

Ecological Resources Associated With T-24 and T-25 and Potential Effects of Constructing a Haul Road

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1.0 Introduction

1.1 Purpose of this Report

The U.S. Department of Energy (DOE) proposes to provide an alternative route, other than the public highway, to transport the several thousand shipments of materials and wastes expected over the next 10 years (Engineering Design File [EDF] -9513) between the Materials and Fuels Complex (MFC) and other Idaho National Laboratory (INL) Site facilities. The proposed action is needed to reduce shipment costs, improve operational efficiency, and reduce impacts to the public by minimizing road closures. Currently, shipments are via the public U.S. Highway 20. An internal road would allow shipments between facilities rather than using public roadways. The cost and time required for permits, road closures, and shipping container certification is considerable when using the public road.

DOE is analyzing a gravel road for year-around use. The analysis evaluates clearing and grading a base, installation of necessary culverts and drainage, placing/compacting gravel for the roadway. The haul road would be used to transport spent fuel, transport special nuclear material, accommodate fuel transfers, transport testing or experiment materials, and transport wastes.

The purpose of this report is to assess the potential impacts to ecological resources including threatened, endangered, and sensitive species due to construction and operation of a road as described in the Alternatives. The alternatives reported here are based on those described in an internal draft of the Environmental Assessment DOE/EA-1772 on March 18, 2010.

1.2 Description of the Proposed Action

Currently, materials are transported between MFC and the balance of the INL over U.S. Highway 20, either in full compliance with Department of Transportation (DOT) regulations or in “out-of-commerce” shipments when full compliance with DOT regulations cannot be achieved. Out-of-commerce shipments must be planned and executed in a manner that provides a degree of safety at least equivalent to shipment under DOT regulations and require that the highway be closed to public traffic during shipment. DOT-compliant shipments often require multiple transfers of the material between DOT-approved shipping containers and specialized INL containers that facilitate moving the material into facilities for examination. Although these INL containers are safe for transporting the material, they have not been tested and licensed by the Nuclear Regulatory Commission for transportation on public highways. When the INL containers are used for out-of-commerce shipments, customarily the Idaho Department of Transportation is notified. Multiple contractor organizations are involved in planning the shipment and closing the road, often at night. Shipment schedules are designed to minimize inconvenience to the public, which is not always supportive of INL’s need.

The existing available roads include T-3, T-24, and T-25. T-3 and T-24 are very primitive two-track roads and would not support any transport vehicles of the size required. Using an existing site road, without upgrading it, is not acceptable from a safety standpoint due to uneven surfaces affecting load stability, power line clearance, tight turning radius, dramatic vertical curvature that could tip or high center the load, and unstable or soft spots that could tip the load.

Establishing an upgraded site road to support the required transport vehicles is the only option that meets the on-site transportation requirements and avoids closure of U.S. Highway 20. The upgraded road would satisfy the requirements for the majority of the required shipments with a

design capacity for a 100,000-lb gross vehicle weight, double drop, three-axle trailer with 6-inch ground clearance (EDF-9513). Shipments exceeding that limit may have to use U.S. Highway 20. A few such unusual shipments on U.S. Highway 20, with the associated road closures, are assumed to be acceptable without inconvenience to the public.

The internal road would be a controlled access road for maintenance and out-of-commerce shipments only. Design would be for maximum speed of 35 miles per hour (EDF-9513).

1.2.1 Alternative 1—New Route South of T-25 Utilizing the Existing Road to the Extent Possible

The route proposed for Alternative 1 would travel south of the T-25 power line maintenance road. The route from INTEC to MFC would be the following: travel Lincoln Boulevard south to Central Facilities Area, take East Portland Avenue to Jefferson Boulevard, travel north along Jefferson Boulevard, turn east on Wilson Boulevard, travel Wilson Boulevard to Fillmore, then north to T-25, and continue along a corridor south of the existing T-25 east to MFC.

Lincoln Boulevard, Portland Avenue, and Jefferson Boulevard are existing, paved, maintained roads. Wilson Boulevard is a paved road but is currently classified as inactive and, therefore, not maintained. The pavement on Wilson Boulevard is breaking up and is in poor condition. The pavement would break up under heavy use and would eventually require regrading of the road and shoulder areas.

T-25 is a power line service road currently used to maintain the power line, by security vehicles, for ecological studies, etc. The first 4 miles on the western approach of the road has been improved and is passable in the summer by larger trucks but is too soft to travel in the winter. The remainder of the road is a two-track road accessed by four-wheel-drive vehicles for power line maintenance and fire protection. The road has rock outcroppings, with soft sand or silt material in low spots. Following recent range fires, sand has blown into many of the low areas, creating soft conditions that are difficult to travel.

The Alternative 1 route would follow the T-25 corridor, but rather than follow the existing T-25 road, which weaves back and forth under the power line, the proposed road would stay south of the power line and avoid the power line and the buried fiber optic cable just north of the power line.

1.2.2 Alternative 2—T-24 Upgrade

The T-24 route is an inactive road consisting of a two-track, four-wheel-drive trail described as very rough. The route of T-24 from INTEC would travel along Lincoln Boulevard south to the Central Facilities Area, take East Portland Avenue to Jefferson Boulevard, travel north along Jefferson Boulevard, turn east on Wilson Boulevard, travel Wilson Boulevard to the Critical Infrastructure Test Range Complex perimeter fence and road north to T-24, and continue along T-24 east to MFC. Wilson Boulevard would require regrading as described in Section 1.2.2

A new section of road must be constructed along the T-24 route. Considerable rock removal, cutting, filling, compaction, and grading are required on this route. Alternative 2 minimizes length of impacted area and construction (10 miles versus 13 miles for Alternative 1). This route uses a perimeter road around the Critical Infrastructure Test Range Complex. Therefore, coordinating road use with Homeland Security activities would be required.

1.3 Natural Resource Aspects

Under DOE Policy 430.1 (Facility and Land Use Planning, July 1996), “it is Department of Energy policy to manage all of its land and facilities as valuable national resources. Stewardship is based on the principles of ecosystem management and sustainable development. DOE integrates mission, economic, ecologic, social, and cultural factors in a comprehensive plan for each site that will guide land and facility use decisions. Each comprehensive plan for each site will consider the site’s larger regional context and be developed with stakeholder participation. This policy will result in land and facility uses which support the Department’s critical missions, stimulate the economy, and protect the environment.”

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 which 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 INL represents the largest remnant of undeveloped, ungrazed sagebrush steppe ecosystem in the Intermountain West (DOE 1997). This ecosystem has been listed as critically endangered with less than two percent remaining (Noss et al. 1995, Saab and Rich 1997). The INL 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 has been designated as the Sagebrush Steppe Ecosystem Reserve that has a mission of conducting research on and preserving sagebrush steppe.

Recognizing that there are requirements for road construction or improvement on the INL to meet DOE objectives, certain measures can be implemented to reduce or eliminate impacts to natural resources from these activities. Specific natural resource aspects include:

- **Minimize the need for rehabilitation following road construction.** The goal of this aspect is to reduce or eliminate the need to rehabilitate areas after road construction. Reducing or eliminating the need for rehabilitation maintains the established adjacent ecosystem in its current state.
- **Threatened, endangered and sensitive species (this includes State of Idaho designated species) and their habitat.** The Endangered Species Act (ESA) requires that Federal agencies “shall seek to conserve endangered and threatened species.” The goal of this aspect is to ensure that ESA listed and Idaho designated species are not adversely impacted by the proposed action.
- **Sage grouse and other sagebrush-obligate species and their habitat.** Because a number of them are at risk of being listed under ESA, the goal of this aspect is not to adversely

impact INL populations of sage grouse and other sagebrush-obligate species and their required habitat through the proposed action.

- **Minimize habitat loss and fragmentation.** Habitat loss and fragmentation can adversely impact plant, and animal species, biodiversity, and ecosystem stability. The goal is to minimize or prevent habitat loss and fragmentation.
- **Culturally significant flora and fauna.** This goal of this aspect is to minimize impacts on culturally significant (to regional Native Americans) plants and animals from the proposed action and associated auxiliary actions.
- **Large undeveloped, sagebrush steppe ecosystem.** The goal of this is to conserve large tracts of sagebrush which eliminate impacts to flora, fauna, biodiversity and threatened and endangered species depending on this ecosystem.
- **Plant genetic diversity.** The goal of this aspect is to maintain native plant genetic diversity by minimizing introduction of non-regional genotypes from being established. This is primarily accomplished through proactive revegetation planning.
- **Unique ecological research opportunities.** The goal of this aspect is to minimize impacts to those research opportunities unique to the sagebrush steppe ecosystem on the INL. The most significant “unique ecological research opportunities” are related to the large, undeveloped, unfragmented sagebrush steppe found on the INL. These sagebrush attributes should be protected from adverse impacts thus preserving these opportunities.
- **Minimize invasion of non-native species including noxious weeds.** Ground disturbing activities, particularly in close proximity to or adjacent to seed sources exacerbate the invasion of noxious species. The goal of this aspect is to prevent invasion of non-native and noxious biota due to the proposed action.

2.0 Ecological Effects of Roads

2.1 Background

The impacts of roads on terrestrial ecosystems, such as the sagebrush steppe on the INL, 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 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. It also makes slopes more vulnerable to landslides and erosion, which in turn remove additional terrestrial wildlife habitat and degrade aquatic habitats (Noss 1996).

Some species thrive on roadsides, but most of these are weedy species. In the Great Basin, rabbitbrush 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 has become a serious agricultural pest. This Eurasian weed invades native communities from roadsides (Noss 1996).

2.2 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 Houlihan 1997). In the long-term, roads tend to favor some species and discourage others, which can lead to a changes 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, Roland 1993).

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.
- Temperature - Dark pavement absorbs radiant heat and releases it at night, creating a "heat island" around roads. This can attract heat-seeking species such as birds and snakes to roads, increasing their mortality by vehicle collision.
- 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 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.

2.3 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 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.

Mychorrhizae 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).

2.4 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).

3.0 Affected Environment

3.1 Ecological Resources

Vilord et al. (2005) reported on ecological surveys and descriptions of ecological resources associated with T-24 and T-25. Much of the information from that report is relevant to this analysis. Although Vilord et al. (2005) did not specifically address the proposed new route south of the existing T-25 and powerline (Alternative 1), they describe a similar route they called “East Powerline Road with Shortcut.” New surveys were conducted on the proposed alternative routes only for pygmy rabbits and sensitive plant species. The route described in Alternative 1 has not been surveyed for any other ecological resources. Surveys for sage-grouse leks along both alternative routes are on-going and will be the subject of a separate report.

3.1.1 Vegetation Communities

Vilord et al. (2005) surveyed and described plant communities along T-24 and T-25 (East Powerline Road). Plant community descriptions for that ecological review were derived primarily from three sources that describe distinct community types encompassed within the larger, more general sagebrush steppe ecosystem on the INL. The references used to describe vegetation classes within the affected environment include the *INEEL Sagebrush Steppe Ecosystem Reserve Management Plan* (BLM 2003), *Plant Communities, Ethnoecology, and Flora of the Idaho National Engineering Laboratory* by Anderson et al. (1996), and *Vegetation Types and Surface Soils of the Idaho National Engineering Laboratory Site* by McBride et al. (1978). Plant community descriptions from the sources listed above were tailored to the vegetation communities that may be affected by the alternatives proposed using vegetation data collected in September and October 2005.

3.1.1.1 Vegetation Community Surveys

Vegetation plots were sampled approximately every 400 m along T-25 and T-24 (Vilord et al. 2005). Between both proposed routes, eight vegetation classes were described. Vegetation classes were based primarily on dominant and co-dominant species within each plot. Vilord et al. (2005) described eight distinct plant communities associated with the T-24 and T-25. They include the following.

Sagebrush Steppe. Sagebrush steppe communities in the surveyed area are generally dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*); however, they are occasionally dominated by Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), and may even be co-dominated by both subspecies. Communities dominated by Basin big sagebrush often occur as patches within extensive stands of Wyoming big sagebrush. The distribution and abundance of these two subspecies is related to soil depth and texture. Basin big sagebrush tends to dominate on deep, well drained, sandy soils, such as soils found on the lee side of lava ridges where sand accumulates. Conversely, Wyoming big sagebrush tends to dominate on fine-textured shallow soils. Native perennial grasses are typically more abundant in the understory of communities dominated by Wyoming big sagebrush than they are in the understory of communities dominated by Basin big sagebrush. Cheatgrass (*Bromus tectorum*) may be common in the understory of Basin big sagebrush stands, but tends to be quite rare in the understory of Wyoming big sagebrush stands. Aside from differences in grass abundance, communities dominated by either subspecies of big sagebrush can have similar understory species compositions. Common understory grasses include bottlebrush squirreltail (*Elymus elymoides*), Sandberg bluegrass (*Poa secunda*), thick-spiked wheatgrass (*Elymus lanceolatus*), and Indian ricegrass (*Achnatherum hymenoides*). Bluebunch wheatgrass (*Pascopyrum spicata*) is abundant in the understory of relatively higher elevation plots, especially along T-25, and needle-and-thread grass (*Hesperostipa comata*) is abundant in lower elevation plots with sandy soils, especially along T-24. Green rabbitbrush (*Chrysothamnus viscidiflorus*), prickly phlox (*Leptodactylon pungens*), spineless horsebrush (*Tetradymia canescens*), and spiny hopsage (*Grayia spinosa*) are frequently occurring shrubs within the sagebrush steppe community type. Broom snakeweed (*Gutierrezia sarothrae*) and dwarf goldenbush (*Ericameria nana*) are locally abundant on basalt outcroppings. Shadscale (*Atriplex confertifolia*) may also occur occasionally in low densities. Pricklypear (*Opuntia polyacantha*) may be locally abundant, and common forbs include Hood's phlox (*Phlox hoodii*), Douglas' dustymaiden (*Chaenactis douglasii*),

tapertip hawksbeard (*Crepis acuminata*), freckled milkvetch (*Astragalus lentiginosus*), fernleaf biscuitroot (*Lomatium dissectum*), and hoary aster (*Machaeranthera canescens*).

Sagebrush/Rabbitbrush. Co-dominated by green rabbitbrush and Wyoming big sagebrush, these communities can have a species rich understory of perennial grasses and forbs. Winterfat (*Krascheninnikovia lanata*) occurs occasionally within this vegetation type, and spineless horsebrush occasionally becomes locally abundant. Common grasses in this community type include needle-and-thread grass, thick-spiked wheatgrass and bottlebrush squirreltail. Great Basin wildrye (*Leymus cineris*) may be locally abundant, and Indian ricegrass occurs regularly, but usually in low densities. Forbs that frequently occur in sagebrush/rabbitbrush communities include Hood's phlox, ballhead gilia (*Ipomopsis congesta*), Wilcox's woollystar (*Eriastrum wilcoxii*), hoary aster, and Douglas' dustymaiden.

Sagebrush/Saltbush. This vegetation class represents communities in which sagebrush species dominate and salt desert shrub species are ubiquitous. This community differs from the sagebrush steppe vegetation class because of the relatively high abundance of salt desert shrub species. Shadscale is the most common salt desert shrub species in this vegetation class. Rabbitbrush is also quite abundant within this community type. Bottlebrush squirreltail is the most abundant understory grass, Indian ricegrass is nearly always present within this community, and needle-and-thread grass and may be locally abundant. Common forbs include tapertip hawksbeard, Hood's phlox, and Douglas' dustymaiden.

Rabbitbrush. Communities within this vegetation class are dominated by rabbitbrush and contain little, if any, sagebrush. Nearly all of the plots within this vegetation class have burned within the last ten years. Other resprouting shrubs such as winterfat and spineless horsebrush occur occasionally in this vegetation type. Along T-25, these communities are often co-dominated by bluebunch wheatgrass. Bottlebrush squirreltail, Sandberg bluegrass, basin wildrye, needle-and-thread grass, and western wheatgrass (*Pascopyrum smithii*) occasionally co-dominated plots within this vegetation type along both roads. Forbs common to these communities include Hood's phlox, hoary aster, shaggy fleabane (*Erigeron pumilus*), Douglas' dustymaiden, tapertip hawksbeard, and ballhead gilia.

Rabbitbrush/Saltbush. Rabbitbrush/Saltbush communities are co-dominated by green rabbitbrush and shadscale saltbush. Only one survey plot occurred within this vegetation class and it had burned within the previous ten years. Native grasses are very abundant within this community and included bottlebrush squirreltail, bluebunch wheatgrass, and Sandberg bluegrass. Tapertip hawksbeard, shaggy fleabane, western tansymustard (*Descurainia pinnata*), and Hood's phlox are forbs common to this vegetation class. Sagebrush occurred in the survey plot within this community type, but at very low densities.

Native Grasslands. Communities within this vegetation class may vary considerably by species composition; however, they are all dominated by perennial grasses. Native grassland communities may be dominated by rhizomatous species, bunchgrasses, or a combination of both. Thick-spiked wheatgrass and western wheatgrass are common dominant rhizomatous species. Bunchgrass species that may dominant or co-dominate grasslands include Great Basin wildrye and bluebunch wheatgrass. Additional grass species such as, bottlebrush squirreltail, Sandberg

bluegrass, needle-and-thread grass, and Indian ricegrass are also abundant, but not dominant, in native grassland communities within the affected area. All of the grassland communities within the affected environment of the road alternatives had burned within the previous ten years.

Shrubs often occur within grassland communities; however, shrub cover is generally sparse. Shrub species that frequently occur within this vegetation class include Wyoming big sagebrush, Basin big sagebrush, green rabbitbrush, and prickly phlox. Spineless horsebrush and shrubby buckwheat (*Eriogonum microthecum*) may also occur sporadically within grassland communities. Pricklypear is often locally abundant. Forbs that typically occur in grasslands include white-stemmed globe-mallow (*Sphaeralcea munroana*), whitestem blazingstar (*Mentzelia albicaulis*), western tansymustard, and western stickseed (*Lappula occidentalis*).

Crested Wheatgrass. Crested wheatgrass (*Agropyron cristatum*) communities are strongly dominated by crested wheatgrass. Some of the plots within crested wheatgrass vegetation class were planted and others are the result of crested wheatgrass invasion into other community types. Low species richness is a characteristic very typical of these communities. Green rabbitbrush and sagebrush may be locally abundant, but the presence of native grass species is rare. Forbs are generally restricted to weedy annuals such as, flatspine stickseed and desert cryptantha (*Cryptantha scoparia*). Native, perennial forbs that occasionally occur in low densities within this vegetation class include Hood's phlox and tapertip hawksbeard.

Annual/Playas/Disturbed Areas. These areas have experienced a great deal of past hydrologic disturbance due to flooding, or soil disturbance associated with wildland fire control measures. Communities within this vegetation type are dominated by annual species including introduced annuals such as tall tumbledustard (*Sisymbrium altissimum*), herb sophia (*Descurainia sophia*), cheatgrass, or native annuals such as western tansymustard. As with crested wheatgrass communities, this vegetation type is characterized by a lack of native grasses. However, these communities do tend to have a relatively diverse compliment of native forbs. Common native forbs in these communities include Douglas' dustymaiden, tapertip hawksbeard, and hoary aster. Low stature shrubs like prickly phlox and broom snakeweed may also be locally abundant in communities within this vegetation class.

3.1.1.2 Summary Statistics for Vegetation Classes

The distribution of plots within each of the vegetation classes along the proposed routes is shown in Figure 1 (Vilord et al. 2005). They reported that the distribution of community type among the plots is more homogenous along T-25 than along T-24. The relative heterogeneity of plot distribution along T-24 was likely due to greater fine scale variation in abiotic factors such as slope and aspect. The number of plots within each vegetation class was similar between roads with the exception of the Annuals/Playas/Disturbed Areas vegetation class (Table 1). Plots in this vegetation class were relatively more abundant along T-24 due to the presence of numerous low-lying basins, playas, and channels that periodically fill with water (Vilord et al. 2005).

Vilord et al. (2005) reported that the average percentage of plots along each route in which any single species dominated or co-dominated was substantially different for several species between the routes. For example, green rabbitbrush was dominant or co-dominant on 55 percent of the plots on T-25 and was dominant or co-dominant on only 40 percent of the plots on T-24.

Similarly, needle-and-thread grass was a co-dominant in 20 percent of the plots along T-24, but was not a dominant or co-dominant in any of the plots along T-25; instead, bluebunch wheatgrass was a key species in over 20 percent of the plots along that route. However, Vilord et al. (2005) also reported that some species such as sagebrush dominated or co-dominated nearly the same proportion of plots along each route.

Vilord et al. (2005) also reported that species richness was, on average, five species per plot greater on T-24 than on T-25. The difference was statistically significant (Students T test, $P < 0.001$). They also reported higher species richness in plots along T-24 was largely due to greater native perennial forb diversity, indicating that the ecological condition of communities along T-24 is better than ecological condition of plant communities along T-25. Species richness of introduced annual species in plots along T-24 was similar to introduced annual species richness in plots along T-25, and thus, doesn't contribute greatly to differences in total species richness between the routes. The average number of noxious weeds species per plot was also higher on T-24 than along T-25; however, that number is quite low overall, and didn't contribute substantially to total species richness in any of the plots (Table 2) (Vilord et al. 2005). In general greater species richness in plots along T-24 was likely to due greater heterogeneity among plots along that route, as discussed above (Vilord et al. 2005).

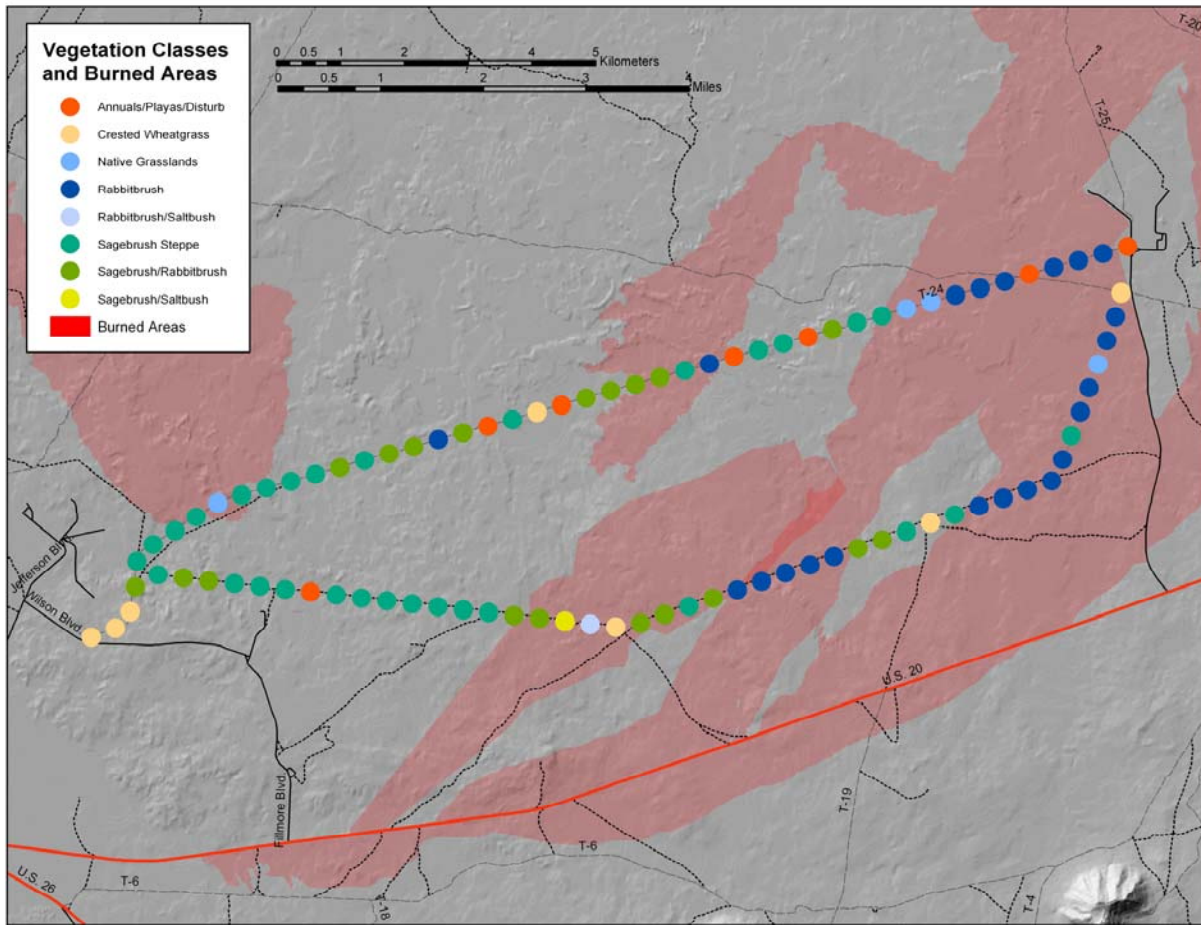


Figure 1. Vegetation classes for each of the plots surveyed by Vilord et al. (2005).

Table 1. The number of plots in each vegetation class (modified from Vilord et al. [2005]).

Plant Communities	T-25	T-24
Sagebrush Steppe	15	15
Sagebrush/Rabbitbrush	9	9
Sagebrush/Saltbush	1	0
Rabbitbrush	14	8
Rabbitbrush/Saltbush	1	0
Native Grasslands	1	3
Crested Wheatgrass	3	1
Annuals/Playas/Disturbed Areas	1	6
Total	45	42

Table 2. Average species richness, number of native perennial forb species, number of introduced annual species, and number of noxious weed species per plot along each proposed route.

	T-25	T-24
Species Richness	19.04	24.21
# of Native Perennial Forbs	4.47	6.93
# of Introduced Annuals	2.36	2.81
# of Noxious Weeds	0.02	0.07

Because that survey was conducted in September and October (Vilord et al. 2005), the detectability of several species was likely quite low. When compared to similar surveys in similar plant communities conducted in June (Blew et al. 2004), we estimated that about 90 percent of the perennial plant species were detected and about 75 percent of the annual species were detected in the surveys conducted for this report. Perennial species that were difficult to detect included, but were not limited to, desert biscuitroot (*Lomatium foeniculaceum*), shaggy fleabane (*Erigeron pumilus*), woollypod milkvetch (*Astragalus purshii*), and white-stemmed globe-mallow. Annual plants that were difficult to detect included, but were not limited to, sticky phacelia (*Phacelia glandulifera*), sand gilia (*Gilia leptomeria*), narrowleaf goosefoot (*Chenopodium leptophyllum*), spreading groundsmoke (*Gayophytum diffusum*), and Wilcox's woollystar. Therefore species richness, especially of native annuals, was likely greatly underestimated in the surveys by Vilord et al. (2005).

3.1.2 Soils

Vilord et al. (2005) reported that the soils along the proposed routes include three general soil groups. These three groups are generally described as Sands, Sands Over Basalt and Loess (Olson et al. 1995). In the areas that include the proposed alternative routes, Olson et al. (1995) mapped the Sands as the Grassy Butte series, Sands Over Basalt as the Malm-Bondfarm-Matheson Complex (M-B-M) and the Loess soils as the Coffee-Nargon-Atom Complex (C-N-A). Thirty-one percent of the T-24 route is in C-N-A, 64 percent in M-B-M and 4 percent in Grassy Butte. T-25 is all within C-N-A.

The C-N-A mapping units include 30 percent Coffee, 30 percent Nargon, 15 percent Atom and 25 percent contrasting inclusions. These soils are primarily loams and silt loams, and are deep to very deep to bedrock. The contrasting inclusions are likely basalt outcrops. Olson et al. (1995) lists potential natural vegetation for these soils as dominated by Wyoming big sagebrush. Rangeland improvement is limited by available water holding capacity and the hazard of wind erosion is slight (Olson et al. 1995).

Characteristics of the Grassy Butte soils include: 1) very deep, well drained to somewhat excessively drained sands, 2) sands are wind deposited, 3) the soils are calcareous throughout their depth and have a lime accumulation beginning at 10 to 19 inches deep, and 4) the hazard of soil blowing (wind erosion) is very high (Olson et al. 1995). 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 Capability Class VIIe (Very severe limitations that make them unsuitable for cultivation or range improvement [revegetation] due to erosion). Crop seedings require replanting of close grown

crops every other year on the Grassy Butte soil (Olson et al. 1995). This suggests poor suitability for rangeland drill seeding.

The M-B-M mapping units include about 60 percent Malm, 20 percent Bondfarm, 15 percent Matheson and 5 percent contrasting inclusions (Olson et al. 1995). The contrasting inclusions are rock outcrops. The soils that make up the M-B-M complex are primarily sandy loams. Olson et al. (1995) lists potential dominant vegetation for the Malm and Bondfarm soils as Wyoming big sagebrush and bluebunch wheatgrass, and for the Matheson soil as basin big sagebrush and bluebunch wheatgrass. Olsen et al (1995) does allow for Indian ricegrass as a potential co-dominant with basin big sagebrush on the Matheson soils.

Observations in the field survey reported by Vilord et al (2005) suggest that the portions of T-24 that are in the areas mapped as M-B-M have as their dominant grass needle-and-thread rather than bluebunch. This suggests that these areas may be more like the Grassy Butte or Matheson-Grassy Butte Complex (Olson et al. 1995). Olson et al. (1995) describes the range site for Matheson in the Matheson-Grassy Butte complex as basin big sagebrush, Indian ricegrass and needle-and-thread. Note that the “Sands” soil group (Figure 4) is mapped coincident with the fence at PBF. The mapping inside the fence was done at a finer scale than outside the fence (Olson et al. 1995), but similar to the scale of the vegetation surveys conducted by Vilord et al (2005). Much of the same sort of landscape position (slope and aspect) found at PBF also occurs along the T-24 route giving further support for the consideration that much of the soil in the M-B-M complex along T-24 may actually include conditions more like Grassy Butte or Matheson-Grassy Butte complex. Those conditions include high to severe risk of wind erosion and poor suitability for rangeland drill seeding (Olson et al. 1995). These sand soils are quite susceptible to invasion by cheatgrass and other non-native annual plants (Vilord et al. 2005).

The interpretation of soils as they relate to the proposed road alternatives is limited because of the scale at which the soil survey and mapping were conducted. To better understand the role of soil in addressing the ecological impacts of the proposed road alternatives, more detailed mapping of these areas is required.

3.1.3 Invasive and Non-Native Species

A total of eleven Idaho Noxious Weeds have been identified on the INL. Of those, only musk thistle (*Carduus nutans*) and Canada thistle (*Cirsium arvense*) were reported by Vilord et al (2005) to occur in the projected road corridors. 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 (*Bromus tectorum*), Russian thistle (*Salsola kali*), halogeton (*Halogeton glomeratus*), tumble mustard (*Sysimbrium altissimum*) and crested wheatgrass (*Agropyron cristatum*, *A. desertorum*, *A. sibiricum*).

Musk thistle and Canada thistle are both very common noxious weeds on the INL. Canada thistle appeared only once in the survey, along T-25 (Vilord et al. 2005). 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, but requires persistent management.

Musk thistle is present on 33 percent of the T-25 segments. It also occurred on 62 percent of the T-24 road segments (Vilord et al. 2005).

Non-native species also present a challenge in disturbed areas. They establish very quickly and successfully compete with the native species. Cheatgrass was present on 98 percent of both the T-25 segments and T-24 segments (Vilord et al. 2005). Halogeton was present on 98 percent of the T-25 segments, but on only 64 percent of the T-24 segments (Vilord et al. 2005). 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.

Although only two noxious weed species were found in the survey by Vilord et al. (2005), it is possible that others were present in the survey corridor. Due to the time frame of that survey, many plants had already senesced. For example, it would be very easy to miss the knapweeds. Dry, dead knapweeds easily resemble native asters. Because the surveys were conducted so late in the year, it is not possible to guarantee other noxious weed species were not present in the project area.

3.1.4 Sensitive Plant Species

A list of the sensitive plant species that have the potential to occur within the area affected by an upgrade of either T-25 or T-24 was compiled using data from the Idaho CDC (2009). All sensitive species known to occur in Butte, Custer, Jefferson, Bonneville and Bingham counties were considered. Species with habitat requirements similar to the conditions occurring around the affected area were included in the list. Sensitive species that were not included in the list were discounted because the habitat around the affected area was not suitable due to topography, soils, or climate. Table 3 lists sensitive plant species for which suitable habitat is present on or around the affected area.

Table 3. Sensitive species potentially occurring in the area affected by an upgrade of either T-25 or T-24 and appropriate State of Idaho, U.S. Forest Service Region 4, and/or Bureau of Land Management Ranking.

Scientific Name	Common Name	State	USFS Reg. 4	BLM
<i>Astragalus aquilonius</i>	Lemhi milkvetch	GP3	S	TYPE 2
<i>Astragalus diversifolius</i>	meadow milkvetch	GP2	S	TYPE 3
<i>Camissonia pterosperma</i>	wing-seeded evening- primrose	S		TYPE 4
<i>Catapyrenium congestum</i>	earth lichen			S
<i>Eriogonum capistratum</i> Rev. var. <i>welshii</i> Rev.	Welsh's buckwheat	GP2	S	TYPE 3
<i>Ipomopsis polycladon</i>	spreading gilia	2		TYPE 3

A survey specifically for sensitive plant species was completed in June of 2009 along both T-24 and T-25. Walking surveys were conducted 100 feet from the middle of the road on each side (200 feet total) in order to accommodate proposed widening and turn outs on the roads. The

yearly precipitation levels were good for vegetation across the desert. Although suitable habitat for the sensitive plant species was located, none of the specific plants in question were found.

3.1.5 Ethnobotany

Vegetation plot data collected along T-25 and T-24 were also analyzed by Vilord et al (2005) for the frequency of occurrence of several species of ethnobotanical concern. 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 included those species documented to have been used by “indigenous groups of the eastern Snake River Plain,” (Anderson et al. 1996). Table 4 lists those species of ethnobotanical concern observed in the vegetation survey plots (Vilord et al. 2005).

Table 4. List of species of ethnobotanical concern occurring on vegetation plots surveyed in the affected area of the proposed road upgrades (Vilord et al. 2005).

Current Scientific Name	Common Name	Uses
<i>Achnatherum hymenoides</i>	Indian ricegrass	food
<i>Allium acuminatum</i>	tapertip onion	food, medicine, flavoring, dye
<i>Allium textile</i>	textile onion	food, medicine, flavoring, dye
<i>Artemisia tripartita</i>	threetip sagebrush	food, medicine, cordage, clothing, shelter, fuel, dye
<i>Artemisia tridentata</i>	big sagebrush	food, medicine, cordage, clothing, shelter, fuel, dye
<i>Calochortus bruneauensis</i>	Bruneau mariposa lily	food
<i>Chenopodium leptophyllum</i>	narrowleaf goosefoot	food
<i>Chrysothamnus viscidiflorus</i>	green rabbitbrush	medicine, gum
<i>Cirsium arvense</i>	Canada thistle	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>Lappula occidentalis</i>	flatspine stickseed	food
<i>Leymus cinereus</i>	basin wildrye	food, manufacture
<i>Lomatium dissectum</i>	fernleaf biscuitroot	food, medicine
<i>Lomatium foeniculaceum</i>	desert biscuitroot	food, medicine
<i>Opuntia polyacantha</i>	pricklypear	food
<i>Poa secunda</i>	Sandberg bluegrass	food, medicine
<i>Salsola kali</i>	Russian thistle	food

Vilord et al (2005) reported that the frequency of species occurrence in plots along either T-25 or T-24 was similar for many of the most common species such as Indian ricegrass, big sagebrush,

green rabbitbrush, and flatspine stickseed. One commonly occurring species, basin wildrye, occurred much more frequently in plots along T-25 than along T-24. They also reported that substantial differences in frequency of occurrence between roads were apparent for less common species such as textile onion, fernleaf biscuitroot, and narrowleaf goosefoot (Table 5).

Table 5. Frequency of occurrence (as a percentage) of species of ethnobotanical interest in vegetation survey plot along T-25 and T-24 (Vilord et al. 2005).

Current Scientific Name	Powerline	T-24
<i>Achnatherum hymenoides</i>	82.22	78.57
<i>Allium acuminatum</i>	0.00	2.38
<i>Allium textile</i>	0.00	14.29
<i>Artemisia tripartita</i>	6.67	0.00
<i>Artemisia tridentata</i>	84.44	78.57
<i>Calochortus bruneaunis</i>	2.22	0.00
<i>Chenopodium leptophyllum</i>	33.33	16.67
<i>Chrysothamnus viscidiflorus</i>	97.78	97.62
<i>Cirsium arvense</i>	2.22	0.00
<i>Delphinium andersonii</i>	8.89	4.76
<i>Descurainia pinnata</i>	82.22	69.05
<i>Descurainia sophia</i>	37.78	47.62
<i>Ericameria nauseosus</i>	11.11	16.67
<i>Lappula occidentalis</i>	57.78	59.52
<i>Leymus cinereus</i>	62.22	23.81
<i>Lomatium dissectum</i>	6.67	19.05
<i>Lomatium foeniculaceum</i>	2.22	0.00
<i>Opuntia polyacantha</i>	64.44	57.14
<i>Poa secunda</i>	82.22	71.43
<i>Salsola kali</i>	11.11	4.76

Because those surveys were conducted late in the growing season the detectability of several of the species of ethnobotanical concern was quite low. For example, both of the onion species are highly desirable forage for small mammals and were likely heavily grazed in June and July, making them difficult to survey in October. From vegetation sampling conducted in June and July in similar plant communities elsewhere on the INL (Blew et al. 2004), we know that desert biscuitroot occurs much more frequently than we detected it on this survey, leading us to conclude that it senesces early in the season and doesn't leave a distinct skeleton, making it difficult to observe. Other species of ethnobotanical concern which are difficult to detect late in the growing season include Bruneau mariposa lily and Anderson's larkspur.

3.1.6 Hydrography

Vilord et al (2005) reported that several ephemeral streams intersect the proposed routes. None of these have any riparian habitat associated with them. Most of them likely carry water in only the wettest of years and probably only associated with spring run-off, a rain-on-snow event, or a significant rainstorm. Nearly all of these streams are small in size. However, Vilord et al. (2005) reported that T-24 crosses one ephemeral stream that is substantial and will likely require a bridge or substantial culvert. None of these streams are gauged and no information about discharge rates is known to be available. Vilord et al. (2005) also reported that the proposed routes cross several basins that likely hold substantial run-off associated with the type of events described above for ephemeral streams. These basins may contain sagebrush steppe, Great Basin wildrye or by annual species depending on the frequency and duration of flooding. Vilord et al. (2005) reported that large basins are intersected by all proposed routes.

3.1.7 Wildlife

Scientists on the INL have been collecting wildlife data for more than 40 years and have recorded a total of 219 vertebrate species (Reynolds et al. 1986) occurring on the INL, many of which are directly associated with sagebrush steppe habitat. Species that permanently reside within the alternative areas (i.e., T-25, T-24) include small and medium sized mammals (bushy-tailed woodrat [*Neotoma cinerea*], Ord's kangaroo rat [*Dipodomys ordii*], pygmy rabbit [*Brachylagus idahoensis*], black-tail jackrabbit [*Lepus californicus*], long-tailed weasel [*Mustela frenata*], badger [*Taxidea taxus*]), and reptiles (sage brush lizard [*Sceloporus graciosus*] and gopher snake [*Pituophis catenifer*]). Such species have small home ranges, limited mobility, or a social structure that restricts movements. 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*], and red-tailed hawk [*Buteo jamaicensis*]) and large mammals (elk [*Cervus elaphus*], mule deer [*Odocoileus hemionus*], and pronghorn antelope [*Antilocapra Americana*]) use the area in a seasonal transitory manner.

Wildlife species of concern addressed in this analysis include all migratory birds (including sage-grouse and raptors), sage-grouse, pygmy rabbits, Great Basin rattlesnakes, and all large mammal species.

Sage-grouse. Sage-grouse were recently found by the US Fish and Wildlife Service to be warranted for protection under the Endangered Species Act, but precluded due to other listing priorities (DOE-FWS 2010). Breeding and wintering habitats for sage-grouse occur within the proposed alternative areas (Figure 2). Although both are important to the survival of sage-grouse, breeding habitats have become a focal point for managing this species. Lyon (2000) estimated the average nest distances to the nearest lek varies from 1.1 to 6.2 km (3.9-0.6 mi) but may be as great as 20 km (12.5 mi). Sage-grouse guidelines from Connelly et al. (2000) suggest that all sagebrush habitats within 2 miles of occupied leks be protected.

The Environmental Surveillance, Education and Research (ESER) program is conducting a sage-grouse radio telemetry study on the INL site. The results of this research will be incorporated into the INL Conservation Management Plan and a Candidate Conservation Agreement with the U.S. Fish and Wildlife Service. Sage-grouse were captured and fitted with radio transmitters at

numerous leks throughout the INL in 2008 and 2009 including at a lek located between T-25 and T-24 southwest of MFC. This lek is located 2 miles or less from T-24 and T-25. Twelve birds from this lek were fitted with radio transmitters in 2008 and telemetry surveys show that seven birds remained in the area between T-24 and T-25 through spring and into early summer (Figure 2). Additional surveys are presently underway to identify and assess attendance at all leks in the vicinity of T-24 and T-25 and will be the subject of a separate report.

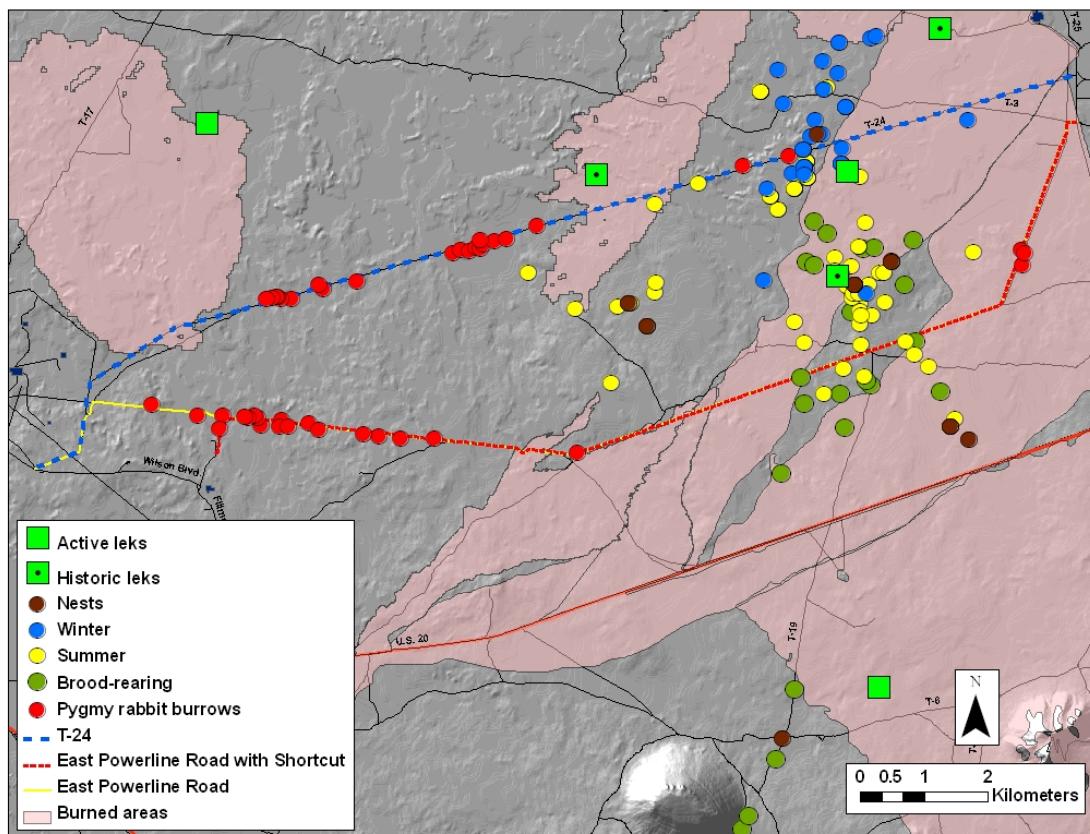


Figure 2. Locations of sage-grouse leks, historic leks, and seasonal use of habitat, as well as pygmy rabbit burrow systems from recent surveys.

Pygmy Rabbits. 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 may be relatively stable because much of the site remains undisturbed; however, little is currently known about the status of pygmy rabbit populations on the INL. Pygmy rabbit occurrence on T-25 and T-24 were assessed based on the presence of pygmy rabbit sign (i.e., sightings of rabbits, burrows, and/or scat) and the presence of suitable sagebrush habitats. Suitable sagebrush habitats were identified by the presence or absence of sagebrush. Unfortunately, surveys by Vilord et al (2005) in Fall 2005 were not conducted under conditions conducive to observing pygmy rabbit sign. However, additional surveys were conducted for pygmy rabbits in winter 2010 when there was adequate snow cover to allow for the identification of tracks.

Surveys were conducted for pygmy rabbits associated with T-24 and T-25 in winter 2010 when there was adequate snow cover to identify tracks. Pygmy rabbit burrows were identified in many locations along T-24 and T-25 (see Figure 2). Most burrows were located in dense patches of basin big sagebrush. All locations were in contiguous, undisturbed sagebrush habitats.

Birds. Most avian species occupying the INL use both sagebrush and grassland habitats from a few days for feeding and resting during migration to several months for breeding and raising young. Many bird species utilize specific habitats for foraging and reproduction. Species that primarily use sagebrush include the greater sage-grouse (*Centrocercus urophasianus*), sage sparrow, Brewer's sparrow (*Spizella breweri*), sage thrasher (*Oreoscoptes montanus*), and loggerhead shrike (*Lanius ludovicianus*). Species that occur mainly in grassland habitats include horned lark, western meadowlark (*Sturnella neglecta*), vesper sparrow (*Pooecetes gramineus*), and grasshopper sparrow (*Ammodramus bairdii*). Although most raptors use the site indiscriminately for foraging, nesting structures are a limiting factor in population abundance and species diversity.

T-24 and T-25 were searched for nests during summer/fall 2005 to determine which species might be present during the breeding season (Vilord et al 2005). Due to low detectability (cryptic nests and multiple search images), observer bias and the season the survey was conducted, it is likely that not all nests in the areas were located. Nests most commonly observed in both alternative areas were Brewer's sparrow, sage sparrow, and sage thrasher. Ninety-eight percent of all nests located were in sagebrush. No ground nesting bird nests were located. If a more accurate assessment of birds that nest in both sagebrush and grassland habitats is desired, surveys should be conducted during June when peak nesting activities occur.

Bird species observed on T-25 during survey conducted in fall 2005 were western meadowlark, white-crowned sparrow (*Zonotrichia albicollis*), sage thrasher, horned lark, sage sparrow and mourning dove (*Zenaida macroura*) (Vilord et al. 2005). Due to the season that these surveys were conducted, no active nests were found. It is likely the birds observed were migrating through to wintering areas farther south. Twenty-nine bird nests were located on the power line road (Table 6). Nests were identified as sage sparrow or Brewer's sparrow, sage thrasher, and loggerhead shrike (Vilord et al. 2005). Although few signs of sage-grouse using the area were located during these surveys, other data indicate that approximately 8.3 kilometers (5.1 miles) of T-25 were within 3.2 km (2 mi) of sage-grouse leks (Figure 2), and certain portions of this area were used by sage-grouse seasonally (Figure 2).

Power poles provide artificial habitat for species such as raptors. Raptors rely on perching structures for nesting, hunting and resting. Although Vilord et al. (2005) observed no raptor nests on power poles that run adjacent to the road, several species were observed using the poles for resting and hunting. Raptors observed by Vilord et al. (2005) include Swainson's hawk (*Buteo swainsoni*), red-tailed hawk, ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), prairie falcon (*Falco mexicanus*), and American kestrel (*Falco sparverius*) (Table 6). The only raptor observed by Vilord et al. (2005) on T-24 was a northern harrier. This is probably due to the limited amount of perching structures available to raptors along T-24 (Vilord et al. 2005).

Table 6. Species occurrences associated with two road corridors, September - October, 2005 (Vilord et al 2005).

Species	Road	
	T-25	T-24
Brewer's or Sage Sparrow nests	8	26
Sage Thrasher nests	19	24
Loggerhead Shrike nests	2	4
Sage-grouse Lek	1	4
Raptor observation	14	2
Pygmy Rabbit sign	2	4
Garter Snakes	2	10
Gopher Snakes	0	1
Big Game (locations from annual surveys)		
Elk (groups)	4	7
Mule Deer (groups)	2	2
Pronghorn (groups)	7	8

Bird species observed by Vilord et al (2005) on T-24 included western meadowlark, white-crowned sparrow, rock wren (*Salpinctes obsoletus*), and mourning dove. Due to the time of year that the survey was conducted (Fall 2005), it is doubtful that any were actively nesting. It is likely they were migrating through to wintering areas farther south (Vilord et al. 2005). However, these birds could potentially nest on the proposed areas during nesting season. Fifty-four bird nests were observed by Vilord et al. (2005) on T-24. Nests were identified as sage sparrow or Brewer's sparrow, sage thrasher, and loggerhead shrike (Table 6).

Rattlesnakes. Great Basin rattlesnakes are listed as protected non-game wildlife by the State of Idaho (Idaho CDC 2005). In addition, they also provide information (e.g. long-term rattlesnake monitoring program conducted by ISU) on ecosystem health on the INL. Great Basin rattlesnakes require winter habitats that allow them to go underground to depths below the frost line. On the INL these habitats are typically associated with volcanic features such as craters, cones, and lava tubes. Differences in the availability of rattlesnake winter habitat were assessed by the number of hibernacula observed and the amount of potential hibernacula based on the presence of volcanic features. Great Basin rattlesnakes on the INL select summer habitats with higher prey availability which are relatively undisturbed (Jenkins and Peterson, 2008). Summer habitat quality was assessed based on the amount of disturbed and undisturbed habitat and the number of prey items (i.e., small mammals) observed during wildlife surveys. To characterize habitats in terms of rattlesnake preference, plant community classifications were collapsed to burned and unburned types. Specifically, sagebrush steppe, sagebrush/rabbitbrush, sagebrush/saltbrush, and rabbitbrush/saltbrush communities were collapsed into an unburned category (i.e., preferred) and rabbitbrush, native grasslands, crested wheatgrass, and annuals/playas/disturbed areas were collapsed into a burned category (i.e., not preferred).

Surveys were conducted in late October when the majority of rattlesnakes are already underground in winter hibernacula (C. Peterson unpublished data). Thus estimates of rattlesnake occurrence by Vilord et al. (2005) were based on the presence of other snake species that occur sympatrically, but remain active later in the season and on the presence of suitable habitat. The presence of garter snakes or gopher snakes suggests that rattlesnakes may also occur because snakes often over-winter in the same locations on the INL (Cooper-Doering 2005). Rattlesnakes prefer and have higher reproductive output in undisturbed sagebrush habitats with abundant prey resources (Jenkins and Peterson, 2008).

No winter snake hibernacula were observed by Vilord et al (2005) on T-25 (Table 7). In addition, little potential rattlesnake winter habitat was observed on T-25 relative to T-24. One garter snake was observed by Vilord et al. (2005) along T-25 which suggests that there is at least one potential rattlesnake hibernaculum in the area (in October snakes would not be far from a hibernaculum). Fifty-eight percent of the vegetation along T-25 was characteristic of preferred rattlesnake summer habitat (Vilord et al. 2005) (Table 7). However, few prey items (i.e., small mammals) were observed by Vilord et al. (2005) along T-25 relative to T-24. They found one rattlesnake shed along T-25 indicating that snakes use this area as summer habitat.

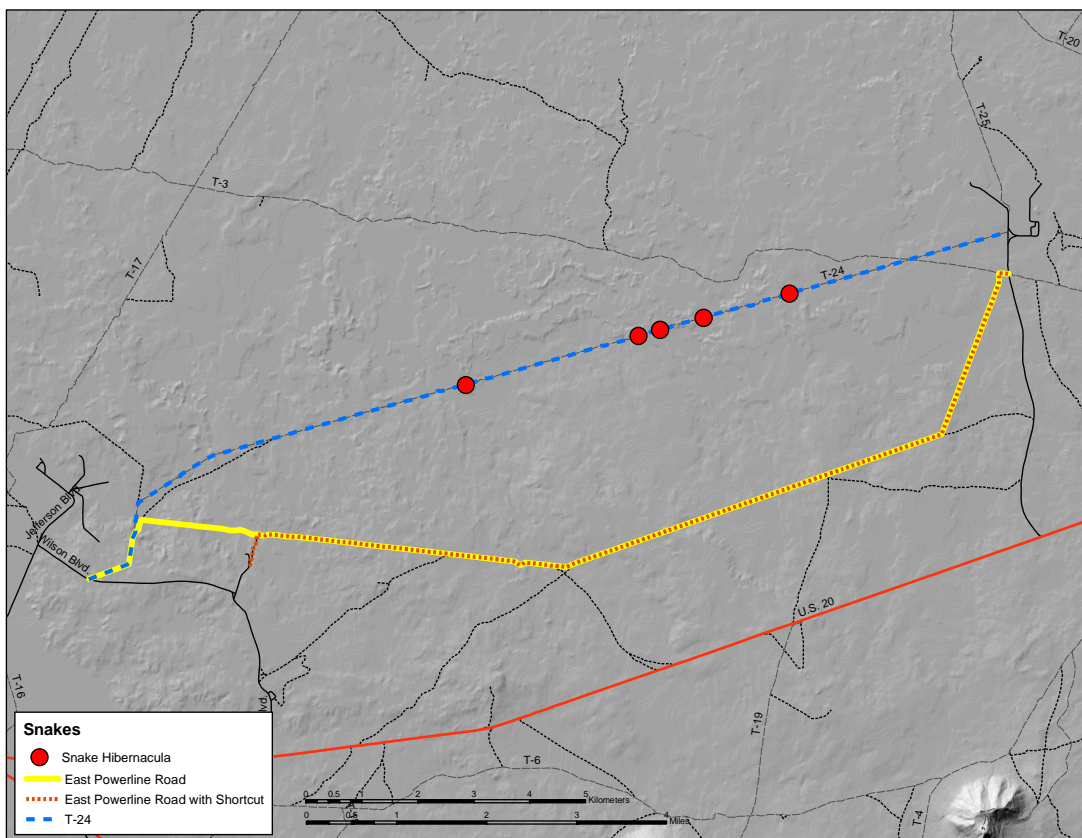


Figure 3. Locations of snake hibernacula found during survey in 2005 (Vilord et al 2005).

Table 7. Predictors of rattlesnake occurrence associated with two road corridors, September - October, 2005 (Vilord et al. 2005).

Occurrence Predictors	Road	
	T-25	T-24
Winter		
Snake Hibernacula	0	5
Potential Snake Hibernacula	Low	High
Individual Snakes	2	11
Summer		
Vegetation (i.e., proportion of plots in preferred habitats)	0.58	0.57
Prey (i.e., number of small mammals)	6	18

Five garter snake and/or gopher snake hibernacula (i.e., potential rattlesnake hibernacula) were observed by Vilord et al (2005) on T-24 (Table 7) (Figure 3). Fifty-seven percent of the vegetation along the T-24 was characteristic of preferred rattlesnake habitat (Vilord et al. 2005) (Table 7). They also found many prey items (i.e., small mammals) along T-24 relative to T-25.

Large Mammals. Elk, mule deer and pronghorn have been observed during semi-annual surveys using the general areas of both alternative routes throughout the year (Figure 4). Comer (2000) found that elk tend to utilize sagebrush on lava habitat more frequently than any other habitat type on the INL. The majority of this habitat type on the INL occurs within the non-grazed areas. Pronghorn and mule deer are more randomly scattered throughout the INL, with concentrations being greater near the Big Lost River Sinks and juniper woodlands respectively.

On T-25, signs of elk, mule deer, and pronghorn antelope use of the area were observed by Vilord et al. (2005) during their survey conducted in Fall 2005. Annual large mammal survey data shows that over the past five years herds of elk, mule deer and pronghorn have been documented within 1.6 km (1 mi) of this route during the summer and winter months (Figure 4). Elk appear to only use this area during the winter. Herds of elk ranged in size from 4 to 19 individuals.

During the survey in Fall 2005, an abundance of large mammal sign and herds of large mammals were observed on T-24 (Vilord et al. (2005). Annual large mammal survey data show that over the past five years herds of mule deer, pronghorn, and elk reside within 1.6 km (1 mi) of this route (Figure 4). These herds range in size from 1 individual to more than 60. Additional telemetry studies are presently underway and include elk captured in the vicinity of T-24 and T-25.

3.1.8 National Environmental Research Park

The INL is 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,

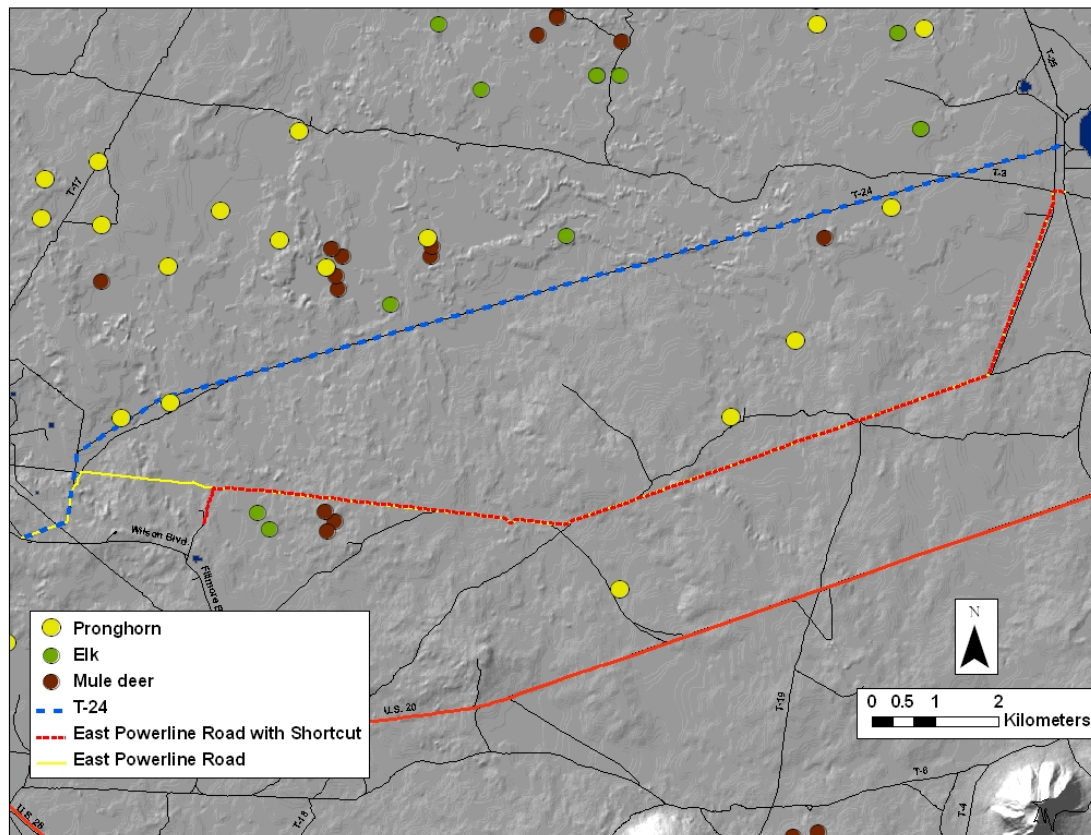


Figure 4. Locations of ungulates sighted during recent (February 2010) aerial surveys.

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 NERPs provide 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 NERPs 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 road alternatives (Figure 5).

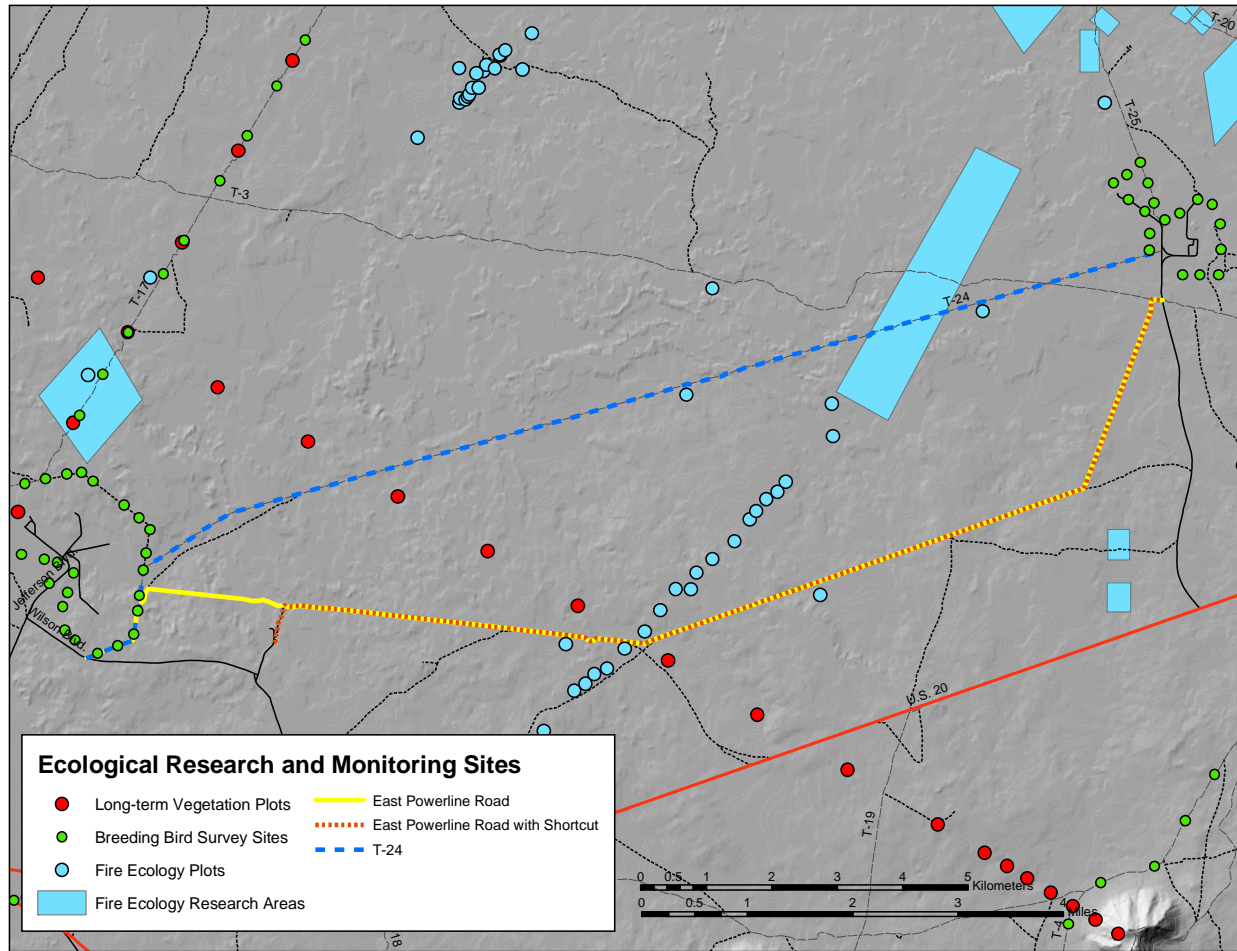


Figure 5. Ecological research and monitoring sites in the vicinity of the proposed routes for the new road (Vilord et al. 2005).

The Long-Term Vegetation Transects (LTV) were established in 1950 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 are scheduled to be surveyed in 2006. Several LTV plots are in the vicinity of the proposed road alternatives.

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.

In addition to the NERP activities described above, additional DOE-sponsored ecological monitoring is conducted near the proposed test site (Figure 5). Two of the facility Breeding Bird

Survey routes on the INL are in the vicinity of the proposed road alternatives. One route follows the fence line around PBF and the other is around MFC. These routes are surveyed during June each year.

Surveys for large mammals, primarily elk, pronghorn and mule deer are conducted in January and July each year. These surveys are conducted using fixed-wing aircraft flying 500 feet above the ground. The surveys are conducted on north-south transects one-half mile apart and cover the area crossed by the potential road corridors.

4.0 Environmental Consequences

4.1 Ecological Resources

Previous ecological surveys documented in Vilord et al. (2005) and more recently in Hafila et al. (2010) form the basis for this analysis. This section addresses both Alternatives 1 and 2 by specific resource.

4.1.1 Vegetation Communities

Road improvement along either route will increase soil disturbance and vegetation community fragmentation. An increase in soil disturbance will likely lead to an associated increase in weedy non-native species and the potential to displace natives in the communities adjacent to the upgraded road will amplify. The prevalence of needle-and-thread grass as a community dominant or co-dominant in plots along T-24 is indicative of sandy soils along that route. Because sandy soils tend to have less structure and, therefore, are more easily displaced, the invasibility of those soils can be quite high. The high risk of invasibility combined with the high frequency (0.93) of cheatgrass in plots along T-24 make the potential risk of cheatgrass invasion much higher on T-24 than on T-25. It should be noted that although the frequency of cheatgrass in plots along T-24 is high, abundance of cheatgrass was quite low. Thus, the potential of cheatgrass invasion is high because a ubiquitous seed source exists, not because the community has already been impacted by the species.

In addition to the impacts of upgrading a road as they relate to invasibility, the initial ecological condition of the plant communities prior to disturbance relates to the potential impacts to the plant community. For example, the plots along the T-24 road tend to have higher total species richness and higher species richness of native forbs and thus, are in better ecological condition. Therefore potential impacts would be greater to the plant communities along T-24 because the initial ecological condition of those communities is higher than that of the plant communities along T-25. Likewise the relative heterogeneity of plots within each vegetation class along T-24, indicates more diverse plant communities than those found along T-25. In brief, T-25 has already experienced some level of disturbance, therefore; the overall impact to the plant communities adjacent to T-25 would be much less than it would be to the plant communities adjacent to the relatively undisturbed T-24.

Potential impacts to the vegetation communities along either potential route can be controlled to some extent by minimizing the footprint of the soil disturbance. Weed control would also be necessary, as even the slightest amount of soil disturbance may lead to non-native species invasions. Revegetation along much of T-24 would be of limited value as an operational control due to the limited capability of soils along that route.

4.1.2 Soils

Soil disturbance for road construction would result in a direct loss of native vegetation and would provide opportunities for invasive and other non-native plants to become established. In the proposed project, soil would be disturbed to a width of approximately 60m (200 feet) along the length of the new road. No information about construction laydown areas or other potential for soil disturbance were made available for this review, but any such areas will likely have similar impacts to those described for the road itself.

Soil degradation may occur as a result of soil compaction. Soil compaction may have a serious negative impact on soil structure and vegetation recovery. Environmental disruption by soil compaction is a long-term event; as the recovery of compacted sandy soils (sandy soils are more susceptible, and recover more slowly than clay or wetter soils) is extremely slow and can take longer than 50 years (Caling and Adams 1999). Sandy soils are present on both alternative routes, but dominate the T-24 route (Figure 4) (Olson et al. 1995) and thus may exhibit limited recovery. Weed invasion of disturbed areas has been linked to changes in soil properties (Zink et al. 1995).

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. Operational controls that could be used to minimize the area and intensity of direct impacts to soils include:

- Designation of roadways, parking and laydown areas and restricting traffic to those designated areas.
- Limiting the amount of traffic allowed access to, and on, the project site.

If the M-B-M soils are actually more like Grassy Butte or Matheson-Grassy Butte complex, then 69 percent of the T-24 route may be in areas with sandy soils that are not suitable for rangeland plantings (revegetation), are susceptible to wind erosion and are at substantial risk to invasion by cheatgrass and other non-native annual plants following disturbance. Because revegetating these soils is unlikely to be successful, revegetation should not be considered as an operational control and surfacing disturbing activities in areas with these soils should be kept to an absolute minimum. The disturbance created should be considered to be permanent.

T-25 soil is all C-N-A and classified as Loess. The Loess soils are primarily loams and silt loams, and are deep to very deep to bedrock. Revegetation in these soils is limited by available water holding capacity and there is a slight hazard of wind erosion. Operational controls that minimize the disturbance and supplemental irrigation would be used to ensure successful revegetation.

4.1.3 Invasive and Non-Native Species

Soil disturbance is a primary contributor to the spread of invasive plants. Invasive and non-native plants are present on the much of T-25 and T-24 and could be spread by mowing, blading, grubbing, and any other means used to remove the vegetation in order to build a road. Seed dispersal may be limited in a number of ways. First, seed dispersal may be limited by disturbing as little area as possible along the road corridors whether that disturbance is mowing, blading,

etc. Second, the timing is critical to seed dispersion. Most invasive and non-native species produce large numbers of seed. The proposed construction schedule would occur coincident with or immediately following seed ripening for several invasive plants, including cheatgrass. Similarly disturbed soils would be open and available to receive seeds though much of the seed dispersal period for nearly all of the invasive species reported by Vilord et al. (2005) to be in the project area. This would result in a greatly increased effort and expense for weed management associated with the construction corridor.

The data collected by Vilord et al. (2005) on the presence of invasive and non-native plants shows equal distribution of cheatgrass between roads. However, there was more halogeton on T-25 than on T-24 and more musk thistle on T-24 than on T-25. While disturbing weeds often creates a larger problem, the distribution of the weeds is equally important. In the case of halogeton, most of the infestations occur in the existing roadway or in disturbed areas immediately adjacent to the road. T-25 has halogeton present along nearly its entire length. Musk thistle is distributed differently in that most of the infestations were located some distance from the road, but close enough to provide seed to any newly disturbed soil. The road shoulder and borrow ditch would be susceptible to invasion for several years following construction. Because of the sand soils found along much of T-24, revegetation is unlikely to be successful as an operational control for invasive and non-native plants for Alternative 2. A weed management plan should be developed and implemented for whichever alternative is selected.

4.1.4 Ethnobotany

The impacts of upgrading either road will likely be greater on less common species than they would be on abundant species. Frequently occurring species are generally quite abundant; thus, removing several individuals will not greatly affect the larger population. Populations of species with more isolated distributions, however, are much more sensitive to the loss of several individuals. Since narrowleaf goosefoot has a relatively low frequency of occurrence overall, but is more common along T-25, that species would most likely experience a greater impact from disturbances associated a road upgrade along that route. Conversely, textile onion and fernleaf biscuitroot will experience greater impact from an upgrade to T-24, as individuals from those relatively limited populations are found more frequently along that route. Since textile onion and fernleaf biscuitroot are considerably more difficult to re-establish than narrowleaf goosefoot, species of ethnobotanical concern that occur in low frequencies would experience greater impact along T-24 that they would along T-25.

Because the soil disturbance and risk of non-native species invasion will impact populations of species of ethnobotanical concern along either route, the most effective operational control to protect those populations would be to minimize the amount of soil disturbed. Potential impacts to populations of plant species of ethnobotanical concern may also be controlled through revegetation of areas impacted by soil disturbance. Seed or seedlings are commercially available for about one third of the species listed in Table 1, so those species may be directly replanted; so long as care is taken to choose appropriate subspecies and cultivars. The use of a diverse mix of native species in revegetation efforts will be important if species of concern, for which seed or stock is not available, are to re-establish voluntarily. Finally, weed control will be critical to facilitate re-establishment of native communities, including species of ethnobotanical concern.

Because of the sand soils along much of T-24, revegetation is unlikely to be successful as an operational control for impacts to species of ethnobotanical concern for Alternative 2.

4.1.5 Sensitive Plant Species

Because no sensitive plant species were found along either T-24 or T-25, it is unlikely there will be an impact to those species due to construction of the proposed road on either of these two alternative routes.

4.1.6 Hydrography

Ecological impacts by altered hydrography would likely occur in the basins bisected by the proposed road. Because the vegetation class present in these basins is the result of the frequency and duration of flooding, any alteration in the flooding regime would likely alter those plant communities. It is expected that the road constructed through these basins will be elevated to limit damage to the road due to flooding in the basin. These elevated roadways would act as dams preventing water from evenly flooding the basin. Consideration for placement of adequate culverts under roads in these basins would be an essential operational control to minimize alteration of the natural patterns of flooding disturbance and subsequent alteration of the native vegetation communities.

4.1.7 Wildlife

Both alternatives would have common unavoidable impacts to wildlife including: 1) loss of ground-dwelling wildlife species and associated habitat, 2) displacement of certain wildlife species due to increased habitat fragmentation, and 3) an increase in the potential for collisions between wildlife and motor vehicles. Although there is little difference in the type of impact, differences vary between alternatives in the severity of the impact to some species. Operational controls would result in a reduction in the impact of roads on wildlife. Operational controls would include, but are not limited to, seasonal timing of activities, lower speed limits, fencing, warning signs, reflectors, ultrasonic warning whistles, habitat alteration, hazing animals from the road, and awareness programs.

Timing of Project Activities. Both alternative areas provide important breeding habitat to many species during the spring, thus seasonal restrictions should be imposed in order to prevent any detrimental effects to breeding populations. The following are times when specific animals are breeding, nesting or birthing, and operational controls that should be implemented to minimize impacts to those biota.

- Sage-grouse lek activity: March 15–May 15 (Disruptive activity restricted to 10 a.m. through 5 p.m. when working closer than 0.6 miles of leks) (USDI BLM 2010).
- Sage-grouse nesting and brood rearing: March 15-June 30 (Surface disturbing and/or disruptive construction activities should be prohibited or restricted when in suitable nesting and brood-rearing habitat.) (USDI BLM 2010).
- Sage-grouse winter habitat: November 15-March 14 (Surface disturbing and/or disruptive construction activities should be prohibited or restricted when in mapped or modeled winter habitat.) (USDI BLM 2010).
- Passerine birds: May 1–September 1 (many species finish nesting by June 30) (Surface and vegetation disturbing activities should avoid this period or be preceded by surveys to

confirm the absence of nesting birds. These surveys should occur no more than two weeks prior to the disturbing activity.)

- Raptors: February 1 - July 1 (Minimize activity in the vicinity of nests during this period)
- Pygmy rabbits: February - July
- Snakes: August - September

Speed Limits. Wildlife strikes by vehicles are a frequent occurrence on many roads. Mortality would be greatly reduced by reducing speeds to <15 mph (24 kph) and increasing awareness of the presence of any animal that might frequent the area. If a wild animal is observed in the road, vehicles should stop and wait until the animal leaves the road, encourage it to move on by driving forward SLOWLY.

Birds. Bird-vehicle collisions not only result in the death of individual birds, but also in preventing birds from successfully breeding. Destruction of roosting places, hunting perches, and nest sites will influence local populations more than the actual loss of individual birds to automobiles (Forman et al. 2003). Some species are more vulnerable to habitat loss than others. Sagebrush obligate species such as Brewer's sparrow, sage sparrow, sage thrasher and sage-grouse rely on sagebrush for nesting and brood rearing. Project activities will impact birds by removing sagebrush thus reducing opportunities for successful breeding. Survey results showed fewer species of concern located on T-25 than on T-24 (Vilord et al. 2005).

Disturbances associated with activities on and near the proposed road have the potential to permanently displace sage-grouse and other birds during winter and spring. Winter and spring are critical survival and reproductive periods for all birds. Potential impacts of the proposed action on birds that use the area can be minimized by maintaining vehicular speeds of less than 24 kph (15 mph) and restricting access to only authorized vehicles. Activities including vegetation removal that occur during the period of May 1 to September 1 would almost certainly result in damage to active nests of passerines and would result in a violation of the Migratory Bird Treaty Act.

Both the ferruginous and Swainson's hawk have been documented to nest on the power line along T-25 as well as the Utah juniper (*Juniperus utahensis*) trees scattered along this road (ESER, unpublished data). The increased noise, activity and dust from additional traffic along T-25 could adversely impact both of these species by causing displacement from current hunting and nesting areas or nest abandonment. Collisions with vehicles are also possible.

Sage-grouse. Breeding, brood-rearing, and over-wintering habitats for sage-grouse occur within the proposed road upgrade area. Although all habitat components are important to the survival of sage-grouse, lek locations (breeding grounds) are commonly considered a focal point for managing this species (Braun et al. 1977). Protecting habitat for non-migratory populations when sagebrush is distributed uniformly includes minimizing disturbance to sagebrush and herbaceous understory within 2 miles of active lek locations, and 3 miles when sagebrush is not distributed uniformly (Connelly et al. 2000). Sage-grouse populations on the INL exhibit numerous seasonal movements and can be considered migratory populations because they make long-distance movements (>6 miles one way) between or among these habitats (Connelly et al. 1988 and Connelly et al. 2000). Migratory populations require the consideration of protecting

areas within 11 miles from leks to include important nesting habitat (Connelly et al. 2000). Research has shown that protecting habitat immediately around leks may not provide protection of important nesting areas (Wakkinen et al. 1992).

Operational controls for construction activities would include limiting activity during lekking season (March 15 through May 31) to the hours of 10 am and 5 pm when working within 0.6 miles of leks, and to avoid construction in nesting, brood rearing and wintering habitat during the periods noted above. To limit road mortality of sage-grouse, the road would be used only for those activities identified in the purpose and need statement and speed would be reduced to <15 mph (24 kph).

Pygmy Rabbits. Removing sagebrush for road construction would impact pygmy rabbits directly by loss of individuals and habitat. Indirect impacts would occur by disturbing soils and promoting the invasion of weeds that may alter fire regimes. In addition, roads fragment suitable habitats and create barriers to rabbit movements. Many portions T-24 contain native vegetation within the middle of the tire tracks of the road. This vegetation reduces the impacts of fragmentation and supports continuity of habitat. Vegetation within the T-25 tracks is sparse and often limited to non-native vegetation. Roads with little to no vegetation growing between the tracks are barriers to movement and dispersal, since pygmy rabbits are unlikely to cross open areas. The effects of fragmentation due to the wider spaces across the road have likely already occurred on a large portion of the T-25 route. To reduce impacts to pygmy rabbits and their habitats, soil disturbance should be minimized and invasion of weeds and direct disturbance of known rabbit locations should be avoided. Road construction should be planned to minimize impact to the pygmy rabbit locations identified in the recent survey. Specifically, the route of the road should be shifted away from rabbit locations by 100 meters (300 feet) to prevent direct impacts. Soil disturbance and the removal of sagebrush should be minimized and disturbed areas should be replanted with native vegetation to prevent additional indirect impacts. Revegetation is unlikely to be successful on the T-24 route.

Rattlesnakes. Great Basin rattlesnakes are listed as protected non-game wildlife by the State of Idaho (Idaho CDC 2005). Overall, T-24 provides significantly more winter and summer habitat for Great Basin rattlesnakes than T-25. More potential hibernacula and higher prey availability were found along T-24. However, vegetation along T-25 suggests that it may also have suitable summer rattlesnake habitat. If T-24 is selected as the route, the existing hibernacula would be destroyed during road construction due to their close proximity to the road (3 are within 5 meters). In addition, if construction occurs when snakes occur in high densities at hibernacula (May-early June and September-early October) there could be significant mortality of snakes and safety concerns for workers.

If T-24 is selected, a 100-m (300-ft) buffer should be placed around each hibernacula and the road should be rerouted around these buffers to prevent the destruction of hibernacula, snake mortality, and safety issues for workers. Construction should also be avoided from May through June and September through October. T-24 has high quality rattlesnake summer habitat. Building the road along this route would disturb soil, promote invasion of invasive plants, and result in lower prey availability. If T-24 is the route selected, disturbance should be minimized along the undisturbed portions of the route. Rattlesnake habitats would also become fragmented

and road mortality of snakes would increase (Jochimsen 2006). To mitigate these effects, a series of crossing tunnels should be placed along the portions of the road that go around the buffered hibernacula. In addition, fences to guide snakes into the tunnels should be installed and maintained. If T-25 is selected as the route, minimum disturbance should occur along the road in non-burned areas and disturbed soils should be replanted with native vegetation to prevent the degradation of rattlesnake summer habitats. Revegetation is unlikely to be successful on the T-24 route.

Large Mammal Species. Vehicle collisions with large mammals involve vehicle damage, human casualties, and lost economic opportunities. Survey data indicate that more large mammals can be found occupying areas closer to T-24 than T-25. Impacts to large mammals can be minimized by choosing the alternative that increases the distance of the project to preferable habitat cover and wildlife movement corridors. Other operational controls would include fencing, warning signs, maintaining vehicular speeds to less than 15 mph (24 kph), using ultrasonic warning whistles on vehicles and restricting access to authorized vehicles only.

4.1.8 Habitat Fragmentation

Habitat Fragmentation would result from the proposed road construction action and cause some negative impacts no matter which alternative is selected. Infrastructure affects natural systems in both direct and indirect ways. The physical presence of roads in the landscape creates new habitat edges, alters hydrological dynamics, and disrupts other ecosystem processes and habitats. Road maintenance and traffic contaminate the surrounding environment with a variety of chemical pollutants and noise. In addition, infrastructure and traffic impose dispersal barriers to most non-flying terrestrial animals, and vehicle traffic causes the death of millions of individual animals per year. The various biotic and abiotic factors operate in a synergetic way across several scales, and cause not only an overall loss and isolation of wildlife habitat, but also split up the landscape in a literal sense (Seiler 2001).

Roads fragment plant and animal populations (Noss 1996). Habitat fragmentation is the process whereby a large, continuous area of habitat is both reduced in area and divided into two or more fragments (Wilcove et al. 1996; Schonewald-Cox and Buechner 1992; Reed et al. 1996; Theobald 1998). Fragmentation can occur when area is reduced to only a minor degree if the original habitat is divided by roads, canals, fire lanes, or other barriers to free movement of species (Primack 1998).

Habitat fragmentation leads to increasing edge effects, 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).

Changes in the microenvironment at the fragment edge can result from habitat fragmentation. 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 that brood parasitism increases on edges and in fragmented habitats (Belthoff and Rideout 2000).

Fragmentation affects animal populations in a variety of 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 effectively cuts the population in half. A network of roads or firelines fragments the population even further (Noss 1996). In addition to direct loss of shrub habitats, responses of shrub-obligate species of wildlife will be related to dispersal capabilities and populations may not persist in landscapes of increasingly fragmented patches of sagebrush after disturbance (Braun et al. 1976; Knick and Rotenberry 1995; Knick and Dyer 1997).

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). Sage-grouse (*Centrocercus urophasianus*), sagebrush obligates, are totally dependent on sagebrush habitat (Benson et al. 1991) and removal of sagebrush has a negative impact on the value for winter habitat (Gates 1983). Good winter range provides sage-grouse with access to sagebrush under all snow conditions. Sage-grouse only eat sagebrush during the winter and often use relatively open habitats with 10-25 percent sagebrush canopy cover and an average height of 25-35 cm above the snow.

Many sage-grouse populations are migratory and individuals may move 100 kilometers or more between seasonal ranges. Sage-grouse have a relatively low reproductive rate compared to other game bird species so populations do not recover quickly following return of optimal conditions (Schroeder 1999).

Roads fragment plant populations and facilitate the spread of invasive animals, insects and plants. Many of the weedy plants that dominate and disperse along roadsides are non-native. 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 under story vegetation, inhibit seed regeneration, and change soil nutrient cycling. Some weeds can cause higher erosion rates or change fire regimes.

In shrub-steppe ecosystems, invading weeds, which were usually non-mycorrhizal, disrupted succession of native species, 99 percent of which were mycorrhizal-dependent. Also, fires have become more common and extensive in sagebrush ecosystems invaded by cheatgrass (Billings 1994). Presence of cheatgrass along edges (roads) may allow it to invade adjacent habitats, increasing the likelihood of fire spread into nearby sagebrush patches, further fragmenting the ecosystem (Knick and Rotenberry 1997).

Disturbance from roads can increase the distance between remaining shrub patches that provide seed sources (Knick and Rotenberry 1997). The dominant shrub on the INL, big sagebrush (*A. tridentata*), does not resprout from crown or roots following fire (Young and Evans 1978). Thus, natural regeneration of these shrublands could be severely limited by availability and dispersion of seed sources. Dispersal of sagebrush is primarily wind driven and occurs largely within 30 m of the seed source (Young and Evans 1989).

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).

4.1.9 Radiological Impacts

Because no details on radiological parameters have been identified for the proposed shipments, it is not possible to determine the potential for radiological impacts to ecological resources.

4.1.10 Ecological Monitoring and NERP Research Activities

There is the potential for impact to ecological research and monitoring activities in the vicinity of the proposed road alternatives. 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 that deemed necessary to achieve project goals. 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, big game surveys, sage-grouse lek routes and other data collection activities. It is essential for the continuation of these research and monitoring programs that ESER personnel not be restricted from accessing these areas on T-24 and T-25.

The Breeding Bird Survey sites around PBF will be disrupted if the T-24 route is chosen. Selecting T-25 would eliminate that impact.

4.1.11 Effects on INL Natural Resource Aspects

To summarize the evaluation of consequences of the proposed road on ecological resources, we have analyzed the impact of the alternatives on each of the INL natural resource aspects. 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 collected as part of other research or monitoring programs as they relate to the natural resource aspects. That narrative synthesis follows below. Also, that synthesis is summarized in Table 8.

Table 8. Evaluation Matrix for Natural Resources Aspects.^a

Natural Resources Aspects Alternatives	Alternative 1	Alternative 2	Alternative 3
	T-25	T-24	No Action
Minimize the need for rehabilitation following construction	1	0	3
Threatened, endangered, and sensitive species and their habitat	2	1	3
Sage-grouse and other sagebrush-obligate species and their habitat	2	0	3
Minimize habitat loss and habitat fragmentation	1	0	3
Culturally significant flora and fauna	2	1	3
Large undeveloped sagebrush steppe ecosystem	1	0	3
Plant genetic diversity	2	2	3
Unique ecological research opportunities	1	0	3
Minimize invasion of non-native species including noxious weeds	2	0	3
<i>Total</i>	<i>14</i>	<i>4</i>	<i>33</i>

^a3—Supports natural resource aspect.

2—May support natural resource aspect with implementation of resource-specific mitigation.

1—May support natural resource aspect, but may cause other impacts regardless of mitigation.

0—Does not support natural resource aspect.

- Reduce the need for rehabilitation following road construction.** Assuming that the width of the disturbance is the same no matter which route is selected, the main differences between routes on the need for rehabilitation is due to the length. The T-24 and T-25 options are nearly the same length and would have the same impact. However, the majority of the T-24 route passes through areas with soils that are not suitable for revegetation and the impacts associated with failure to rehabilitate would likely be permanent. The T-25 route would also require substantial efforts to revegetate.
- Threatened, endangered and sensitive species (this includes State of Idaho designated species) and their habitat.** During our survey, we recorded more sightings of sensitive species on T-24 than on the Powerline road. This was in part due to finding new snake hibernacula on T-24. No snake hibernacula are known along the T-25 route.
- Sage-grouse, pygmy rabbits, and other sagebrush-obligate species and their habitat.** The presence the powerline itself on T-25 has already altered habitat such that it is less suitable for sage-grouse and pygmy rabbit because it provides artificial perches for raptors. The sagebrush habitat on T-24 presently has no such artificial alteration. We also recorded more pygmy rabbit sightings on T-24 than on T-25. Selecting T-24 would result in greater impact to sage-grouse, pygmy rabbits and other sage-grush obligate species.
- Minimize habitat loss and fragmentation.** Because T-24 crosses through a very large area of otherwise undisturbed sagebrush steppe, upgrading this road from a two-track road to a modern two-lane highway would cause both direct habitat loss and fragmentation.

Implementing the recommended operational controls would alleviate some of the effects of fragmentation. However, for certain species, this fragmentation cannot be mitigated. For T-25, the presence of the powerline and periodic blading, significant habitat loss and fragmentation have already occurred on this route. Selecting T-25 means that this resource aspect might be supported, but other impacts to the resource would still result.

- **Culturally significant flora and fauna.** Selecting T-24 would have direct impacts to ethnobotanical species. Selecting T-25 would mitigate this loss because it contains less good condition sagebrush habitat than T-24.
- **Large undeveloped, sagebrush steppe ecosystem.** As described above, T-24 crosses a very large, mostly undisturbed area of sagebrush steppe. Selecting this route would not maintain a large, undeveloped sagebrush steppe ecosystem. Selecting the T-25 route would not directly affect the maintenance of a large undeveloped sagebrush steppe ecosystem because the existing powerline and road have already caused disturbance in that area.
- **Plant genetic diversity.** Construction of this road would require substantial revegetation effort no matter which route is selected. It would be possible to maintain plant genetic diversity by using only locally collected plant materials for use in the revegetation effort. This would include locally collected seed or use of transplanted “wildings.” Because of the sand soils found along much of T-24, revegetation is unlikely to be successful as an operational control for Alternative 2 and, therefore, this aspect for that alternative would not be supported.
- **Unique ecological research opportunities.** Because the unique ecological research opportunities at the INL Site are due to the large, undeveloped, unfragmented sagebrush steppe ecosystem, any alternative that changes those characteristics would not support these unique ecological research opportunities. Because developing the T-24 route would fragment and otherwise impact this undeveloped area, selecting this alternative would result in a reduction in the potential to maintain the unique opportunities for ecological research presently available on the INL Site. Selecting the T 25 route may support the continuation of these opportunities, but other impacts to natural resources would occur.
- **Minimize invasion of non-native species including noxious weeds.** All of the proposed routes will cause disturbance to soils and vegetation communities that will open the door to invasive species. The most cost effective way to prevent invasive species following a disturbance such as is proposed, is to successfully revegetate those disturbed areas with desirable vegetation. However, because of the sand soils encountered on the T-24 route that are known to limit successful revegetation, it is unlikely that this operational control would be effective in those areas. This statement should not be taken to mean that the soils on T-25 will be substantially easier to revegetate. The T-25 route would still require substantial efforts to revegetate. Revegetation in any desert environment should not be considered as trivial.

4.1.12 Cumulative Impacts

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).

Even though we cannot quantify the potential cumulative impacts to ecological resources, it is possible to do a qualitative assessment of what those impacts might be. This new road would reset the southern boundary for what remains of the large, undisturbed central core area of the INL. That boundary is now, arguably, set by Highway 20, with some interruption by the east powerline (primarily along T-25). The power line does cause habitat fragmentation for some species, but not for others. Constructing the road would intensify the fragmentation effect for many additional species. The boundary on the west is generally marked by Lincoln Boulevard, INTEC, CFA and PBF. Recent activities associated with the development of the CITRC have strengthened the effectiveness of the boundary in that area. The National Security Test Range located in what was once the center of that large undisturbed core area has caused a substantial reduction in the size of that undisturbed core area and increased habitat fragmentation.

Because the proposed routes are in or near the planned development corridor, it is reasonable to expect that a new road between CITRC and MFC will result in additional future development along that corridor (DOE 1997). Development of new facility areas in this corridor would also require utility development such as electricity and fiber optic cable. Developing these facilities would bring new disturbance 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 new road. Among the proposed routes, these impacts would be greatest along T-24 and least along the T-25.

As stated previously, the resources to develop a quantitative assessment of cumulative impacts to ecological resources are not yet available. However, as new developments occur on the INL, as good condition sagebrush steppe habitat and populations of sagebrush obligate species continues 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 important that cumulative impacts on the INL be quantified. Being able to quantify cumulative impacts and plan INL developments to minimize those impacts will reduce the likelihood of impacts to the INL mission due to requirements for conservation management of ecological resources.

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6.0 Glossary

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: 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.

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

Senesce: The dormancy of plants due to dry or cold conditions.

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.