.

In 2007, DOE began working with the U.S. Fish and Wildlife Service (FWS) to establish a Candidate Conservation Agreement (CCA) for the protection of Greater sage-grouse (*Centrocercus urophasianus*) on the INL Site. At that time, the sage-grouse had been considered multiple times for listing under the Endangered Species Act (ESA), and DOE-ID was concerned that an ESA listing would jeopardize its ability to carry out its mission expeditiously. In 2010, the sage-grouse was listed as a Candidate species, meaning it warranted ESA protection, but a lack of FWS resources precluded the listing to occur at that time. In 2014, DOE-ID completed and signed the sage-grouse CCA. The purpose of the CCA was to identify actions that DOE-ID would implement to minimize threats to sage-grouse on the INL Site. Having an agreement in place provided a high level of certainty for DOE-ID, because if the sage-grouse became listed, the CCA could easily be converted into a Biological Opinion—a required document for any INL Site activities that might harm or disturb sage-grouse. In 2015, the USFWS reversed its previous decision, finding that sage-grouse no longer warranted protection under the ESA. However, DOE has continued to work with the USFWS recently completed a Conference Opinion based on the CCA (a Conference Opinion is the equivalent of a Biological Opinion, but for non-listed species). Because of DOE's proactivity in signing the CCA, it has had and continues to have a large measure of certainty and flexibility as it pursues its mission, while fulfilling its stewardship to preserve the ecological resources at the INL Site.

A number of environmental factors/resources at the INL Site need to be considered during planning because of the potential for impacts to these resources from actions that may result from planning. The types of factors that are considered include the following: regional considerations such as population, land uses, and socioeconomic conditions; sitewide area infrastructure such as transportation routes, power distribution systems, communication systems, utility systems, and other land uses; resources such as soils, water resources, biota, and cultural resources; and natural hazards at the INL Site such as wildland fire, seismic hazards, and floods (INL 2016).

As stated in the Idaho National Laboratory Comprehensive Land Use and Environmental Stewardship Report (INL 2016), several considerations form the basis for current INL Site land use planning assumptions. These include prior land use planning assumptions from the original

Comprehensive and Facility Land Use Plan, public input from the INL Site Environmental Management Citizens Advisory Board and the Environmental Management Site-Specific Advisory Board, and incorporation of DOE and the INL Site management team's strategic vision for the INL Site. The following planning assumptions are based on planning assumptions developed in the original Comprehensive and Facility Land Use Plan:

- INL will achieve its vision of becoming the preeminent nuclear research, development, and demonstration laboratory, a major center for national security technology development and demonstration, and remain a multi-program national laboratory.
- The INL Site and its associated 2,303 km² (889 mi²) will remain under federal government management and control through at least the year 2095.
- Portions of the INL Site will remain under federal government management and control in perpetuity.
- The DOE-EM footprint will be reduced at the INL Site as the DOE-EM cleanup mission continues to completion in the year 2035.
- New buildings will be constructed to provide state-of-the-art research capabilities that are necessary to fulfill the INL Site mission.
- New building construction may include structures in existing facility areas and construction of new facility areas.
- To the extent practical, new building construction will be encouraged in existing facility areas (i.e., the Research and Education Campus [REC] in Idaho Falls and the Advanced Test Reactor [ATR] Complex and the Materials and Fuels Complex [MFC] at the INL Site) to take advantage of existing infrastructure.
- Construction of new facility areas should occur in the identified core infrastructure areas.
- As the INL Site implements its mission, R&D advancements will result in obsolescence of existing buildings.
- As contaminated facility areas become obsolete, environmental remediation, decommissioning, and decontamination will be required.
- The environmental remediation, decommissioning, and decontamination process will be completed in accordance with the existing regulatory structure.
- The federal government will authorize and appropriate sufficient funds to provide adequate controls (i.e., institutional controls or engineered barriers) for areas that pose a significant health or safety risk to the public and workers until the risk diminishes to an acceptable level for the intended purpose.
- Regional economic development is closely related to the activities of the INL Site. The significance of the INL's Site influence on the region depends on the diversity and strength of the regional economy.
- Cooperative partnerships between the public and private sectors may be developed to support modernization and expansion of the INL Site R&D facilities.
- In accordance with DOE Order 144.1, Administrative Change 1, "Department of Energy American Indian Tribal Government Interactions and Policy," DOE recognizes that a

trust relationship exists between federally recognized tribes and DOE. DOE will consult with tribal governments to ensure that tribal rights and concerns are considered prior to DOE taking actions, making decisions, or implementing programs that may affect the tribes.

- No residential development will occur within INL Site boundaries, although potential development may occur in Idaho Falls.
- Grazing will be allowed to continue on the INL Site in designated areas.
- DOE-ID has a Candidate Conservation Agreement with the U.S. Fish and Wildlife Service (USFWS) to protect greater sage-grouse and its habitats on the INL Site.
- To protect human health and the environment, INL Site operations, including onsite disposal, will remain in full compliance with applicable environmental laws, regulations, and other requirements.

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5. Glossary Terms

Detectability: The ability to discover the existence or presence of something.

Ethnobotany: The study of plants as they pertain to an indigenous culture.

Ethnoecology: The study of the natural environment as it pertains to an indigenous culture.

Habitat fragmentation: A splitting of contiguous areas into smaller and increasingly dispersed fragments.

Hibernacula: A protective structure in which an organism remains dormant for the winter.

Home range: The geographic area to which an organism normally confines its activity.

Lek: An area where male grouse congregate for breeding purposes.

Non-game species: Animals which are not normally hunted, fished, or trapped.

Roost: A place on which birds rest or sleep.

Sagebrush obligate species: A species that is only able to exist or survive in sagebrush habitat.

Sympatric: Species or other taxa with ranges that overlap.

Transitory: Existing or lasting only a short time; short-lived or temporary.

Wilding: Individual plants that are removed from nearby natural communities and immediately transplanted onto a disturbed site.

Appendix A: Plant Community Descriptions

Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous

Vegetation: The plant community represented by this vegetation class is characterized by an abundance of native, perennial rhizomatous grasses. Dominant species include streambank wheatgrass (*Elymus lanceolatus*), western wheatgrass (*Pascopyrum smithii*), or a combination of the two. In addition to the rhizomatous grasses, several native bunchgrasses are generally present, often with much lower cover, and may include: Indian ricegrass (*Achnatherum hymenoides*), needle and thread (*Hesperostipa comata*), and bottlebrush squirreltail (*Elymus elymoides*). Green rabbitbrush (*Chrysothamnus viscidiflorus*) occurs with high constancy, but low to moderate cover. Additional shrubs, such as big sagebrush (*Artemisia tridentata*), spiny hopsage (*Grayia spinosa*), and winterfat (*Krascheninnikovia lanata*) may also occur sporadically and with minimal cover. A variety of forb species may be present with low to moderated cover. Some of the more consistently occurring species include povertyweed (*Iva axillaris*), whitestem blazingstar (*Mentzelia albicaulis*), Hood's phlox (*Phlox hoodii*), and flaxleaf plainsmustard (*Schoenocrambe linifolia*). Cover from non-native herbaceous species may range from absent to moderate. In stands where they occur, common non-native species include; cheatgrass (*Bromus tectorum*), desert alyssum (*Alyssum desertorum*), tall tumbled mustard (*Sisymbrium altissimum*), and saltlover (*Halogeton glomeratus*).

Big Sagebrush Shrubland: This broadly defined big sagebrush class is characterized by an open to moderately dense shrub layer. It occurs where Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) intermix at a very fine spatial scale. This vegetation class also represents plant communities where big sagebrush is not readily identifiable at the subspecies level due to phenotypic variability in response to edaphic factors or possible hybridization. Green rabbitbrush (*Chrysothamnus viscidiflorus*) is almost always present across this community type, although cover is usually relatively low. Other shrubs occur sporadically, generally with low frequency and sparse cover. Plains pricklypear (*Opuntia polyacantha*) and shadscale saltbush (*Atriplex confertifolia*) are a few of the more commonly occurring species. The herbaceous stratum of this plant community is typically sparse to moderate in terms of cover. Species composition of native grasses may be quite variable from one stand to another; however, bottlebrush squirreltail (*Elymus elymoides*), Sandberg bluegrass (*Poa secunda*), streambank wheatgrass (*Elymus lanceolatus*), and Indian ricegrass (*Achnatherum hymenoides*) are among the most abundant grass species. Forbs present on more diverse sites may include: Hood's phlox (*Phlox hoodii*), *Chenopodium* spp., *Eriogonum* spp., and western tansymustard (*Descurainia pinnata*). Cover from exotic species ranges from absent to moderate, the most abundant of which are cheatgrass (*Bromus tectorum*), crested wheatgrass (*Agropyron cristatum*), and desert alyssum (*Alyssum desertorum*).

Needle and Thread Herbaceous Vegetation: The grassland community represented by this vegetation class occurs in small to medium-sized patches, often in scars of recent wildland fires. Needle and thread (*Hesperostipa comata*) forms a moderate to dense herbaceous layer. Streambank wheatgrass (*Elymus lanceolatus*) and Indian ricegrass (*Achnatherum hymenoides*) tend to have high constancy but contribute moderate to low relative cover in this vegetation type. Additional grass species which may be common, but not necessarily constant include Western wheatgrass (*Pascopyrum smithii*) and bottlebrush squirreltail (*Elymus elymoides*). Scattered shrubs are often present and include green rabbitbrush (*Chrysothamnus viscidiflorus*), big sagebrush (*Artemisia tridentata*), plains prickly pear (*Opuntia polyacantha*), and winterfat

(*Krascheninnikovia lanata*), but they most often occur with very low cover. Native forbs tend to have low to moderate cover and high diversity, but species composition is variable among sites. Some of the more common species include: whitestem blazingstar (*Mentzelia albicaulis*), Hood's phlox (*Phlox hoodii*), and lemon scurfpea (*Psoralea lanceolata*). Non-native species cover ranges from absent to nearly co-dominant in patches of this community type. When present, the most abundant non-native species are desert alyssum (*Alyssum desertorum*), tall tumble mustard (*Sisymbrium altissimum*), and cheatgrass (*Bromus tectorum*).

Green Rabbitbrush Shrubland: Shrublands in this vegetation class are characterized by a moderate to dense shrub layer dominated by green rabbitbrush (*Chrysothamnus viscidiflorus*). Other short shrubs may be present but generally contribute little cover to the shrub stratum. Additional species may include big sagebrush ssp. (*Artemisia tridentata*), plains pricklypear (*Opuntia polyacantha*), shadscale saltbush (*Atriplex confertifolia*), and gray horsebrush (*Tetradymia canescens*). Compared to other green rabbitbrush shrubland classes at the INL Site, the herbaceous layer of this class is generally sparse in terms of cover, and it ranges from being moderately diverse to relatively depauperate in terms of species composition. Graminoids which occur in the sparse herbaceous stratum with the greatest constancy include Indian ricegrass (*Achnatherum hymenoides*) and bottlebrush squirreltail (*Elymus elymoides*). Needle and thread (*Hesperostipa comata*), streambank wheatgrass (*Elymus lanceolatus*), and Sandberg bluegrass (*Poa secunda*) may also occur in the herbaceous layer, but the presence and abundance of these species may be quite variable from one stand to another. When present, cheatgrass (*Bromus tectorum*) and crested wheatgrass (*Agropyron cristatum*) may contribute sparse to moderate cover in the herbaceous understory. Forbs may be diverse in communities represented by this vegetation class, but they typically contribute very little cover and species composition is highly variable from one stand to another. Native forbs may include: Narrowleaf goosefoot (*Chenopodium leptophyllum*), Hood's phlox (*Phlox hoodii*), tapertip hawksbeard (*Crepis acuminata*), cryptanthas (*Cryptantha* spp.), and flaxleaf plainsmustard (*Schoenocrambe linifolia*). Nonnative forbs, such as desert alyssum (*Alyssum desertorum*) have become abundant in some stands.

Wyoming Big Sagebrush Shrubland: This big sagebrush shrubland class is broadly defined as it occurs on the INL Site. The shrub canopy may range from open to dense and is dominated by Wyoming big sagebrush (*Artemisia tridentata*) ssp. *wyomingensis*. Green rabbitbrush (*Chrysothamnus viscidiflorus*) is almost always present and may co-dominate stands. Other shrubs, such as additional sagebrush species (*Artemisia* spp.), shadscale saltbush (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*) and plains pricklypear (*Opuntia polyacantha*) may also occur with some abundance in the shrub and/or dwarf shrub stratum. The herbaceous layer of this vegetation class can be quite variable from one stand to another, ranging from sparse to moderate in terms of cover. Bottlebrush squirreltail (*Elymus elymoides*) and Sandberg bluegrass (*Poa secunda*) dominate the sparse understory of many stands. In locations where the herbaceous layer has slightly higher cover, other important native graminoids may include; Indian ricegrass (*Achnatherum hymenoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needle and thread (*Hesperostipa comata*), and Great Basin wildrye (*Leymus cinereus*). Forbs are generally sparse in terms of cover, but are diverse and species composition varies greatly from site to site. Some common species include: cushion buckwheat (*Eriogonum ovalifolium*), silvery lupine (*Lupinus argenteus*), Cryptantha spp., scarlet globemallow (*Sphaeralcea munroana*), and Hood's phlox (*Phlox hoodii*). Introduced species like cheatgrass

(*Bromus tectorum*) may be common in disturbed stands and crested wheatgrass (*Agropyron cristatum*) is common along roadsides and in other areas where it has been planted.

Green Rabbitbrush/Desert Alyssum Shrub Herbaceous Vegetation: This vegetation class represents plant communities where the shrub stratum is dominated by green rabbitbrush (*Chrysothamnus viscidiflorus*), but the herbaceous understory is dominated by non-native annuals. The canopy of the shrub layer ranges from open to moderately dense. Few other shrub species are common in this plant community, but big sagebrush (*Artemisia* spp.) individuals may occur sporadically. The herbaceous layer is generally very diverse and substantial in terms of species composition and relative cover. Desert alyssum (*Alyssum desertorum*) is usually the dominant herbaceous species; however, several non-native annual species may be abundant or even dominate localized stands. Additional non-native species may include: cheatgrass (*Bromus tectorum*), saltlover (*Halogeton glomeratus*), Russian thistle (*Salsola kali*), tall tumbledustard (*Sisymbrium altissimum*), and herb sophia (*Descurainia sophia*). Native herbaceous species are common in this vegetation type but even combined they contribute less than half of the total herbaceous cover. Native bunchgrasses such as needle and thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides*), and Sandberg bluegrass (*Poa secunda*) are almost always present but never highly abundant. Associated native forbs generally contribute very little cover but may include: narrowleaf goosefoot (*Chenopodium leptophyllum*), tapertip hawksbeard (*Crepis acuminata*), *Cryptantha* spp., western tansymustard (*Descurainia pinnata*), shaggy fleabane (*Erigeron pumilus*), Hood's phlox (*Phlox hoodii*), hoary tansyaster (*Machaeranthera canescens*), and flaxleaf plainsmustard (*Schoenocrambe linifolia*).

Crested Wheatgrass Semi-natural Herbaceous Vegetation: This vegetation class is characterized by a moderate to dense herbaceous layer which is strongly dominated by crested wheatgrass (*Agropyron cristatum*). Crested wheatgrass is a perennial bunchgrass from the plains of Siberia and it is often considered to be a naturalized species. On the INL Site it forms nearly monotypic stands with very little species diversity. Other non-native herbaceous species may occur in this community as well, especially in areas with soil disturbance, but they generally contribute very little total cover. Native species, which may be present sporadically with very low cover values, include shrubs, particularly green rabbitbrush (*Chrysothamnus viscidiflorus*), and grasses such as Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Elymus elymoides*).

Indian Ricegrass Herbaceous Vegetation: This grassland vegetation class occurs in small to medium-sized patches, often in burned sagebrush shrublands that were in good condition prior to the wildland fire. It also occurs in unburned patches associated with dwarf shrub communities. Total vegetation cover often does not exceed 40% and may be as low as 20%. Indian ricegrass (*Achnatherum hymenoides*) is always abundant and needle and thread (*Hesperostipa comata*) may occasionally co-dominate the herbaceous stratum. Streambank wheatgrass (*Elymus lanceolatus*) and bottlebrush squirreltail (*Elymus elymoides*) are also common graminoids, which may range from sparse to abundant, depending on the site. Scattered shrubs are often present. Green rabbitbrush (*Chrysothamnus viscidiflorus*) has high constancy and is sometimes abundant. Big sagebrush (*Artemisia tridentata* spp.), winterfat (*Krascheninnikovia lanata*), gray horsebrush (*Tetradymia canescens*), and sickle saltbush (*Atriplex falcata*) may also occur sporadically. Forbs have high diversity but species composition is inconsistent among sites and total cover is generally sparse.

Cheatgrass Semi-natural Herbaceous Vegetation: Cheatgrass (*Bromus tectorum*), an introduced, annual grass species dominates this vegetation class. Total vegetation cover is highly variable from one stand to another. Native species persist in some stands; however, cover and diversity are typically low, and component native species composition can be quite variable depending on the plant community that was present prior to the conversion to an introduced herbaceous species. Native shrubs may occur sporadically with low cover values. Green rabbitbrush (*Chrysothamnus viscidiflorus*), big sagebrush (*Artemisia tridentata* spp.) and gray rabbitbrush (*Ericameria nauseosa*) are the most constant native shrubs in this class. Sandberg bluegrass (*Poa secunda*) and bottlebrush squirreltail (*Elymus elymoides*) are the most frequently occurring and abundant native grasses in this community type, although many other native grass species may occur with sparse cover as well. Several native perennial and annual forb species may also occur infrequently in stands of this type. Introduced annual forbs such as tall tumblemustard (*Sisymbrium altissimum*), herb sophia (*Descurainia sophia*), and desert alyssum (*Alyssum desertorum*) often occur with substantial abundance in this vegetation type.

Great Basin Wildrye Herbaceous Vegetation: The physiognomy of this vegetation class is that of a tall, moderately dense grassland which is dominated by Great Basin wildrye (*Leymus cinereus*). Great Basin wildrye occurs in large, relatively evenly-spaced clumps. Other species may be found in interspaces between the clumps or around the periphery of dense stands. Scattered shrubs may be present but total shrub cover is sparse. Basin big sagebrush (*Artemisia tridentata* spp. *tridentata*) and green rabbitbrush (*Chrysothamnus viscidiflorus*) have the highest constancy in stands of this type. Additional grass species may also occur sporadically at lower cover values and component graminoids may include: Indian ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides*), and cheatgrass (*Bromus tectorum*). Forb cover is generally sparse in communities of this type and species composition can be quite variable from one stand to another.

Sandberg Bluegrass Herbaceous Vegetation: This vegetation class is characterized by the dominance of Sandberg bluegrass (*Poa secunda*), a short statured native, perennial bunchgrass. The absolute cover of the herbaceous layer may range from sparse to moderately dense. Stands with low total cover values are generally depauperate. Plant communities which are represented by this class and exhibit higher total vegetative cover values also tend to be somewhat more diverse. Shrubs like green rabbitbrush (*Chrysothamnus viscidiflorus*), gray horsebrush (*Tetradymia canescens*), sickle saltbush (*Atriplex falcata*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and winterfat (*Krascheninnikovia lanata*) may occur sporadically but with sparse cover. Additional graminoids in the herbaceous layer may include: Indian ricegrass (*Achnatherum hymenoides*), needle and thread (*Hesperostipa comata*), streambank wheatgrass (*Elymus lanceolatus*), bottlebrush squirreltail (*Elymus elymoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and western wheatgrass (*Pascopyrum smithii*). Many of these grasses occur with relatively high constancy but low to moderate cover values. Forb cover may range from sparse to moderate, and species composition is variable. The most common native forb is whitestem blazingstar (*Mentzelia albicaulis*). The non-native forbs tall tumblemustard (*Sisymbrium altissimum*), desert alyssum (*Alyssum desertorum*) and cheatgrass (*Bromus tectorum*) may also be common in some stands.

Dwarf Goldenbush Dwarf Shrubland: Dwarf goldenbush (*Ericameria nana*) is the dominant dwarf shrub in this sparse vegetation class. Other small-statured shrubs also occur with high

constancy and sparse to low cover values. Species include: broom snakeweed (*Gutierrezia sarothrae*), plains pricklypear (*Opuntia polyacantha*), and granite prickly phlox (*Linanthus pungens*). Native grasses are common but are variable in species composition and cover. High constancy species include: needle and thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*) and Sandberg bluegrass (*Poa secunda*). Native forbs are often present but do not contribute much vegetative cover as plants tend to be very small and widely spaced. Native forb species composition varies greatly across the range of this class on the INL Site. For example, king bladderpod (*Lesquerella kingii*) is common in the central portion of the site and biennial cinquefoil (*Potentilla biennis*) is abundant near the western boundary. The non-natives, cheatgrass (*Bromus tectorum*) and desert alyssum (*Alyssum desertorum*) are also common in plant communities represented by this vegetation class.

Green Rabbitbrush - Winterfat Shrubland: This plant community is characterized by low to moderate vegetation cover and is dominated by the dwarf shrub, winterfat (*Krascheninnikovia lanata*). Green rabbitbrush (*Chrysothamnus viscidiflorus*) is nearly always present although relative cover values are extremely variable, ranging from sparse to co-dominant. Other shrubs and dwarf shrubs, which occur sporadically in this community may include: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), plains pricklypear (*Opuntia polyacantha*), low sagebrush (*Artemisia arbuscula*), gray horsebrush (*Tetradymia canescens*), shrubby buckwheat (*Eriogonum microthecum*), and granite prickly phlox (*Linanthus pungens*). Herbaceous vegetation is typically patchy and sparse and Indian ricegrass (*Achnatherum hymenoides*) occurs with high constancy in the understory. Other herbaceous species may be variable from one stand to another in terms of species composition, but total herbaceous cover is generally low. Common herbaceous species may include native grasses such as bottlebrush squirreltail (*Elymus elymoides*), streambank wheatgrass (*Elymus lanceolatus*), needle and thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), and Sandberg bluegrass (*Poa secunda*), and forbs such as Torrey's milkvetch (*Astragalus calycosus*), slimleaf goosefoot (*Chenopodium leptophyllum*), cushion buckwheat (*Eriogonum ovalifolium*), Hood's phlox (*Phlox hoodii*), hoary tansyaster (*Machaeranthera canescens*), whitestem blazingstar (*Mentzelia albicaulis*), and povertyweed (*Iva axillaris*). Introduced species including Russian thistle (*Salsola kali*), cheatgrass (*Bromus tectorum*) and saltlover (*Halogeton glomeratus*) are common in disturbed sites.

Sickle Saltbush Dwarf Shrubland: Sickle saltbush (*Atriplex falcata*) is the dominant species in this sparsely vegetated dwarf shrubland community. Stands of this vegetation type are generally very simple in terms of structure and species composition. The dwarf shrub canopy rarely contains additional shrubs, but winterfat (*Krascheninnikovia lanata*) or green rabbitbrush (*Chrysothamnus viscidiflorus*) may occur sporadically. Indian ricegrass (*Achnatherum hymenoides*) occurs with high constancy in the sparse herbaceous stratum. Herbaceous diversity is typically low and forb cover is sparse. Saltlover (*Halogeton glomeratus*), a non-native annual, occurs with some regularity but with low average cover values in plant communities represented by this vegetation class.

Three-tip Sagebrush Shrubland: Three-tip sagebrush (*Artemisia tripartita*) is the dominant species in this shrubland vegetation class. Total vegetative cover is moderate, and the shrub canopy is typically dense. The shrub stratum is generally not very diverse; however, other shrubs and dwarf shrubs may occur with low cover values and common species include:

Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*), granite prickly phlox (*Linanthus pungens*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Cover of the herbaceous stratum ranges from low to moderate. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is often abundant in the understory and bottlebrush squirreltail (*Elymus elymoides*) and Sandberg bluegrass (*Poa secunda*) occur with high constancy and variable cover values. Forb cover ranges from sparse to moderate. Herbaceous species composition can be quite diverse but is highly variable from one stand to another.

Shadscale Dwarf Shrubland: Low-growing shadscale saltbush (*Atriplex confertifolia*) is the dominant shrub in this vegetation class. In some stands, the shrub stratum is nearly monotypic and in others it can be quite diverse. Other shrubs and dwarf shrubs, when present, may include: bud sage (*Picrothamnus desertorum*), Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*), broom snakeweed (*Gutierrezia sarothrae*), plains pricklypear (*Opuntia polyacantha*), spiny hopsage (*Grayia spinosa*), winterfat (*Krascheninnikovia lanata*) and greasewood (*Sarcobatus vermiculatus*). The herbaceous stratum is generally very sparse and communities in this vegetation class often have large expanses of exposed, bare soil. Indian ricegrass (*Achnatherum hymenoides*) occurs with high constancy and at low cover values. Bottlebrush squirreltail (*Elymus elymoides*) and Sandberg bluegrass (*Poa secunda*) are also often present but sparse. Forbs vary greatly across the range of this vegetation class and rarely contribute significant cover. Degraded stands may contain non-native annuals like cheatgrass (*Bromus tectorum*) and/or saltlover (*Halogeton glomeratus*) in the understory.