

3.8 SOILS AND GEOLOGY

This section describes the soils and geologic resources of the proposed project area. It also describes the methods used to determine initial, residual, and permanent impacts, and it provides recommendations for mitigation measures to minimize impacts.

3.8.1 Environmental Setting

The sections below describe the general physical setting for soils and geology across the proposed alternatives; they also describe the key regulatory guidance applicable to soils and geology for state and federal lands.

As generally described by NorthWestern (2008a), the project area is divided at the northern margin of the Snake River Plain into two physiographic provinces. The northern portion of the project is in the Northern Rocky Mountain physiographic province, and the southern portion is in the Snake River Plain physiographic province. The contrast in geology and landforms between the two provinces is striking.

The Northern Rocky Mountain province is characterized by tall mountains and broad valleys often bounded by active faults. The mountains consist of a wide variety of sedimentary, metamorphic, and igneous rocks ranging from Archean gneiss greater than 2.5 billion years old to Eocene volcanics approximately 40 million years old. The valleys are generally filled with young sedimentary material eroded from the emergent mountain peaks. In places, the sedimentary valley-fill deposits extend more than 10,000 feet below the ground surface. Metalliferous mineral resources, often associated with intrusive and volcanic igneous rocks, and active and abandoned mines are present in this province, particularly in Zone 1 in the area of the Boulder batholith near Butte, Montana. Other metal and non-metal mineral resources are present, particularly in the Montana portion of the proposed project.

The eastern Snake River Plain province is characterized as a nearly level volcanic plain. The rocks underlying the surface are generally composed of rhyolite, with minor basalt flows, some less than 2,000 years old, emplaced within the uppermost part of the thick rhyolite sequence. Caves, lava tubes, and other unique geologic features are present in this region and their presence may affect the location and design of project infrastructure.

Between the basalt outcrops, the surface of the plain is covered with unconsolidated deposits including sand dune fields, shallow dry lakebeds, stream deposits, and loess. The project area is near several active fault zones (USGS 2008). Active faults are defined as those that have had significant movement in the Quaternary period (the last 1.6 million years). The faults mapped in the southwestern Montana and eastern Idaho region generally occur in northwest to southeast trending zones. The zones may be comprised of several individual fault strands that are similar in sense of motion and age of activity. Analysis of movement on most of the recent faults suggested that this region is undergoing tectonic extension. This type of faulting results in the relative uplift of the mountain ranges in comparison to adjacent valley floors.

Soil development is reflective of source material, climate, and duration of weathering. Soils in the project area are generally divided into two groups: (1) a northern group occurring north of the Snake River Plain and (2) a southern group occurring within the Snake River Plain. Soils within the northern group are derived from relatively local sources; for example, bedrock or alluvial deposits. Soils within the Snake River Plain are largely derived from weathering of wind-blown loess originating close to the retreating ice front far to the north and deposited during the close of the last Ice Age, approximately 10,000 years before present. The arid Snake River Plain also is host to numerous large dune fields. The dunes are

composed entirely of cohesionless fine to medium sand that actively migrates along with the prevailing wind direction.

To allow for the evaluation of potential impacts to soils and geology over such a broad landscape and to permit a comparison of alternatives, it was necessary to identify key soil and geologic factors and characteristics. These characteristics are used to identify the sensitivity of the resource to potential impacts associated with the proposed project and are a function of the existing condition of the soil and geology. Section 3.8.3 describes key soil factors.

3.8.2 Regulatory Setting

The proposed project corridor traverses lands managed by federal agencies, the states of Idaho and Montana, and private individuals. The sections below summarize the regulatory requirements that apply to soils and geology.

Federal

Within the federal lands are two national forests and five BLM management units (field offices). Each forest has a Forest Management Plan (FMP), and each BLM unit has a Resource Management Plan (RMP) that addresses, either directly or indirectly, the management of soils and geology resources. The federal land management plans are:

- Butte RMP (BLM 2009)
- Dillon RMP (BLM 2006)
- Big Desert Management Framework Plan, Upper Snake River Field Office (BLM 1981)
- Medicine Lodge RMP, Idaho Falls District (BLM 1985a)
- Little Lost/Birch Creek Management Framework Plan (BLM 1997)
- Monument RMP, Shoshone and Burley Field Offices (BLM 1986)
- Beaverhead-Deerlodge Revised Forest Plan (USFS 2009)
- Targhee Forest Plan (USFS 1997)

State

Montana. The requirements for transmission lines in Montana are in Title 75 (Environmental Protection), Chapter 20 (MFSA) of the Montana Code Annotated and administered through the Major Facility Siting Program of the MDEQ. Circular MFSA-2, Application Requirements for Linear Facilities, provides guidance on the specific soils and geology information that must be presented in the application.

Idaho. Idaho has no specific state guidance for transmission lines. NorthWestern presented soils and geology information for Idaho in the same format as required by MDEQ to maintain consistency and facilitate agency review (NorthWestern 2008a). The same approach was used to prepare this EIS section.

Specific federal and state soils and geology standards and guidelines are discussed concurrently with the mitigation efforts to ensure they are met.

In addition to the regulations described above, comments related to soils and geology obtained during the EIS scoping process and summarized in the Scoping Report (PBS&J 2009c) are addressed.

3.8.3 Analysis Methods

Data presented in several documents were reviewed for accuracy and used in conjunction with GIS database(s) to characterize soils and geology resources and potential impacts along the alternative transmission line routes (NorthWestern 2008a). Geologic data sources included the Montana Bureau of Mines and Geology, Idaho Geologic Survey, and the U.S. Geological Survey (USGS) (NorthWestern 2008a). Geologic hazards were obtained from geologic maps and the USGS Quaternary Faults and Folds Database; that information was summarized in GIS by NorthWestern and updated for this analysis (NorthWestern 2008a). The database contains only faults that show evidence of being the source of large-magnitude, surface-deforming earthquakes during the past 1.6 million years.

The soils analysis used key soil parameters from the GIS-based STATSGO database. This database was complete for the entire region of study and contains data on numerous soil map unit physical and chemical characteristics and was designed primarily for regional, multicounty, river basin, state, and multistate resource planning, management, and monitoring (Soil Survey Staff 2009). For disturbances associated with overland travel and new roads, the NorthWestern indicative road layout GIS layer (October 28, 2009) was used (See Section 3.1 for a detailed discussion of this layer). Data were adapted for presentation using the six analysis zones and corresponding links and alternatives.

Within a zone, data summaries, resource sensitivity analyses, and potential impact determinations were performed at the link and alternative scale to facilitate describing and comparing impacts among the alternatives. LROs were compared to the links they could replace if selected. Analyses were performed for three disturbance areas: transmission line corridor, overland travel routes (roads), and new roads.

Relative sensitivity classes were developed for soils and geology/geohazards resources based on their occurrence and key physical characteristics of the existing resource. The geologic evaluation focused on geohazards (including Quaternary faults), mass movement (potential or mapped), and areas of potential liquefaction, which were defined as floodplain alluvial deposits, fine-grained lacustrine deposits, and unconsolidated mine tailings. Potential mass movement was defined as areas with Cretaceous shales on slopes exceeding 15 percent. The presence or absence of mapped or potential geohazards resulted in high or low sensitivity and potential impacts, respectively.

Overall soil sensitivity (low, moderate, high) was determined using a combination of three parameters that characterize the soils' sensitivity to water erosion (Kw Factor), wind erosion (Wind Erodibility Group [WEG]), and relative productivity associated with soil loss (T Factor) (Natural Resource Conservation Service 2007).

In addition to the specific soils factors discussed above, Circular MFSA-2 (Section 3.4, 1[k]) requires the identification of areas with severe reclamation constraints, including soils formed on the following rock types:

- *Cretaceous shales*. Fine-grained, fissile siltstones and mudstones formed in a shallow marine environment that can weather to produce soils with relatively high clay and salt content that impedes the establishment of vegetation and can be prone to erosion.
- *Intrusive rock types*. Igneous rocks that formed beneath the earth's surface and can weather to coarse-grained, nutrient poor, sandy soils prone to erosion.
- *Lacustrine deposits*. Fine, silty material deposited in lakes that can have physical and chemical characteristics that impede the establishment of vegetation and can be prone to erosion.

Soils formed on these rock types are conservatively assumed to be present where the rocks are mapped, regardless of STATSGO soil data (Kw Factor, WEG, and T Factor) in these areas.

For soils (including those formed on the above rock types), the sensitivity classes were used in conjunction with topographic slope to determine initial (temporary) impacts during construction; for example, ground disturbance of soils formed on intrusive rocks would have a higher initial impact (i.e., erosion potential) on a steep slope compared to a relatively flat slope. Similarly, soils more sensitive to water (Kw) or wind erosion (WEG) would have higher impacts for a given slope.

Residual and permanent impacts were determined for soils and geohazards in a manner similar to that conducted for initial impacts, but after considering the application of resource-specific and management-based mitigation measures. The magnitude of an impact was determined based on the availability and ability to implement the mitigation measures to alleviate the impact. For example, properly implemented erosion control and revegetation plans and efforts can mitigate impacts associated with both initial and long-term soil erosion. The degree of success of the mitigation would be affected in part by the inherent sensitivity of the resource to erosion and the slope, with impacts on steeper slopes more difficult to mitigate. All impacts associated with new roads were determined to be permanent.

The size of the corridor for which information was analyzed is 1 mile on each side of the transmission line centerline or LROs, for a total width of 2 miles. The proposed new Townsend and Mill Creek substations fall within this corridor.

The total mileage of sensitive soils and geohazards was determined along the transmission corridor centerline and results are summarized along this centerline. To determine initial and residual impacts, the miles of sensitive soils were converted to acreage using the corridor disturbance model developed by NorthWestern and shown in Appendix C.8.1 (NorthWestern 2008a). This model provides temporary and permanent disturbance areas for towers, staging areas, and other infrastructure. The largest soils disturbance is associated with the removal of trees from forested land within the right-of-way. Disturbances associated with overland and new roads were based on the proposed road layout (NorthWestern January 2010).

The impact analysis focuses on the characteristics of the resources within the corridor(s) that have the greatest potential to affect both initial and residual impacts. To facilitate discussion, mileposts are shown for each link along the transmission corridor centerline in Figures 3.8-1–3.8-6 and 3.8-13–3.8-18 at the end of this section. An explanation of the soils and geology data and factors, as well as a detailed explanation of the methodology used in the sensitivity and impact analyses, is in Appendix C.8.1.

3.8.4 Impact Analysis

3.8.4.1 No Action Alternative

The no action alternative would result in no impacts to soils and geology resources from the proposed project. Ongoing soil and geologic processes including erosion and mass wasting would continue.

3.8.4.2 Proposed Project

To quantify the potential impacts to soils and geology, it was first necessary to identify areas of mapped and potential geohazards and sensitive soils. The sections below describe the sensitivity of the existing resources and provide an analysis of potential impacts. Implementation of mitigation measures (Section 3.8.5) is assumed in the discussion of residual impacts.

Impacts to soils and geology can be divided into indirect and direct categories. Indirect impacts include those that do not directly disturb the soils or geologic resource, whereas direct impacts (initial, residual, and permanent) include those activities that have an impact on the actual physical soils or geologic resource.

Indirect impacts to soils and geologic resources would primarily be associated with increased public access resulting from road construction. These impacts are generally long term and relate to increased compaction and erosion of soil and the possible removal of unique geologic features during operation of the transmission line. Erosion and compaction impacts to soils can also affect other resources including vegetation, wildlife, water quality, and wetlands.

Direct impacts to soils and geologic resources would be primarily the result of ground disturbance associated with construction activities. Initial (temporary) impacts are those directly associated with ground disturbance during construction of the proposed transmission line, ancillary roads, structures, and facilities. Residual impacts are those that remain after mitigation measures have been employed and could include increased soil compaction, decreased organic matter content, changed physical and chemical composition, increased susceptibility to erosion, mixed soil horizons, exposure to contaminant spills and reduced soil productivity. These impacts may or may not substantially affect the function of a soil or its ability to provide a growth medium for vegetation (i.e., slight mixing of soil horizons or slight loss of organic matter). Permanent impacts include loss of soil use or function associated with structures, substations, new permanent road construction, and facility and transmission line operations and maintenance.

Soils Impacts

The overall soils sensitivity represents the highest sensitivity level of any of the three data categories for a soil map unit (Tables 3.8-2–4). Although summarized together to estimate the overall sensitivity of the soils to potential impacts, these factors are shown separately to facilitate interpretation of the spatial distribution of the individual factors. Detailed analyses of soils sensitivity is in Appendix C.8.3. Data for the rock types that can weather to produce erodible soils with reclamation constraints are also summarized for each disturbance type. The distance that each centerline and representative road crosses each sensitivity class is presented to characterize the resource throughout the length of the proposed project prior to disturbance.

In most corridor locations, the erosion sensitivity and productivity/reclamation constraints are within one sensitivity class (i.e., moderate and high) of each other (Figures 3.8-7–3.8-12 and 3.8-13–3.8-18). Differences relate to the particular soil attributes characterized by each soil factor; for example, a relatively thick soil may not have severe reclamation constraints (T Factor) but may be highly erodible (Kw Factor and WEG) because of its texture. This relationship is common in the aeolian soils on the Snake River Plain in Zones 5 and 6. Overall, the majority of soils within the corridor and in proposed new and overland road locations are moderately to highly sensitive to erosion and the loss of productivity (Figures 3.8-7–3.8-12 and 3.8-13–3.8-18).

Potential impacts to soils from the proposed project include compaction, mixing of topsoil and subsoil, loss of organic matter and soil microbial communities, and erosion by water and wind during and after construction. Constraints on reclamation and revegetation would also be associated with disturbance to sensitive soils. During power line and infrastructure construction activities (including road building and overland travel), soils disturbance is to a large extent unavoidable. Construction activities would expose soils to varying degrees of erosion, mixing, and compaction. Soils within forested areas, where complete clearing of trees from the right-of-way is required, would have the greatest impacts. During construction and after reclamation, soils are also highly susceptible to invasion by noxious weeds. After construction, implementation of mitigation measures specified in Section 3.8.5 should substantially reduce residual

impacts. Direct impacts to soils can indirectly affect wildlife resources, vegetation, and water quality. These impacts are discussed in their applicable EIS sections (3.3, 3.10, and 3.12, respectively).

In proposed overland travel routes, impacts would not be substantial and would be mostly limited to soil compaction, although some erosion is likely in areas where minor ground disturbances occur. Natural recovery of soils and vegetation, aided by mitigation efforts as needed, would be expected over time. Impacts to soils associated with existing roads would depend on the level of disturbance, which in turn depends on the level of improvements performed on these roads. Impacts would generally be expected to be low and similar to the current road status.

Impacts to soils would be high and permanent in areas where new permanent access roads would be constructed (Table 3.8-4). Sediment production from new road construction is typically high in the first year after construction and then quickly decreases in subsequent years (Ketcheson and Megahan 1996) and un-reclaimed roads would continue to have high levels of residual impacts (impacts associated with sediment production are discussed in Section 3.12). Where new roads are reclaimed, residual impacts would be expected to be low and not substantial. However, the impact analysis assumes that new roads are permanent; therefore, there is no difference between initial and residual impacts from new road construction.

Impacts associated with soils formed from erodible rock with reclamation constraints would be similar to those of other sensitive soils.

Because of construction activities associated with the proposed project, all alternatives in all zones have high and moderate levels of initial impacts (Table 3.8-7). These areas generally correspond closely to the moderate and high sensitivity soils (Figures 3.8-7–3.8-12 and 3.8-13–18). The absolute areas of temporary and permanent impacts are greatest in the longest alternatives because impacts are determined on a unit area of disturbance per mile of power line corridor. Permanent impacts are associated with transmission line towers for all alternatives (Table 3.8-7).

Impacts associated with rocks that form erodible soils with reclamation constraints are greatest in Zones 1 and 2 because of the presence of intrusive rocks located in steep terrain. Cretaceous rocks are present to a limited extent in Zones 1, 2, and 3. Lacustrine sediments are found over relatively small areas only in Zones 5 and 6. Overall, the disturbance acreage associated with soil formed on erodible rock types with reclamation constraints is small compared to the total disturbed area of soil (Table 3.8-7).

Zone 1. The majority of soils for all alternatives in Zone 1 would exhibit high and moderate levels of initial impact associated with construction of the proposed project. Initial and permanent impacts are similar for Alternatives 1A, 1B, and 1C. The total impacted area is less for Alternative 1D because of its shorter length as compared to the other alternatives and because it travels through less forested areas, where impacts associated with tree removal for the right-of-way are not present. The presence of soils derived from Cretaceous shales on Links 2-3a and 4-2 would reduce reclamation effectiveness.

The area of permanent impacts associated with new roads is greatest in Alternative 1A (Table 3.8-11). Initial impacts in overland road areas (Table 3.8-8) are low to moderate for all alternatives, with the lowest total areas in Alternatives 1A and 1D.

All alternatives in Zone 1 have the potential for high initial erosion impacts associated with highly erodible sandy soils developed on the Boulder batholith (intrusive rock), and with limited areas of Cretaceous shales. Most of the Cretaceous shales do not fall along the proposed transmission line centerline. The potential for impacts is highest in Alternative 1A because of the amount of intrusive rocks present.

Zone 2. Alternative 2C would have more miles of high initial impacts associated with construction of the proposed project when compared to the other alternatives in Zone 2. Moderate initial impacts are generally similar between all alternatives. Because it is longer, permanent impacts are greatest in Alternative 2C. Permanent impacts are similar for the other alternatives. Soils derived from Cretaceous elements would reduce the effectiveness of reclamation on all alternatives in this zone.

The number of acres of permanent impacts associated with new roads and initial impacts for overland travel routes is greatest in Alternative 2C because of its longer length; it is considerably higher in Alternatives 2D and 2E compared to Alternatives 2A and 2B. Overland travel routes have initial impacts that are low to moderate.

All alternatives in Zone 2 have the potential for some high initial impacts associated with soils formed on intrusive rock types and Cretaceous shales. The potential for initial impacts is somewhat higher in Alternative 2C because of the amount of intrusive rocks present.

Zone 3. All five alternatives in Zone 3 have similar areas of disturbance, with Alternative 3A exhibiting the greatest area of high initial impacts associated with construction of the proposed project. Permanent construction-related impacts are also similar for all alternatives.

Permanent impacts associated with new roads are considerably higher in Alternatives 3B and 3C than in Alternative 3A. The overall area of impacts associated with overland travel routes is relatively low for all alternatives, with low and moderate initial impacts similar for all alternatives. All three alternatives have similar potential high levels of initial impacts associated with soils formed from Cretaceous shales (Links 15-1 and 17-2).

Zone 4. The only alternative in Zone 4 would result in a slightly greater area of moderate compared to high initial impacts associated with construction of the proposed project. The majority of initial impacts associated with overland travel routes are low. Cretaceous shales, intrusive rock types, and lacustrine deposits are not found in this area; therefore, no impacts to soils formed from these rock types would occur in this zone.

Zone 5. The area of high initial impacts associated with construction of the proposed project is similar for all alternatives and substantially more than areas of moderate and low impacts. This is a result of the erodible tendencies of the soils present along these alternatives. Soils along Links 21 and 23 are not severely constrained for reclamation because of their thickness; they are, however, highly susceptible to erosion because of their aeolian origin. All four alternatives have similar areas of permanent impacts related to construction of the proposed project. Alternative 5A has the lowest area of permanent impacts associated with new roads. Levels of potential impact from overland travel routes are moderate for all alternatives.

For all alternatives, there are some low initial impacts in small areas associated with the presence of soils formed from underlying lacustrine deposits in Links 19, 20, and 22 between mileposts 53 and 55, 28 and 29, and 2 and 3, respectively. No soils formed from Cretaceous shales or intrusive rocks are present on any alternatives in this zone.

Zone 6. Only one alternative is in Zone 6. Soils have the same general characteristics as those in Zone 5. The majority of the soils exhibit high initial impacts because of their sensitivity to erosion. Initial impacts for overland travel routes are mostly moderate.

Geology Impacts

Direct impacts to the geologic resources would occur in areas where blasting or removing bedrock would be required to construct the proposed project. Impacts would also result from the excavation and use of unconsolidated geologic material (gravel and sand) for road base and/or concrete mixing.

In addition to impacts to the geology resource, the transmission line and ancillary structures can be impacted by the geohazards, including mass movement (landslides), fault activity and associated ground shaking or rupture, and liquefaction of wet, unconsolidated materials associated with fault movement. Impacts could include the destabilization or toppling of towers, infrastructure failure of substations and roads, and impacts associated with downed power lines, including loss of service, fire potential, and the need to construct new roads to access damaged lines/infrastructure. In Zones 4 through 6, the presence of lava tubes and caves in basalt could present impediments to the location of structures and infrastructure.

It is presumed that structures and infrastructures would be designed to professional structural and electrical engineering standards to withstand the effects of known and predicted earthquakes and associated ground movements in the region of the proposed project. Regardless of the design standards, ground shaking and movement associated with a significant earthquake could result in damage to structures and infrastructure. It is also possible that ground movement outside of the 2-mile-wide corridor of analysis could affect structures and infrastructure in the corridor.

Direct impacts to mineral, oil, and gas resources could also occur. There could be impacts to future mining, oil, and gas resources, operations, claims leases, or access if transmission line structures or infrastructure are located in these areas. Section 3.6 describes locations and possible impacts to and mitigation measures for mineral, oil, and gas resources, and claims. Impacts by zone and alternative are discussed below.

The impacts analysis was limited to the proposed transmission line corridor. The analysis excluded preliminary new and overland travel route locations provided by NorthWestern because the majority of roads are located within the 2-mile-wide corridor analysis area, and any significant earth rupture or mass movement that would affect infrastructure would likely affect roads. No impacts would occur in areas without geohazards.

Table 3.8-1 summarizes the geologic hazards for each alternative. Figures 3.8-1–3.8-6 present the geohazards for each zone and alternative. For consistency and presentation purposes, rock types that form soils with reclamation constraints are also shown on these figures; that information is also summarized in tables and discussed with soils data. A detailed discussion of geohazards is presented for each zone and alternative in the impacts sections. Results of the geohazard analysis are summarized in Appendix C.8.2. The occurrence of a fault or mapped mass movement feature within a link or alternative is considered a high potential impact (Table 3.8-1, Figures 3.8-1 through 3.8-6). As discussed in Section 3.8.5, mitigation measures are expected to reduce these high levels of impact and constraints to structures and infrastructure resulting from geohazards.

Zone 1. For all alternatives, potential high initial impacts or constraints are associated with geohazards in Zone 1. Active faults are present in Alternatives 1B, 1C, and 1D (Links 5, 6-1, 6-2, 7-3, 7-4, and 8-1), crossing the centerline in Links 6-1, 7-4, and 8-1 (Figure 3.8-1). Additional faults lie to the north of Link 5. The transmission line would cross slightly less than 0.1 mile of liquefaction/mass movement potential along Alternatives 1A and 1B (Figure 3.8-1). These are small areas of unconsolidated fill from mine tailings (Link 2-2, mileposts 1 and 2) and small areas of potential mass movement associated with Cretaceous shales on slopes exceeding 15 percent (Links 2-3a and 4-2) in Alternative 1D. A relatively large area of tailings is present adjacent to the centerline in Link 2-3d. Liquefaction potential is present along all alternatives, but the mileage in Alternative 1A is considerably lower relative to the other

alternatives (Table 3.8-1). The largest area is near the proposed Townsend Substation at the junction of Links 1 and 3-1. Overall, Alternative 1A has a lower risk of impacts from geohazards.

Zone 2. Active faults are present in all alternatives and cross the transmission corridor centerline in Links 6-1 and 7-4 in Alternative 2C and Link 30 in Alternative 2D. A large fault parallels the proposed transmission line between mileposts 11 and 16 in Links 11-1 and 11-2, and a group of small faults is present approximately 5 miles east of Link 12 near milepost 20. No mapped mass movement features are in Zone 2, but potential mass movement areas associated with Cretaceous shales are present along portions of all alternatives in Links 11-4, 12, and 13 near mileposts 20, 35, and 15, respectively (Figure 3.8-2). The largest area is in Alternative 2D because of Cretaceous shales in Links 31 and 33. Liquefaction potential is present in all alternatives, with the largest occurrence in Alternatives 2B and 2C. The presence of these geohazards results in high potential impacts associated with each alternative. Overall, Alternative 2 A has a lower risk of impacts associated with geohazards.

Zone 3. Several smaller active faults are present in all alternatives, paralleling and crossing the proposed centerline in Alternative 3A (Links 15-2d and 17-2) between mileposts 30 and 37. Potential mass movement areas are similar for all alternatives, with the greatest area in Link 17-2, which is in proximity to several small active faults between mileposts 7 and 10. Mapped mass movement is present in small areas of Alternatives 3A (Link 15-2d) and 3C (Link 39) (Figure 3.8-3 and Figures 3.8-19 through 3.8-22). Natural resources personnel from MDEQ and PBS&J observed three landslides on the east side of the Beaverhead River and I-15 in the general vicinity of Clark Canyon. These features occur on Links 16-3b and 16-3c of Alternative 3B (Figure 3.8-3). Cretaceous rocks are present on all alternatives in this zone. The potential for liquefaction is present in all alternatives, with the greatest extent in Alternative 3A, resulting in the potential for high initial impacts associated with each alternative.

Zone 4. The potential for liquefaction exists between mileposts 12 and 17, but no mass movement or faults are along the only alternative in Zone 4. Active faults are present within 5 miles of the corridor.

Zone 5. Faults are present and cross the corridor centerline in Alternatives 5A, 5B, and 5D (Links 19 and 21-1), but no mapped or potential mass movement features are present in any alternatives. Fault density is high between mileposts 25 and 38 in Link 19 (Figure 3.8-5). This area has a high liquefaction potential that is present in all alternatives; however, there is a considerably higher mileage in Alternative 5A relative to the other alternatives. The potential impacts for all alternatives are high but may be considerably greater for Alternative 5A because of the presence of more faults and liquefiable sediments on Link 19 (Figure 3.8-5). In fact, Alternative 5A would cross more potentially liquefiable soils than any other alternative for the entire project.

Zone 6. No faults or mapped or potential mass movement areas are present in the only alternative in this zone. The potential for liquefaction exists over relatively small areas of lacustrine sediments between mileposts 75 and 80 and 104 and 105, the latter area at the Midpoint Substation. The overall terrain is flat because of its route over the Snake River Plain.

3.8.4.3 Local Routing Options and Link Comparison

Soils. All proposed LROs and associated links would result in moderate and high initial impacts to soils resources (Table 3.8-12), with the longer LROs showing the greater areas of impacts. The majority of LROs and corresponding links show low to no substantial residual impacts after mitigation, with similar residual and permanent impacts (Table 3.8-14). The Upper Boulder 1 and 2 and Lower Boulder LROs were analyzed and compared to Links 4-1b and/or 4-2a and 4-2b, depending on link layout (Figure 3.1-1). These are the longest LROs in the proposed project area. These LROs would result in similar areas of high initial and permanent impacts but slightly less area of low to no substantial residual impacts

compared to corresponding Links 4-1b, 4-2a, and 4-2b. Selection of the North of Buxton, Maiden Rock, Frying Pan Gulch, Clark Canyon East, Diamond Butte, and Fleecer LROs would result in somewhat greater areas of initial and residual impacts relative to their respective links.

Initial impacts associated with soils formed from erodible rock types are also similar between LROs and corresponding links. The Mount Haggin LRO would decrease the high initial impacts by approximately one half, whereas the North of Buxton LRO would increase the high initial impacts considerably increased exposure of intrusive rocks. Residual impacts associated with erodible soils rock types are generally similar between the LROs and associated links, with North of Buxton and Mount Haggin LROs showing the same relationship to their respective links as for initial impacts.

Initial (Table 3.8-13) and residual (Table 3.8-15) impacts associated with overland travel routes are found only in a limited number of LROs and are nominal. Permanent impacts from new roads (Table 3.8-16) are generally similar between LROs and the corresponding link.

Geology. Overall, the proposed LROs have geohazard impacts similar to the corresponding mainline links that they would replace if selected (Table 3.8-6). The Lima LRO would include a fault crossing the centerline of the proposed transmission line that does not cross at Link 17-2; however, this LRO would still be in proximity to a group of small faults. The use of the Diamond Butte LRO would result in the exposure of the proposed power line to potential and mapped mass movement features relative to Link 17-4. The same is true for mapped mass movement for the Clark Canyon East LRO relative to Link 16-3c. The Lower Boulder 2 LRO would result in no areas of liquefaction or potential mass movement relative to its corresponding link.

3.8.4.4 Climate Change

The effects of climate change on soil and geologic resources in the proposed project corridor would reflect broad changes on a regional scale. General warming could lead to changes in precipitation patterns and intensity that could affect soil composition and development over the long term. Attendant changes in vegetation communities would also affect soils. Increased precipitation could lead to greater runoff and soil erosion and associated sediment loading to streams. Increased periods of prolonged saturation could increase occurrences of mass movement on some soil types. Climate change is not expected to greatly affect other geohazards. The effects of climate change on these resources would be similar for the proposed project and the no action alternative.

3.8.5 Mitigation Measures

Mitigation measures to reduce impacts to soils and geologic resources include planning, design, management, regulatory enforcement, reclamation, and construction techniques employed to reduce, minimize, or avoid the impacts associated with construction, operation, and maintenance of the proposed project.

Soil and geology impacts during construction and operation of the proposed project would be reduced by the requirements of the agency stipulations (the MDEQ draft Environmental Specifications, the USFS Record of Decision (ROD) for the *Designation of Section 368 Energy Corridors on National Forest System Land in 10 Western States* (USFS 2009b), and the BLM *Approved Resource Management Plan Amendments/ROD for Designation of Energy Corridors on Bureau of Land Management Administered Lands in 11 Western States* (BLM 2009c) (Appendix B.4). Additional mitigation measures specified in the sections below will also reduce impacts to soil and geology resources.

Many vegetation mitigation measures specified in the agency stipulations also reduce the impacts of soil erosion. Vegetation mitigation measures, as well as those that address impacts from road construction and reclamation, and control of water runoff from roads and disturbed areas also mitigate impacts to soils.

3.8.5.1 Soils Mitigation Measures

Although technically, the MDEQ mitigations apply to state and private land in Montana, as was discussed in Section 3.1, it was assumed that jurisdictions in Idaho would consider adopting measures similar to those in the draft MDEQ Environmental Specifications or the preliminary POD.

Construction

The MDEQ mitigation measures shown below would reduce soil erosion, compaction, and mixing during construction activities; this would be achieved by decreasing the amount of disturbed area through limits on construction areas and activities, minimizing the construction of new roads, optimizing overland travel, and requiring planning and implementation of measures to actively control runoff from roads and disturbed areas.

Erosion: 2.7.1–2.7.7; 2.7.9; 2.8.4; 2.8.7; 2.9.2; 2.9.4; 2.9.5; 2.9.10; 2.9.12; 2.11.1; 2.11.9; 2.11.12–2.11.14; 2.11.16; 2.11.18; 2.11.19; 2.14.6; Appendices A, H, I, J, and L

Compaction: 2.7.1–2.7.6; 2.8.4; 2.8.7; 2.9.2; 2.9.4; 2.9.5; 2.9.10; 2.9.12; 2.11.12–2.11.14; Appendices A, H, I, J, and L

Mixing: 2.1.4; 2.7.6; Appendices H, I, J, and L

Post-Construction and Reclamation

The MDEQ mitigation measures shown below would reduce soil erosion, compaction, and mixing by requiring reclamation planning and implementation of measures following construction:

Erosion: 3.1.2; 3.2.1–3.2.11; 3.2.13; 3.2.14; 3.3.1; SG-2; Appendices A, H, I, and L

Compaction: 3.1.2; 3.2.1–3.2.3; 3.2.14; 3.3.1; Appendices A, H, I, and L

Mixing: 3.1.2; 3.2.1; 3.2.10; Appendices A, H, I, and L; SG-1; SG-2

Operations and Maintenance

The MDEQ mitigation measures shown below would reduce long-term erosion and compaction during operation of the transmission line by requiring planning and implementation of management and maintenance measures related to erosion control and access limitation.

Erosion: 4.1.1–4.1.5; 4.2.1; 4.2.2; 4.5.1; Appendices I and J

Compaction: 4.1.1; 4.1.5; 4.2.2; 4.5.1; Appendices I and J

Abandonment and Decommissioning

The MDEQ mitigation measures shown below would reduce long-term erosion and compaction during and following decommissioning and abandonment of the transmission line.

Erosion: 5.1.0; Appendix N

Compaction: 5.1.0; Appendix N

Impacts to soils during construction, post-construction/reclamation, operation and maintenance, and decommissioning of the transmission line would be further reduced through application of soil and reclamation mitigation measures described in Appendix B, Interagency Operating Procedures (IOP), of the aforementioned BLM and USFS planning and management documents (BLM 2009c; USFS 2009b).

Supplemental Mitigation Measures—Soils

The mitigation measures shown below would require stockpiling of soils removed during construction for use in reclamation activities. These are required to improve the effectiveness of reclamation/restoration and therefore reduce the residual level of impacts from project construction.

- SG-1. When feasible, perform separate salvage and stockpiling of the organic-rich upper A-horizon from underlying subsoil (B) horizons. During reclamation activities, first place and spread the stockpiled subsoil horizon material; then place and spread the stockpiled A-horizon material. Minimize mixing of horizons.
- SG-2. For soil salvaged from new road and permanent structure areas, use direct hauling and place soils in adjacent areas to be reclaimed, where applicable.
- SG-3. Adhere to all relevant and appropriate BLM and USFS standards, guidelines, and policies from RMPs and FMPs for the respective BLM field offices and national forests. Before construction or disturbance, perform all field reconnaissance and inventory work to identify areas of unique and/or fragile geologic and soil resources as described in the applicable USFS FMPs and BLM RMPs.
- SG-4. USFS Region 1 Soil Quality Standards do not apply to dedicated uses such as power line construction; however, soil productivity will be maintained or restored on temporarily disturbed sites in an attempt to meet the standards to the extent practicable. Ground-based logging equipment will be used on slopes steeper than 35 percent only after an onsite evaluation determines that soil productivity can be maintained or restored.

3.8.5.2 Geohazards

The risk of impacts to the proposed project in areas of geohazards (mass movement, liquefaction, and active faults) can be minimized through the mitigation measures that require avoidance of the hazard, design and engineering, or rerouting to a favorable alternative local site; however, it is recognized that large ground movements may ultimately impact infrastructure and that the risk cannot be completely removed.

To minimize potential impacts associated with structural failure of the transmission towers, infrastructure, or substations as a result of ground rupture, liquefaction or mass movement, MDEQ requires as mitigation a pre-construction geotechnical evaluation and report (measure 3.1.3 and Appendix A of the draft Environmental Specifications).

Impacts to geologic resources and from geohazards during construction, post-construction/reclamation, operation and maintenance, and decommissioning of the transmission line would be further reduced through application of mitigation measures described in Appendix B.4, IOP, of the aforementioned BLM and USFS RODs (BLM 2009c; USFS 2009b).

Supplemental Mitigation Measures—Geohazards

In addition to these measures, it is recommended that the following geologic/geohazard mitigation measures be implemented to adequately mitigate for geohazard risks:

- SG-5. Perform a reconnaissance-level geologic field investigation as part of project planning and construction. In areas of Zones 4 through 6 where basalt bedrock is present at or near the surface, determine the occurrence of lava tubes and caves and take appropriate measures to avoid these or mitigate through design and construction any potential effects on structures and infrastructure. Additionally, confirm the presence of active mass movement areas along the entire proposed corridor and take appropriate structure design measures to minimize the risk to the transmission line.
- SG-6. Perform a detailed inventory, with field confirmation, in the proposed project corridor to identify unique geologic features including caves, lava tubes, and other features identified by the Natural Resources Conservation Service (NRCS), BLM, USFS, or state and local agencies. Where possible, avoid ground disturbance and construction in these areas.
- SG-7. As described in the Scoping Report (PBS&J 2009c), Highway 20/26/93 and North 93 from the Highway 75 junction to Challis is a proposed geologic scenic byway, especially in the reach from Arco to the Highway 75 junction. As part of the reconnaissance-level geologic investigation, and before final design, present for approval to the applicable agencies proposed areas of disturbance in this corridor.

Mitigation of Indirect Impacts

Measures recommended to minimize indirect impacts include closing all access roads to areas not required for regular operations and maintenance activities. Closures should be coordinated with agencies and private landowners. All temporary roads required during construction activities should be permanently closed and reclaimed.

Mitigation Cost Analysis

Relative mitigation cost estimates were developed for each alternative (Appendix C.8.5).

The primary impacts to soils are erosion, compaction, mixing of soil horizons, and a loss of productivity. These impacts are mitigated primarily through the implementation of erosion control and reclamation and revegetation activities. For this reason, soils mitigation costs are closely tied to revegetation and reclamation efforts. Relative cost estimates for mitigation activities were developed based on the levels of residual impacts to soils. Residual soil impacts consider key factors that would control costs of a given mitigation measure, including the sensitivity of the resource to an impact and slope. The level of effort for mitigation should therefore be generally proportional to the residual soils impacts associated with a given alternative. For example, reclamation of disturbances on steeper slopes requires not only more time and effort but also typically more erosion control measures relative to a flat or gentle slope. In areas where tree removal is required for the transmission line right-of-way, the disturbed area and attendant impacts and cost would be greater. The unit cost per acre was adjusted to account for the severity of impacts to the soils (that is, high impact equals higher cost).

Impacts related to geohazards are primarily concerned with impacts to structures and infrastructure of the transmission line and are addressed through planning, design, and construction methods applicable to the entire corridor, including avoidance of high-risk areas. Costs associated with these actions are not considered in this discussion. Additionally, cost estimates reflect unique obstacles or severe conditions that may be encountered in portions of a given alternative during mitigation.

In Zone 1, mitigation costs are notably higher for Alternative 1A than for the other alternatives (Table 3.8-17). Alternative 1A has substantially greater areas of impacts associated with tree removal in the forest right-of-way. This—in combination with sensitive soils, some formed on intrusive rocks, and relatively steep terrain in some areas—leads to higher unit costs than for the other alternatives. Costs for Alternative 1B are somewhat higher than for Alternatives 1C and 1D for similar reasons as Alternative 1A.

In Zone 2, relative soil mitigation costs are somewhat higher in Alternatives 2C and 2D because of impacts associated with the presence of more forested right-of-way and sensitive soils. Mitigation unit costs are similar for alternatives in Zones 3 and 5 because of the similarity in terrain and soil sensitivity through which they travel and lack of forests. Zones 4 and 6 each have only a single alternative; therefore, a comparison of costs is not possible.

3.8.6 Residual Impacts

The sections below summarize the residual impacts by zone for soils resources after implementation of the mitigation measures (Section 3.8.5).

3.8.6.1 Soils

Residual impacts including soil erosion, compaction, and mixing of soil horizons were analyzed quantitatively using soil factors and slope values described in Section 3.8.3. Greater sensitivity of the soils to water and wind erosion and reduced vegetation production associated with soil loss would, as well as steeper slopes, result in greater areas of residual impacts following reclamation because of the probability of relative lower success of reclamation/mitigation in areas of highly sensitive soils and steeper slopes. Some residual impacts, including mixing of soil horizons and loss of organic matter and soil microbial communities would occur in all areas where soils would be stripped and stockpiled and to a lesser extent in areas that are ripped in-place prior to reclamation or mitigation.

Following mitigation, the majority of soils for all alternatives would exhibit residual impacts that would not be considered substantial adverse affects. Impacts associated with new roads were presumed to be permanent. If some roads are eventually reclaimed, either during operation or decommissioning of the proposed project, residual impacts would be expected to not be substantial. Residual soil impacts are discussed by zone below.

Zone 1. After mitigation, roughly equal areas of low residual impacts would remain, but these would not be considered substantial residual impacts for Alternatives 1B and 1C (Table 3.8-9). Alternative 1A would have more areas of low impacts compared to no substantial impact areas because of the presence of steeper terrain and increased disturbance associated with the forest right-of-way. Alternative 1D would have the smallest area of residual impacts. Moderate residual impacts are not widespread and are somewhat lower for Alternatives 1B and 1D compared to Alternatives 1A and 1C.

The area of permanent impacts associated with new roads is greatest in Alternative 1A (Table 3.8-11). The majority of overland road areas in all alternatives show no substantial or very low residual impacts (Table 3.8-10).

After mitigation for erodible soils, no residual high impacts and mostly low to moderate residual impacts related to erodible rock types would be expected for all alternatives. The highest level of residual impacts would be in Alternative 1A. Overland travel routes in all alternatives show no substantial residual impacts.

Zone 2. After mitigation, and with the exception of Alternative 2D, roughly equal areas of low and no residual impacts would remain in each alternative, with Alternative 2C having a greater area of low impacts (compared to no substantial impacts) because of its greater relative length. The area of moderate residual impacts is minimal for all alternatives. Overland travel routes show no substantial residual impacts for all alternatives.

The implementation of mitigating measures related to erodible rock types and Cretaceous soils would result in some low to moderate residual impacts for all alternatives in Zone 2. Residual impacts would be greatest in Alternative 2C because of the presence of steep slopes (in excess of 30 percent) comprised of intrusive rocks.

Zone 3. After mitigation, the areas of low and no substantial residual impacts are similar within and between all alternatives. The majority of impacted areas for all alternatives show no substantial residual impacts, with minor amounts of low impacts. Mitigation measures would reduce impacts to low to moderate levels for soils formed from Cretaceous shales (Links 15-1 and 17-2).

Zone 4. The only alternative in Zone 4 would result in more area of no impacts versus low impacts, with nominal moderate impacts. The majority of residual impacts associated with overland travel routes are nominal.

Zone 5. After mitigation, the majority of areas for all alternatives would exhibit no substantial residual impacts because the generally flat to gentle terrain in Zone 5 makes reclamation easier. There are no substantial residual impacts from overland travel routes for the majority of all alternatives.

Zone 6. This zone has only one alternative. After mitigation, nearly the entire route shows no substantial residual impacts. As with Zone 5, this is primarily because of the gentle topography in this zone. There would be no substantial residual impacts for overland travel routes; however, owing to the high mileage of new roads, the acreage of permanent impacts is high. If these roads are eventually reclaimed, the residual impacts would be expected to be low.

3.8.6.2 Geology and Geohazards

It is anticipated that the implementing geology and geohazard mitigation measures, including performance of pre-construction geology and geotechnical investigations, would lead to engineering, construction, and operational measures that result in low to no substantial residual impacts. If pre-construction engineering studies indicate that impacts cannot be properly mitigated within the proposed location of the line, alternative measures, to be determined in consultation with the agencies, would be implemented.

Table 3.8-1. Summary in Miles of Sensitivity, Initial, and Residual Impacts for Geohazards for Transmission Corridor Centerline^{1,2}

Zone	Alternative	Geohazard Occurrence						
		Mass Movement ³	Links	Potential Liquefaction	Links	Distance of Active Faults Within 2-Mile Wide Corridor Around Centerline (Miles) ⁴	No. of Times Active Faults Crossed by Corridor Centerline ⁴	Links Containing Faults ⁵
1	A	0.1	2-2,2-3a	0.3	2-2	0.0	0	None
	B	0.1	4-1a,4-2a	4.1	4-1a,4-2b,5,6-1,6-2,7-1	9.3	2	5, 6-1,6-2,7-3,7-4
	C	0.0	None	4.6	3-1,3-2,5,6-1,6-2,8-1	7.5	2	5, 6-1,6-2,8-1
	D	<0.1	4-1a,4-2a	2.7	4-1a,4-2b,5	0.7	0	5
2	A	0.7	11-4,13	3.5	11-1,11-2,11-3,11-4,13	9.0	0	11-1, 11-2,11-3
	B	0.5	11-4	7.6	11-1,11-2,11-3,11-4,14-1,14-3	9.0	0	11-1, 11-2,11-3
	C	0.2	12	6.0	6-1,6-2,7-1,7-2,7-3,7-4,12	11.9	2	6-1,6-2,7-3,7-4,12
	D	7.9	27,28,31,33	1.5	29,30,31	7.3	2	30
	E	0.2	12	4.5	12	3.3	0	12
3	A	1.5	15-1 15-2d,17-2	6.1	15-2c,15-2d,17-1,17-2,17-3,17-4	20.4	3	15-2d,17-1,17-2
	B	1.1	17-2	4.6	16-3a,16-3d,17-1,17-2,17-3,17-4	11.9	0	16-3a, 17-1,17-2
	C	1.7	15-1 17-2, 39	2.0	16-3d,17-1,17-2,17-3,17-4,39	11.2	0	17-1,17-2
4	A	0.0	None	3.3	18	0.0	0	None
5	A	0.0	None	26.2	19,22	10.8	4	19
	B	0.0	None	1.4	20,22	4.8	2	21-1
	C	0.0	None	1.2	20	0.0	0	None
	D	0.0	None	1.2	20	4.8	2	21-1
6	A	0.0	None	1.9	24	0.0	0	None

1 Geohazard sensitivity and initial (potential) impacts to structures and infrastructure are high prior to mitigation.

2 Geohazard mitigation results in no to low geohazard impacts to structures and infrastructure.

3 Includes mapped mass movement and potential mass movement (equivalent to Cretaceous shales on slopes > 15 percent). **Bold** values indicate links and alternatives with mapped mass movement.

4 Faults: Left column is miles of faults in 2-mile buffer zone; right column is number of intersections of a fault with the transmission corridor centerline.

5 Links where faults cross reference centerline in **bold**.

Table 3.8-2. Mileage Summary for Overall Soil Sensitivity for Transmission Corridor Centerline

Zone	Alternative	Soil Sensitivity Class (Kw, WEG, T Factor)			Rock Types Forming Erodible Soils with Reclamation Constraints*		
		Low	Moderate	High	Cretaceous Shales	Intrusives	Lacustrine Deposits
1	A	7.3	35.3	39.1	0.1	30.4	0.0
	B	0.0	39.2	51.0	0.6	20.0	0.0
	C	0.0	26.2	68.7	0.0	13.7	0.0
	D	0.0	17.0	37.0	0.6	2.5	0.0
2	A	0.0	40.9	16.6	0.7	6.7	0.0
	B	0.0	29.7	27.5	0.7	6.7	0.0
	C	0.0	58.3	31.5	0.9	22.6	0.0
	D	0.0	46.3	18.1	14.0	0.0	0.0
	E	0.0	36.1	17.5	0.9	5.1	0.0
3	A	0.0	44.7	27.6	4.7	0.0	0.0
	B	0.0	54.5	12.7	2.5	0.0	0.0
	C	0.0	55.1	17.0	2.5	0.0	0.0
4	A	0.0	16.0	4.0	0.0	0.0	0.0
5	A	0.0	14.0	93.4	0.0	0.0	2.8
	B	0.0	17.2	96.8	0.0	0.0	3.0
	C	0.0	5.9	111.5	0.0	0.0	2.8
	D	0.0	5.1	106.2	0.0	0.0	2.8
6	A	8.1	7.4	91.3	0.0	0.0	1.9

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-3. Mileage Summary for Overall Soil Sensitivity for Overland Roads

Zone	Alternative	Soil Sensitivity Class (Kw, WEG, T Factor)			Rock Types Forming Erodible Soils with Reclamation Constraints*		
		Low	Moderate	High	Cretaceous Shales	Intrusives	Lacustrine Deposits
1	A	0.0	28.3	7.8	0.0	0.9	0.0
	B	0.0	43.7	31.0	0.2	2.9	0.0
	C	0.0	36.4	52.8	<0.1	6.0	0.0
	D	0.0	16.2	20.6	0.2	0.0	0.0
2	A	0.0	27.2	6.5	0.0	0.3	0.0
	B	0.0	26.1	20.0	1.3	0.3	0.0
	C	0.0	27.5	18.3	0.6	1.2	0.0
	D	0.0	11.2	13.9	0.6	0.0	0.0
	E	0.0	0.0	7.9	0.0	0.0	0.0
3	A	0.0	12.9	16.7	0.4	0.0	0.0
	B	0.0	15.7	14.4	0.4	0.0	0.0
	C	0.0	14.6	6.8	0.4	0.0	0.0
4	A	0.0	12.7	1.6	0.0	0.0	0.0
5	A	0.0	5.4	46.8	0.0	0.0	0.3
	B	0.0	5.5	40.7	0.0	0.0	0.1
	C	0.0	1.6	82.0	0.0	0.0	0.1
	D	0.0	1.0	76.4	0.0	0.0	0.1
6	A	2.2	0.0	23.2	0.0	0.0	1.0

Note: Mileage from preliminary road layout (from NorthWestern 2009).

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-4. Mileage Summary for Overall Soil Sensitivity for New Roads

Zone	Alternative	Soil Sensitivity Class (Kw, WEG, T Factor)			Rock Types Forming Erodeable Soils with Reclamation Constraints*		
		Low	Moderate	High	Cretaceous Shales	Intrusives	Lacustrine Deposits
1	A	17.8	52.0	93.4	0.6	24.0	0.0
	B	0.0	53.6	71.6	0.5	6.9	0.0
	C	0.0	17.9	94.0	0.3	1.3	0.0
	D	0.0	34.7	73.6	0.5	1.9	0.0
2	A	0.0	35.1	3.7	0.0	0.6	0.0
	B	0.0	43.2	35.0	0.0	0.6	0.0
	C	0.0	163.6	51.3	1.3	13.4	0.0
	D	0.0	134.8	32.4	17.7	9.8	0.0
	E	0.0	144.0	40.5	1.3	8.4	0.0
3	A	0.0	77.5	34.7	2.0	0.0	0.0
	B	0.0	175.8	34.8	2.0	0.0	0.0
	C	0.0	174.4	60.5	2.2	0.0	0.0
4	A	0.0	23.4	3.5	0.0	0.0	0.0
5	A	0.0	0.0	23.5	0.0	0.0	0.0
	B	0.0	2.8	51.6	0.0	0.0	0.8
	C	0.0	2.8	49.7	0.0	0.0	0.8
	D	0.0	2.8	46.9	0.0	0.0	0.8
6	A	2.0	7.9	48.7	0.0	0.0	0.6

Note: Mileage from preliminary road layout (from NorthWestern 2009).

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-5. Summary in Miles of Overall Soil Sensitivity for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodeable Soils with Reclamation Constraints*	
	Low	Moderate	High	Cretaceous Shales	Intrusives
Radersburg (LRO2-2)	0.0	0.3	4.5	0.0	0.0
2-2	0.0	0.2	4.1	0.0	0.0
Boulder Hill (LRO2-3b)	0.8	1.8	1.5	0.0	2.0
2-3b	1.1	2.0	1.4	0.0	3.0
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	0.0	0.5	13.3	0.1	0.0
4-1b + 4-2a	0.0	4.9	8.7	0.6	1.0
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	0.0	0.5	11.9	0.3	0.4
4-2a	0.0	4.9	7.3	0.6	0.9
Lower Boulder (LRO4-2b + Link 3-2)	0.0	7.0	4.2	0.0	0.0
4-2b	0.0	5.2	4.8	0.0	0.0
South of Butte (LRO6-2)	0.0	3.2	0.0	0.0	0.0
6-2	0.0	2.5	0.0	0.0	0.0
Beef Trail (LRO7-2)	0.0	2.7	0.0	0.0	1.7
7-2	0.0	2.7	0.0	0.0	1.8
North of Buxton (LRO7-4)	0.0	3.9	2.7	0.0	1.6
7-4	0.0	4.5	0.3	0.0	0.4
Mount Haggin (LRO9-3)	0.0	0.0	1.7	0.0	1.5
9-3	0.0	0.0	1.8	0.0	1.7
Maiden Rock (LRO11-3)	0.0	4.3	0.7	1.1	0.0
11-3	0.0	2.1	0.1	0.0	0.0

Table 3.8-5. Summary in Miles of Overall Soil Sensitivity for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodeable Soils with Reclamation Constraints*	
	Low	Moderate	High	Cretaceous Shales	Intrusives
Willow Creek (LRO14-2)	0.0	0.0	1.3	0.0	0.0
14-2	0.0	0.0	1.3	0.0	0.0
Frying Pan Gulch (LRO16-2)	0.0	3.1	1.7	0.0	0.0
16-2	0.0	3.8	0.9	0.0	0.0
Clark Canyon East (LRO16-3c)	0.0	5.3	2.5	0.0	0.0
16-3c	0.0	8.7	0.0	0.0	0.0
Lima (LRO17-2)	0.0	11.1	2.5	5.4	0.0
17-2	0.0	7.7	2.8	2.5	0.0
Diamond Butte (LRO17-4)	0.0	4.7	0.0	0.0	0.0
17-4	0.0	4.8	0.0	0.0	0.0
Fleecer (LRO28)	0.0	3.2	0.0	1.6	0.0
28	0.0	2.5	0.0	1.5	0.0
Rock Creek (LRO32)	0.0	4.0	0.0	2.1	0.0
32	0.0	3.7	0.0	0.0	0.0

Notes: Areas calculated using 24-foot road width and preliminary road layout (from NorthWestern 2008a). Values are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

* No soils are formed on Lacustrine sediments in any LROs; therefore, the Lacustrine category is not shown.

Table 3.8-6. Summary in Miles of Sensitivity Impacts for Geohazards for Transmission Corridor Centerline for Local Routing Options and Corresponding Links^{1,2}

LRO/Link	Impacts ^{1,2}			
	Mass Movement ³	Potential Liquefaction	Faults ⁴	
Radersburg (LRO2-2)	0.3	<0.1	0.0	0
2-2	0.1	0.3	0.0	0
Boulder Hill (LRO2-3b)	0.0	0.0	0.0	0
2-3b	0.0	0.0	0.0	0
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	0.0	0.0	0.0	0
4-1b + 4-2a	<0.1	0.0	0.0	0
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	0.0	0.0	0.0	0
4-2a	<0.1	0.0	0.0	0
Lower Boulder (LRO4-2b + Link 3-2)	0.0	0.4	0.0	0
4-2b	0.0	0.5	0.0	0
South of Butte (LRO6-2)	0.0	0.3	3.4	0
6-2	0.0	1.1	2.4	0
Beef Trail (LRO7-2)	0.0	0.0	0.0	0
7-2	0.0	0.0	0.0	0
North of Buxton (LRO7-4)	0.0	0.0	2.7	1
7-4	0.0	0.0	2.0	1
Mount Haggin (LRO9-3)	0.0	0.0	0.0	0
9-3	0.0	0.0	0.0	0
Maiden Rock (LRO11-3)	1.0	0.2	1.0	0
11-3	0.0	0.1	1.3	0
Willow Creek (LRO14-2)	0.0	0.0	0.0	0
14-2	0.0	0.0	0.0	0
Frying Pan Gulch (LRO16-2)	0.0	0.0	0.0	0
16-2	0.0	0.0	0.0	0
Clark Canyon East (LRO16-3c)	0.0	0.0	0.0	0
16-3c	0.0	0.0	0.0	0
Lima (LRO17-2)	1.4	0.4	7.1	1
17-2	1.1	0.2	8.7	0

Table 3.8-6. Summary in Miles of Sensitivity Impacts for Geohazards for Transmission Corridor Centerline for Local Routing Options and Corresponding Links^{1,2}

LRO/Link	Impacts ^{1,2}		
	Mass Movement ³	Potential Liquefaction	Faults ⁴
Diamond Butte (LRO17-4)	0.4	0.4	0.0 0
17-4	0.0	1.0	0.0 0
Fleecer (LRO28)	0.8	0.0	0.0 0
28	0.9	0.0	0.0 0
Rock Creek (LRO32)	1.9	0.0	0.0 0
32	0.0	0.0	0.0 0

- 1 Geohazard sensitivity and initial (potential) impacts to structures and infrastructure are high prior to mitigation.
- 2 Geohazard mitigation measures result in no substantial to low geohazard impacts to structures and infrastructure.
- 3 Includes mapped mass movement and potential mass movement (equivalent to Cretaceous shales on slopes > 15 percent). **Bold** values indicate links and alternatives with mapped mass movement.
- 4 Faults: Left column is miles of faults in 2-mile buffer zone; right column is number of intersections of a fault with the transmission corridor centerline.

Table 3.8-7. Summary in Acres of Initial Impacts for Soils for Transmission Corridor Centerline

Zone	Alternative	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodible Soils with Reclamation Constraints*								
					Cretaceous Shales			Intrusives			Lacustrine		
		Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
1	A	17	305	1062	0.0	0.5	0.5	61.4	144.1	428.2	0.0	0.0	0.0
	B	0	354	851	3.4	1.9	0.7	70.6	84.2	168.4	0.0	0.0	0.0
	C	0	247	854	0.0	1.0	2.0	73.9	66.2	76.8	0.0	0.0	0.0
	D	0	167	496	3.4	1.9	0.7	5.3	6.5	16.2	0.0	0.0	0.0
2	A	0	326	372	0.7	1.8	5.3	8.2	17.0	77.7	0.0	0.0	0.0
	B	0	230	462	0.7	1.8	5.3	8.2	17.0	77.7	0.0	0.0	0.0
	C	0	390	780	7.1	0.5	2.2	68.5	96.5	232.0	0.0	0.0	0.0
	D	0	278	582	27.4	41.1	88.9	0.0	1.0	2.0	0.0	0.0	0.0
	E	0	203	426	7.1	0.5	2.2	3.2	18.8	79.8	0.0	0.0	0.0
3	A	0	358	430	13.0	23.7	14.1	0.0	0.0	0.0	0.0	0.0	0.0
	B	0	486	248	6.9	7.6	12.3	0.0	0.0	0.0	0.0	0.0	0.0
	D	0	486	300	6.9	7.6	12.3	0.0	0.0	0.0	0.0	0.0	0.0
4	A	0	130	88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	A	0	152	1017	0.0	0.0	0.0	0.0	0.0	0.0	29.0	1.6	0.0
	B	0	186	1048	0.0	0.0	0.0	0.0	0.0	0.0	42.0	32.1	0.0
	C	0	64	1208	0.0	0.0	0.0	0.0	0.0	0.0	20.0	29.9	0.0
	D	0	55	1150	0.0	0.0	0.0	0.0	0.0	0.0	20.0	29.9	0.0
6	A	87.4	804	989	0.0	0.0	0.0	0.0	0.0	0.0	20.4	0.0	0.0

Note: Areas calculated using disturbance model presented in Appendix C.8.1 (from NorthWestern 2008a).

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-8. Summary in Acres of Initial Impacts for Soils for Preliminary Overland Roads

Zone	Alternative	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodible Soils with Reclamation Constraints*								
		No Substantial Impact	Low	Moderate	Cretaceous Shales			Intrusives			Lacustrine		
					No Substantial Impact	Low	Moderate	No Substantial Impact	Low	Moderate	No Substantial Impact	Low	Moderate
1	A	0.0	28.2	7.9	0.0	0.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0
	B	0.0	43.7	31.0	6.2	0.0	0.0	5.0	3.1	0.0	0.0	0.0	0.0
	C	0.0	35.8	53.4	0.8	0.0	0.0	5.5	3.8	0.0	0.0	0.0	0.0
	D	0.0	16.2	20.6	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	A	0.0	26.2	7.6	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.0
	B	0.0	25.4	20.7	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.0
	C	0.0	27.5	18.4	0.0	0.0	0.0	5.0	3.1	0.0	0.0	0.0	0.0
	D	0.0	11.2	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E	0.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	A	0.0	12.8	16.8	10.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	0.0	15.6	14.5	10.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	D	0.0	14.5	6.9	10.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	A	0.0	12.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	A	0.0	5.4	46.8	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
	B	0.0	5.5	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
	C	0.0	1.6	82.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
	E	0.0	1.0	76.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
6	A	62.8	0.0	685.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0

Note: Areas calculated using 24-foot road width and preliminary road layout (from NorthWestern 2008a).

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-9. Summary in Acres of Residual Impacts for Soils for Transmission Corridor Centerline

Zone	Alternative	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints*											
						Cretaceous Shales				Intrusives				Lacustrine			
		No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent
1	A	335	764	113	172	0.0	0.4	0.4	0.2	52.2	396.3	121.2	63.9	0.0	0.0	0.0	0.0
	B	446	538	32	189	2.7	2.1	0.0	1.2	59.9	184.5	36.7	42.0	0.0	0.0	0.0	0.0
	C	442	422	38	199	0.0	1.0	2.0	3.0	62.0	110.1	16.0	28.8	0.0	0.0	0.0	0.0
	D	291	245	13	114	2.7	2.1	0.0	1.2	4.3	15.6	2.8	5.2	0.0	0.0	0.0	0.0
2	A	210	357	11	121	0.5	5.7	0.0	1.5	6.8	64.9	17.2	14.0	0.0	0.0	0.0	0.0
	B	244	313	13	120	0.5	5.7	0.0	1.5	6.8	64.9	17.2	14.0	0.0	0.0	0.0	0.0
	C	361	598	23	188	5.7	0.9	1.3	1.9	58.3	225.2	65.9	47.5	0.0	0.0	0.0	0.0
	D	192	504	28	135	22.2	87.0	18.9	29.4	0.0	1.0	2.0	3.0	0.0	0.0	0.0	0.0
	E	207	306	4	112	5.7	0.9	1.3	1.9	2.7	56.4	32.0	10.7	0.0	0.0	0.0	0.0
3	A	321	311	4	152	10.5	27.0	3.4	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	303	284	6	141	5.6	12.7	3.4	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	C	287	331	16	151	5.6	12.7	3.4	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	A	101	72	2	42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	A	899	42	3	226	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.4	1.3	0.0	11.8
	B	988	7	0	239	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.7	1.3	0.0	12.4
	C	1022	3	0	247	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.6	1.3	0.0	11.6
	D	971	1	0	234	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.6	1.3	0.0	11.6
6	A	926	6	0	224	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	4.0

Note: Areas calculated using disturbance model presented in Appendix C.8.1 (from NorthWestern 2008a).
* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-10. Summary in Acres of Residual Impacts for Soils for Preliminary Overland Roads

Zone	Alternative	Rock Types Forming Erodible Soils with Reclamation Constraints*												
		Soils Using Kw, WEG, and T Factor			Cretaceous Shales			Intrusives			Lacustrine			
		No Substantial Impact	Low	Moderate	No Substantial Impact	Low	Moderate	No Substantial Impact	Low	Moderate	No Substantial Impact	Low	Moderate	
1	A	36.1	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0
	B	74.7	0.1	0.1	6.2	0.0	0.0	8.4	0.1	0.0	0.0	0.0	0.0	0.1
	C	89.1	0.1	0.1	0.8	0.0	0.0	17.6	0.0	0.0	0.0	0.0	0.0	0.1
	D	36.7	0.0	0.0	6.2			0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	A	33.7	0.1	0.1	0.0	0.0	0.0	1.0	0.1	0.0	0.0	0.0	0.0	0.1
	B	46.0	0.1	0.1	0.0	0.0	0.0	1.0	0.1	0.0	0.0	0.0	0.0	0.1
	C	45.8	0.1	0.1	0.0	0.0	0.0	8.4	0.1	0.0	0.0	0.0	0.0	0.1
	D	25.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E	7.9	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	A	29.6	0.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	30.1	0.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	C	21.4	0.0	0.0	11.5			0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	A	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	A	52.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
	B	46.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
	C	83.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
	D	77.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		0.0
6	A	62.8	685.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0

Note: Areas calculated using 24-foot road width and preliminary road layout (from NorthWestern 2008a).

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-11. Summary in Acres of Permanent Soil Impacts from New Roads

Zone	Alternative	Soils Using Kw, WEG, and T Factor	Rock Types Forming Erodible Soils with Reclamation Constraints*		
			Cretaceous	Intrusive	Lacustrine
1	A	163.2	1.9	69.8	0.0
	B	125.2	1.3	20.0	0.0
	C	112.0	0.9	3.9	0.0
	D	108.3	1.3	5.4	0.0
2	A	38.8	0.0	1.8	0.0
	B	78.1	0.0	1.8	0.0
	C	214.9	3.9	38.9	0.0
	D	167.2	51.5	28.4	0.0
	E	184.5	3.9	24.3	0.0
3	A	112.2	5.9	0.0	0.0
	B	210.6	5.9	0.0	0.0
	C	234.9	6.3	0.0	0.0
4	A	26.9	0.0	0.0	0.0
5	A	23.5	0.0	0.0	0.0
	B	54.3	0.0	0.0	2.2
	C	52.5	0.0	0.0	2.2
	D	49.6	0.0	0.0	2.2
6	A	1,704	0.0	0.0	1.8

Notes: Areas calculated using 24-foot road width and preliminary road layout (from NorthWestern 2008a). All impacts associated with new roads are permanent.

* Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

Table 3.8-12. Summary in Acres of Initial Impacts to Soils for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodible Soils with Reclamation Constraints*					
				Cretaceous Shales			Intrusives		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Radersburg (LRO2-2)	0.0	2.9	50.3	0.0	0.0	0.0	0.0	0.0	0.0
2-2	0.0	1.2	46.6	0.0	0.0	0.0	0.0	0.0	0.0
Boulder Hill (LRO2-3b)	7.0	18.6	22.8	0.0	0.0	0.0	8.1	11.2	6.9
2-3b	12.0	23.2	21.5	0.0	0.0	0.0	21.6	12.9	6.7
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	0.0	5.0	144.3	1.1	0.0	0.0	0.0	0.0	0.0
4-1b + 4-2a	0.0	48.2	122.0	3.4	1.9	0.7	4.6	0.0	3.8
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	0.0	5.0	129.0	2.8	0.0	0.0	2.8	2.6	0.0
4-2a	0.0	48.2	106.9	3.4	1.9	0.7	3.8	1.4	3.8
Lower Boulder (LRO4-2b + Link 3-2)	0.0	58.2	74.4	0.0	0.0	0.0	0.0	2.6	0.0
4-2b	0.0	47.7	112.5	0.0	0.0	0.0	0.0	0.0	0.0
South of Butte (LRO6-2)	0.0	23.9	18.4	0.0	0.0	0.0	0.0	0.0	0.0
6-2	0.0	24.8	4.3	0.0	0.0	0.0	0.0	0.0	0.0
Beef Trail (LRO7-2)	0.0	28.9	0.2	0.0	0.0	0.0	16.0	2.0	0.2
7-2	0.0	29.0	0.2	0.0	0.0	0.0	15.3	4.0	0.2
North of Buxton (LRO7-4)	0.0	39.1	46.1	0.0	0.0	0.0	1.1	4.2	24.6
7-4	0.0	41.3	14.2	0.0	0.0	0.0	0.0	2.1	5.7
Mount Haggin (LRO9-3)	0.0	0.0	19.0	0.0	0.0	0.0	2.7	8.0	6.9
9-3	0.0	0.0	21.8	0.0	0.0	0.0	1.7	4.0	14.1
Maiden Rock (LRO11-3)	0.0	10.7	43.8	0.2	1.6	10.6	0.0	0.0	0.0
11-3	0.0	17.4	6.2	0.0	0.0	0.0	0.0	0.0	0.0

Table 3.8-12. Summary in Acres of Initial Impacts to Soils for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodible Soils with Reclamation Constraints*					
				Cretaceous Shales			Intrusives		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Willow Creek (LRO14-2)	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0
14-2	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0
Frying Pan Gulch (LRO16-2)	0.0	24.2	27.8	0.0	0.0	0.0	0.0	0.0	0.0
16-2	0.0	34.3	16.4	0.0	0.0	0.0	0.0	0.0	0.0
Clark Canyon East (LRO16-3c)	0.0	43.3	45.5	0.0	0.0	0.0	0.0	0.0	0.0
16-3c	0.0	75.2	25.2	0.0	0.0	0.0	0.0	0.0	0.0
Lima (LRO17-2)	0.0	80.4	66.2	25.0	11.4	22.5	0.0	0.0	0.0
17-2	0.0	64.6	49.8	6.9	7.6	12.3	0.0	0.0	0.0
Diamond Butte (LRO17-4)	0.0	23.4	27.7	0.0	0.0	0.0	0.0	0.0	0.0
17-4	0.0	45.5	6.3	0.0	0.0	0.0	0.0	0.0	0.0
Fleecer (LRO28)	0.0	24.0	10.5	1.5	7.7	8.3	0.0	0.0	0.0
28	0.0	14.2	13.2	0.8	6.6	9.2	0.0	0.0	0.0
Rock Creek (LRO32)	0.0	14.2	30.2	0.3	1.8	21.3	0.0	0.0	0.0
32	0.0	19.8	20.8	0.0	0.0	0.0	0.0	0.0	0.0

Notes: Areas calculated using disturbance model presented in Appendix C.8.1 (from NorthWestern 2008a). Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

* No soils are formed on Lacustrine sediments in any LROs; therefore, the Lacustrine category is not shown.

Table 3.8-13. Summary in Acres of Initial Impacts to Soils for Overland Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodible Soils with Reclamation Constraints*					
				Cretaceous Shales			Intrusives		
	No Impact	Low	Moderate	No Impact	Low	Moderate	No Impact	Low	Moderate
Radersburg (LRO2-2)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2	0.9	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boulder Hill (LRO2-3b)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-3b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1b + 4-2a	0.0	0.0	61.5	4.7	1.5	0.0	0.0	0.0	0.0
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2a	0.0	0.0	61.5	4.7	1.5	0.0	0.0	0.0	0.0
Lower Boulder (LRO4-2b + Link 3-2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2b	0.0	0.0	34.4	0.0	0.0	0.0	0.0	0.0	0.0
South of Butte (LRO6-2)	3.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-2	5.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beef Trail (LRO7-2)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-2	5.5	0.0	0.0	0.0	0.0	0.0	2.1	0.5	0.0
North of Buxton (LRO7-4)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-4	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mount Haggin (LRO9-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maiden Rock (LRO11-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3.8-13. Summary in Acres of Initial Impacts to Soils for Overland Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor			Rock Types Forming Erodible Soils with Reclamation Constraints*					
				Cretaceous Shales			Intrusives		
	No Impact	Low	Moderate	No Impact	Low	Moderate	No Impact	Low	Moderate
Willow Creek (LRO14-2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Frying Pan Gulch (LRO16-2)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clark Canyon East (LRO16-3c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-3c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lima (LRO17-2)	4.3	0.0	0.0	16.5	0.4	0.0	0.0	0.0	0.0
17-2	4.5	0.4	0.0	10.9	0.6	0.0	0.0	0.0	0.0
Diamond Butte (LRO17-4)	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17-4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fleecer (LRO28)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek (LRO32)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: Areas calculated using 24 foot road width and preliminary road layout (from NorthWestern 2008a). Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

* No soils are formed on Lacustrine sediments in any LROs; therefore, the Lacustrine category is not shown.

Table 3.8-14. Summary in Acres of Residual Impacts to Soils for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}							
					Cretaceous Shales				Intrusives			
	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent
Radersburg (LRO2-2)	20.7	19.1	3.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2	16.7	21.8	0.3	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boulder Hill (LRO2-3b)	23.8	16.1	0.0	8.6	0.0	0.0	0.0	0.0	6.5	15.4	0.0	4.3
2-3b	30.4	17.0	0.0	9.3	0.0	0.0	0.0	0.0	17.9	17.1	0.0	6.3
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	94.3	25.4	0.7	29.0	0.9	0.0	0.0	0.2	0.0	0.0	0.0	0.0
4-1b + 4-2a	60.0	79.5	2.2	28.5	2.7	2.1	0.0	1.2	3.7	4.3	0.9	2.1
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	87.5	19.9	0.7	25.9	2.2	0.0	0.0	0.5	2.3	1.1	0.0	0.8
4-2a	51.6	75.7	2.2	25.6	2.7	2.1	0.0	1.2	3.1	4.3	0.9	2.0
Lower Boulder (LRO4-2b + Link 3-2)	35.2	60.8	2.9	23.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2b	29.1	103.2	7.1	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South of Butte (LRO6-2)	16.5	19.1	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-2	18.4	5.5	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3.8-14. Summary in Acres of Residual Impacts to Soils for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}							
					Cretaceous Shales				Intrusives			
	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent
Beef Trail (LRO7-2)	21.7	1.8	0.0	5.6	0.0	0.0	0.0	0.0	12.9	1.8	0.0	3.5
7-2	20.1	3.4	0.0	5.7	0.0	0.0	0.0	0.0	12.3	3.4	0.0	3.8
North of Buxton (LRO7-4)	32.0	28.9	10.3	14.0	0.0	0.0	0.0	0.0	0.9	13.9	11.7	3.4
7-4	21.3	20.9	3.3	10.0	0.0	0.0	0.0	0.0	0.0	3.0	4.0	0.8
Mount Haggin (LRO9-3)	2.1	12.8	0.5	3.5	0.0	0.0	0.0	0.0	2.2	11.6	0.5	3.2
9-3	2.0	15.2	0.7	3.9	0.0	0.0	0.0	0.0	1.4	14.2	0.7	3.5
Maiden Rock (LRO11-3)	3.0	38.7	2.3	10.4	0.1	9.0	0.0	2.3	0.0	0.0	0.0	0.0
11-3	3.7	15.3	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Willow Creek (LRO14-2)	4.4	7.1	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-2	5.0	6.7	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Frying Pan Gulch (LRO16-2)	19.4	22.6	0.0	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-2	22.3	18.5	0.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clark Canyon East (LRO16-3c)	16.4	50.0	5.9	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-3c	35.1	47.0	0.0	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3.8-14. Summary in Acres of Residual Impacts to Soils for Transmission Corridor Centerline for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}							
					Cretaceous Shales				Intrusives			
	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent
Lima (LRO17-2)	41.4	76.2	0.6	28.4	20.1	22.3	5.1	11.4	0.0	0.0	0.0	0.0
17-2	42.0	49.2	1.0	22.2	5.6	12.7	3.4	5.2	0.0	0.0	0.0	0.0
Diamond Butte (LRO17-4)	7.2	34.1	0.0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17-4	24.8	16.9	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fleecer (LRO28)	5.0	22.8	0.0	6.7	1.2	12.8	0.1	3.4	0.0	0.0	0.0	0.0
28	1.2	20.8	0.0	5.3	0.7	12.8	0.0	3.2	0.0	0.0	0.0	0.0
Rock Creek (LRO32)	4.9	31.1	0.0	8.4	0.2	8.0	10.8	4.4	0.0	0.0	0.0	0.0
32	5.2	27.5	0.0	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Areas calculated using disturbance model presented in Appendix C.8.1 (from NorthWestern 2008a).

1 Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor. 2 No soils are formed on Lacustrine sediments in any LROs; therefore, the Lacustrine category is not presented.

Table 3.8-15. Summary in Acres of Residual Impacts to Soils for Overland Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}								
					Cretaceous Shales				Intrusives				
	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	
Radersburg (LRO2-2)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
2-2	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0
Boulder Hill (LRO2-3b)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-3b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1b + 4-2a	61.5	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2a	61.5	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lower Boulder (LRO4-2b + Link 3-2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2b	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South of Butte (LRO6-2)	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0
6-2	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0
Beef Trail (LRO7-2)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
7-2	5.5	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	5.5	0.0	0.0

Table 3.8-15. Summary in Acres of Residual Impacts to Soils for Overland Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}								
					Cretaceous Shales				Intrusives				
	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	
North of Buxton (LRO7-4)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
7-4	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
Mount Haggin (LRO9-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maiden Rock (LRO11-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Willow Creek (LRO14-2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Frying Pan Gulch (LRO16-2)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
16-2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Clark Canyon East (LRO16-3c)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-3c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lima (LRO17-2)	4.3	0.0	0.0	16.9	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0
17-2	4.9	0.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0
Diamond Butte (LRO17-4)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
17-4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
Fleecer (LRO28)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3.8-15. Summary in Acres of Residual Impacts to Soils for Overland Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor				Rock Types Forming Erodible Soils with Reclamation Constraints ^{1, 2}							
					Cretaceous Shales				Intrusives			
	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent	No Substantial Impacts	Low	Moderate	Permanent
Rock Creek (LRO32)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: Areas calculated using 24-foot road width and preliminary road layout (from NorthWestern 2008a).

1 Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

2 No soils are formed on Lacustrine sediments in any LROs; therefore, the Lacustrine category is not shown.

Table 3.8-16. Summary in Acres of Permanent Soil Impacts from New Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor	Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}	
		Cretaceous	Intrusive
Radersburg (LRO2-2)	10.2	0.0	0.0
2-2	5.1	0.3	0.0
Boulder Hill (LRO2-3b)	9.0	0.4	4.1
2-3b	9.8	1.3	6.7
Upper Boulder 1 (LRO4-2a-1 + LRO4-2a-3)	34.9	0.3	0.4
4-1b + 4-2a	37.1	1.3	3.5
Upper Boulder 2 (LRO4-2a-2 + LRO4-2a-3)	27.3	0.4	0.1
4-2a	32.3	1.3	3.4
Lower Boulder (LRO4-2b + Link 3-2)	21.0	0.0	0.0
4-2b	34.2	0.0	0.0
South of Butte (LRO6-2)	3.4	0.0	2.5
6-2	0.0	0.0	2.4
Beef Trail (LRO7-2)	0.0	0.0	0.0
7-2	3.2	0.0	3.2
North of Buxton (LRO7-4)	18.3	0.0	3.7
7-4	13.1	0.0	2.4
Mount Haggin (LRO9-3)	4.5	5.6	4.2
9-3	1.3	5.9	0.7
Maiden Rock (LRO11-3)	16.8	5.0	0.0
11-3	9.8	0.0	0.0
Willow Creek (LRO14-2)	3.5	0.0	0.0
14-2	6.5	0.0	0.0
Frying Pan Gulch (LRO16-2)	12.8	0.0	0.0
16-2	14.0	0.0	0.0
Clark Canyon East (LRO16-3c)	40.5	0.0	0.0
16-3c	45.9	0.0	0.0
Lima (LRO17-2)	28.6	5.6	0.0
17-2	31.1	5.9	0.0
Diamond Butte (LRO17-4)	16.1	0.0	0.0
17-4	12.9	0.0	0.0
Fleecer (LRO28)	5.2	3.3	0.0
28	7.7	4.5	0.0

Table 3.8-16. Summary in Acres of Permanent Soil Impacts from New Roads for Local Routing Options and Corresponding Links

LRO/Link	Soils Using Kw, WEG, and T Factor	Rock Types Forming Erodible Soils with Reclamation Constraints ^{1,2}	
Rock Creek (LRO32)	15.5	10.0	0.0
32	16.3	0.0	0.0

Notes: Areas calculated using 24-foot road width and preliminary road layout (from NorthWestern 2008a). All impacts associated with new roads are permanent.

1 Areas are not mutually exclusive from NRCS soils-based impacts calculated using Kw, WEG, and T Factor.

2 No soils are formed on Lacustrine sediments in any LROs; therefore, the Lacustrine category is not shown.

Table 3.8-17. Summary of Relative Soil Mitigation Costs

Zone	Alternative	Miles	Relative Unit Cost Per Mile
1	A	81.8	85.5
	B	90.2	63.2
	C	94.9	53.2
	D	54.1	58.4
2	A	57.5	55.2
	B	57.2	56.4
	C	89.7	64.3
	D	64.4	67.3
	E	53.6	59.7
3	A	72.2	50.1
	B	67.2	54.2
	C	72.0	54.8
4	A	20.0	49.4
5	A	107.4	44.7
	B	114.0	44.9
	C	117.5	44.8
	D	111.3	44.8
6	A	106.8	48.9

Note: Based on average per-acre costs for mitigation used for the Vegetation (Section 3.10) cost analysis; includes reclamation and heavy equipment use (RSMMeans 2003) for low impacts (see Appendix C.8.5 for detail).



Figure 3.8-1. Zone 1 Townsend to Mill Creek - Geohazards and Erodible Rock Types



Figure 3.8-2. Zone 2 Mill Creek to Glen - Geohazards and Erodible Rock Types



Figure 3.8-3. Zone 3 Glen to Stateline - Geohazards and Erodible Rock Types



Figure 3.8-4. Zone 4 Stateline to Sheep Station - Geohazards and Erodible Rock Types



Figure 3.8-5. Zone 5 Sheep Station to Coffee Point - Geohazards and Erodible Rock Types

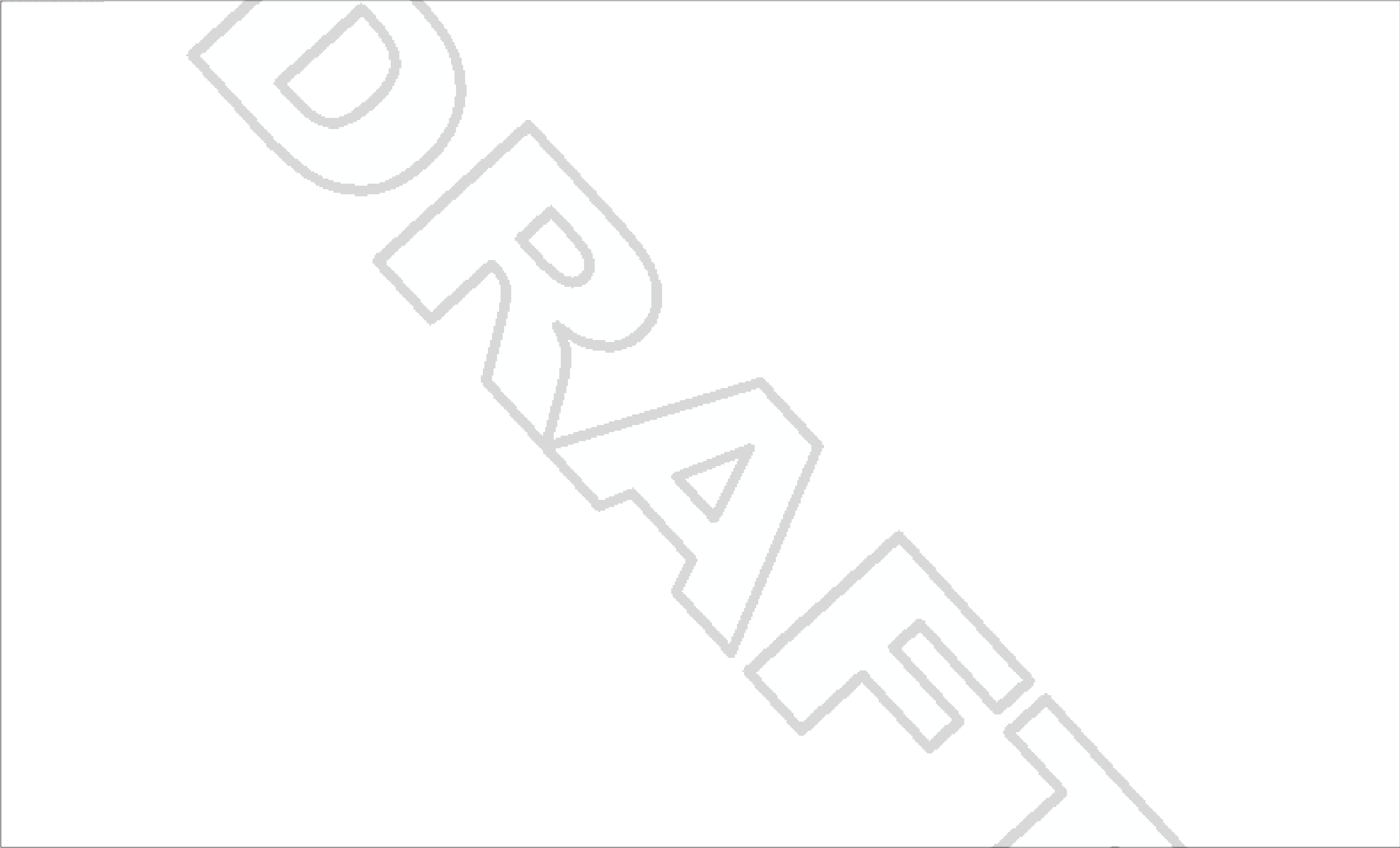


Figure 3.8-6. Zone 6 Coffee Point to Midpoint - Geohazards and Erodible Rock Types

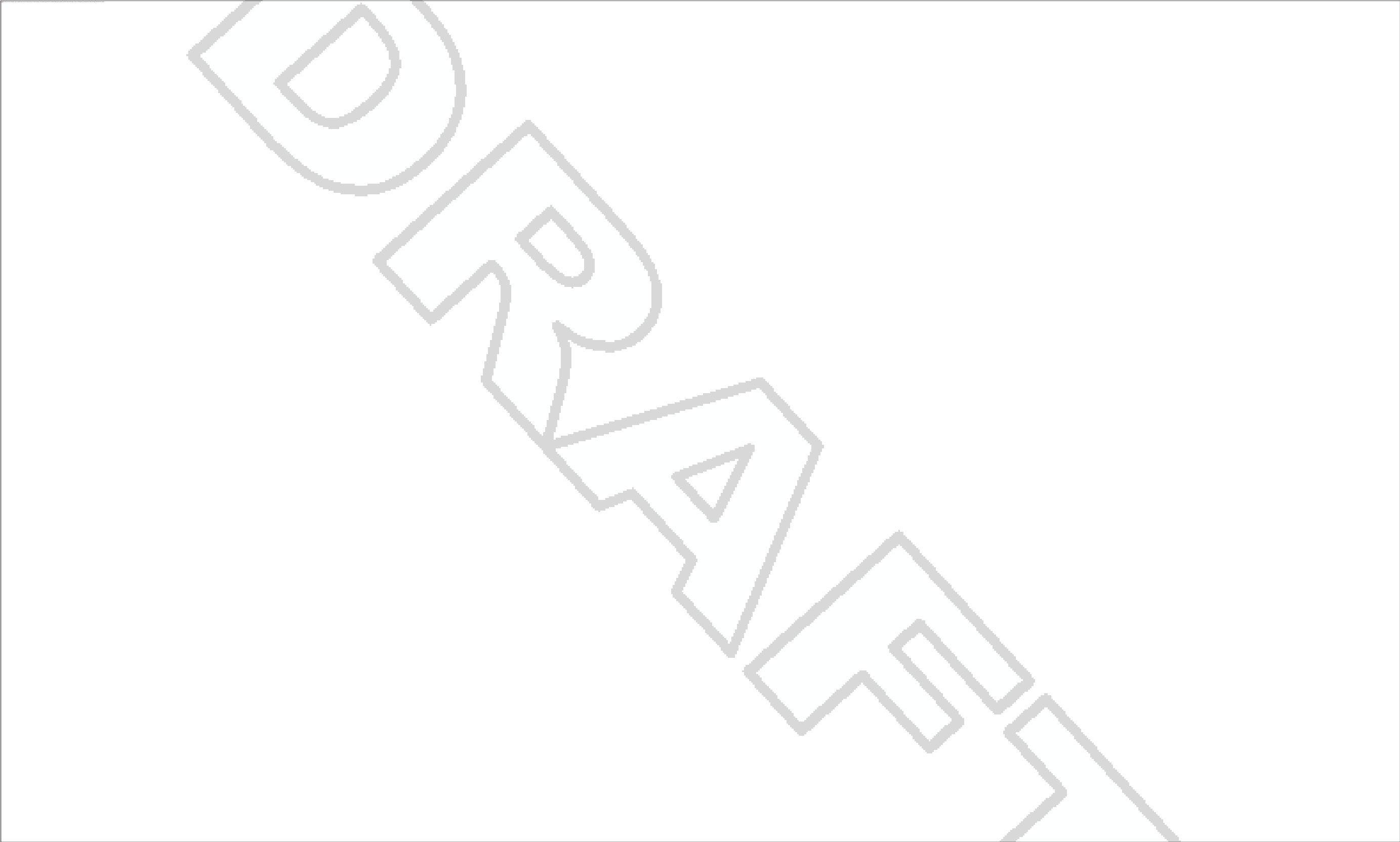


Figure 3.8-7. Zone 1 Townsend to Mill Creek - Soil Erosion Sensitivity



Figure 3.8-8. Zone 2 Mill Creek to Glen - Soil Erosion Sensitivity



Figure 3.8-9. Zone 3 Glen to Stateline - Soil Erosion Sensitivity



Figure 3.8-10. Zone 4 Stateline to Sheep Station - Soil Erosion Sensitivity



Figure 3.8-11. Zone 5 Sheep Station to Coffee Point - Soil Erosion Sensitivity

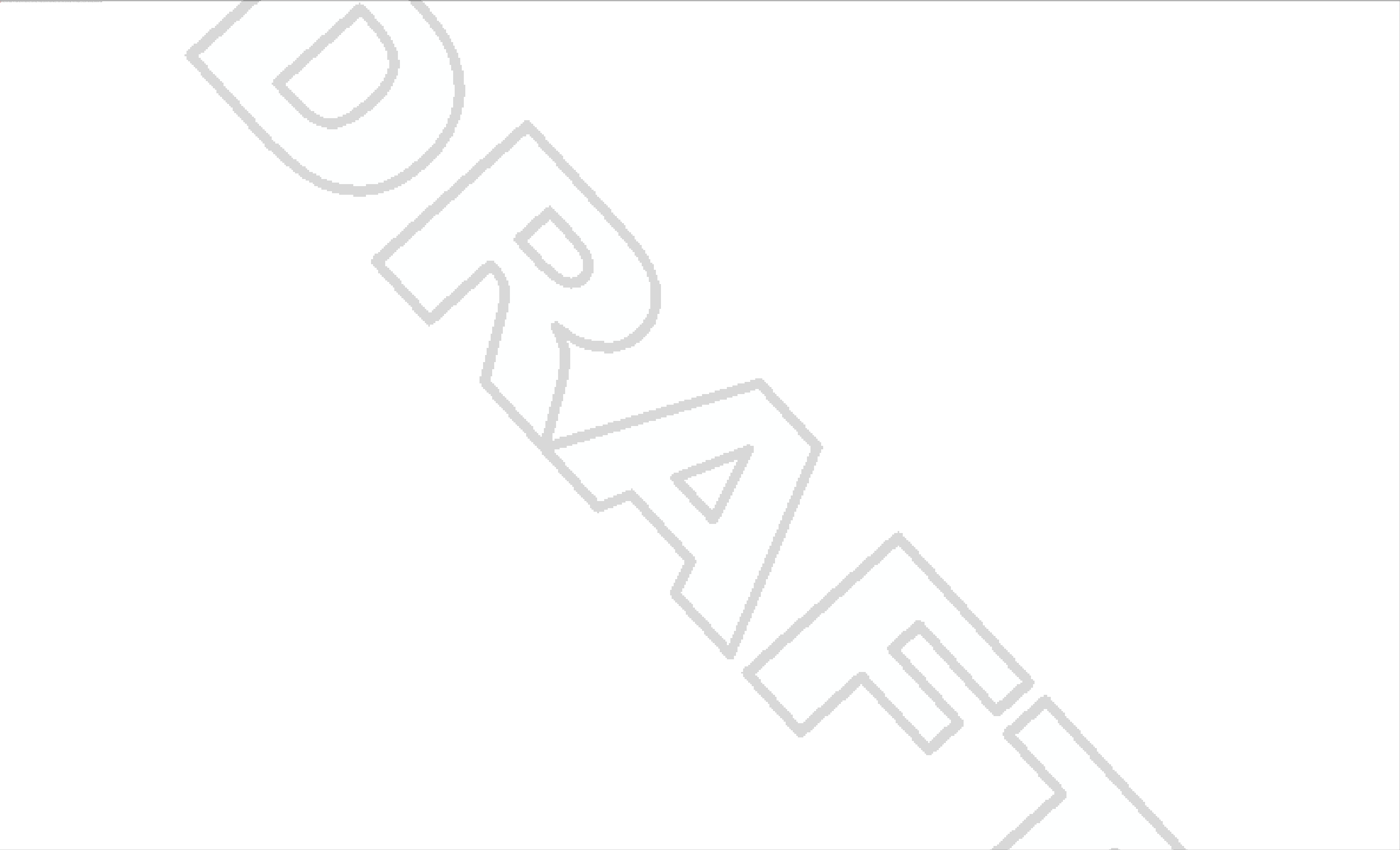


Figure 3.8-12. Zone 6 Coffee Point to Midpoint - Soil Erosion Sensitivity



Figure 3.8-13. Zone 1 Townsend to Mill Creek - Soil Reclamation Constraints



Figure 3.8-14. Zone 2 Mill Creek to Glen - Soil Reclamation Restraints



Figure 3.8-15. Zone 3 Glen to Stateline - Soil Reclamation Constraints



Figure 3.8-16. Zone 4 Stateline to Sheep Station - Soil Reclamation Constraints



Figure 3.8-17. Zone 5 Sheep Station to Coffee Point - Soil Reclamation Constraints

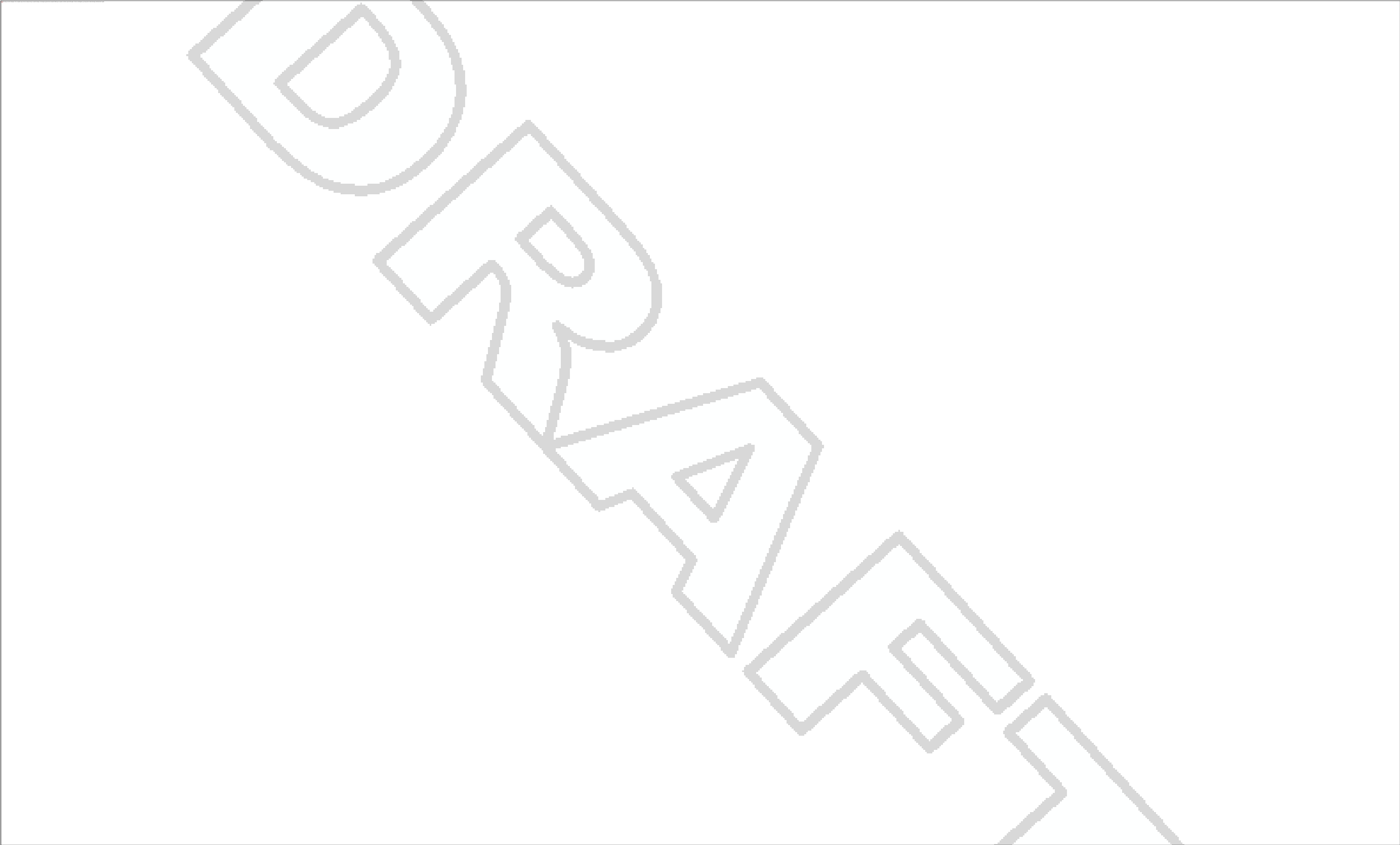


Figure 3.8-18. Zone 6 Coffee Point to Midpoint - Soil Reclamation Constraints

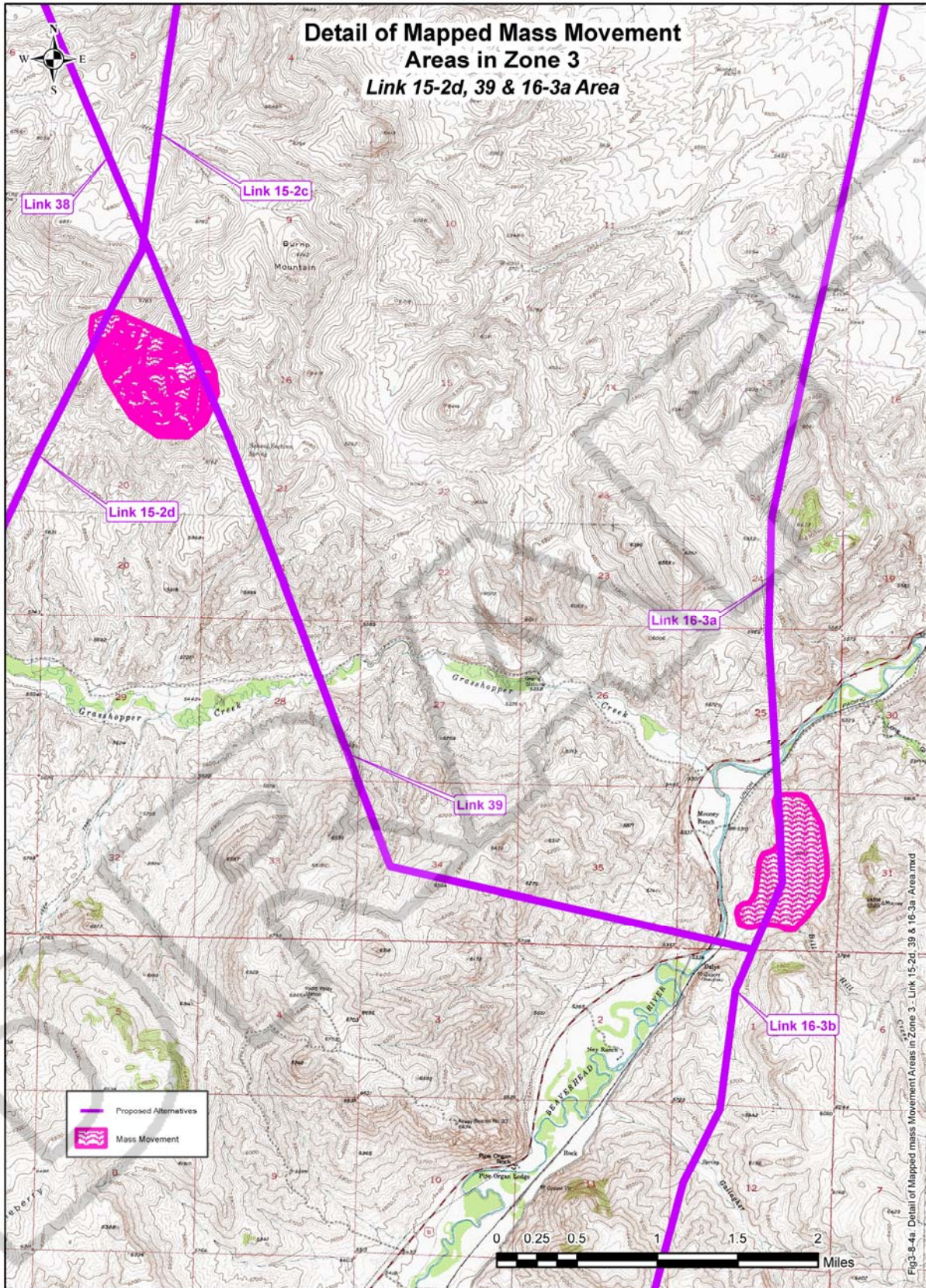


Figure 3.8-19. Detail of Mapped Mass Movement Areas in Zone 3 – Link 15-2d, 39 and 16-3a Area

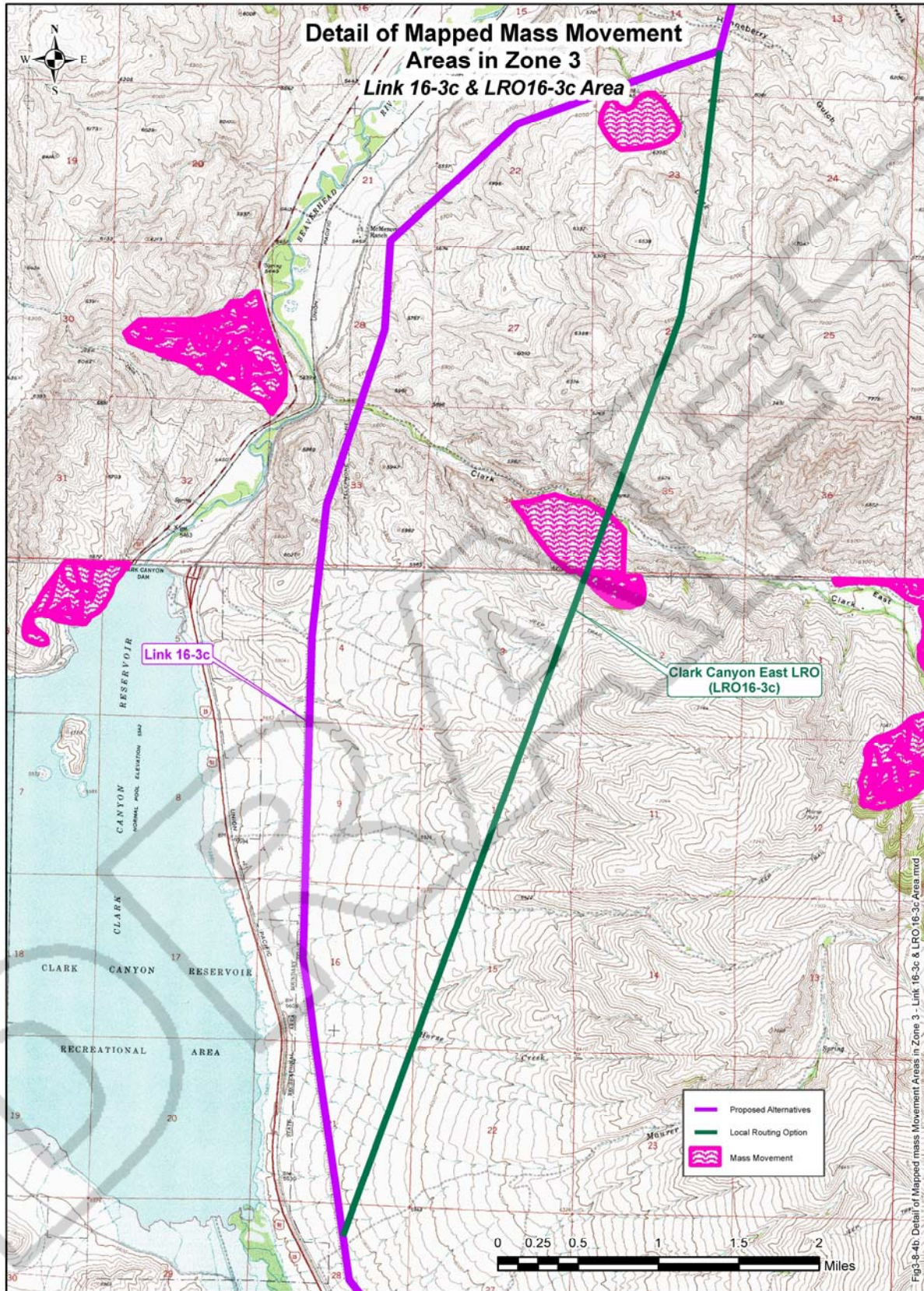


Figure 3.8-20. Detail of Mapped Mass Movement Areas in Zone 3 – Link 16-3c and LRO16-3c Area

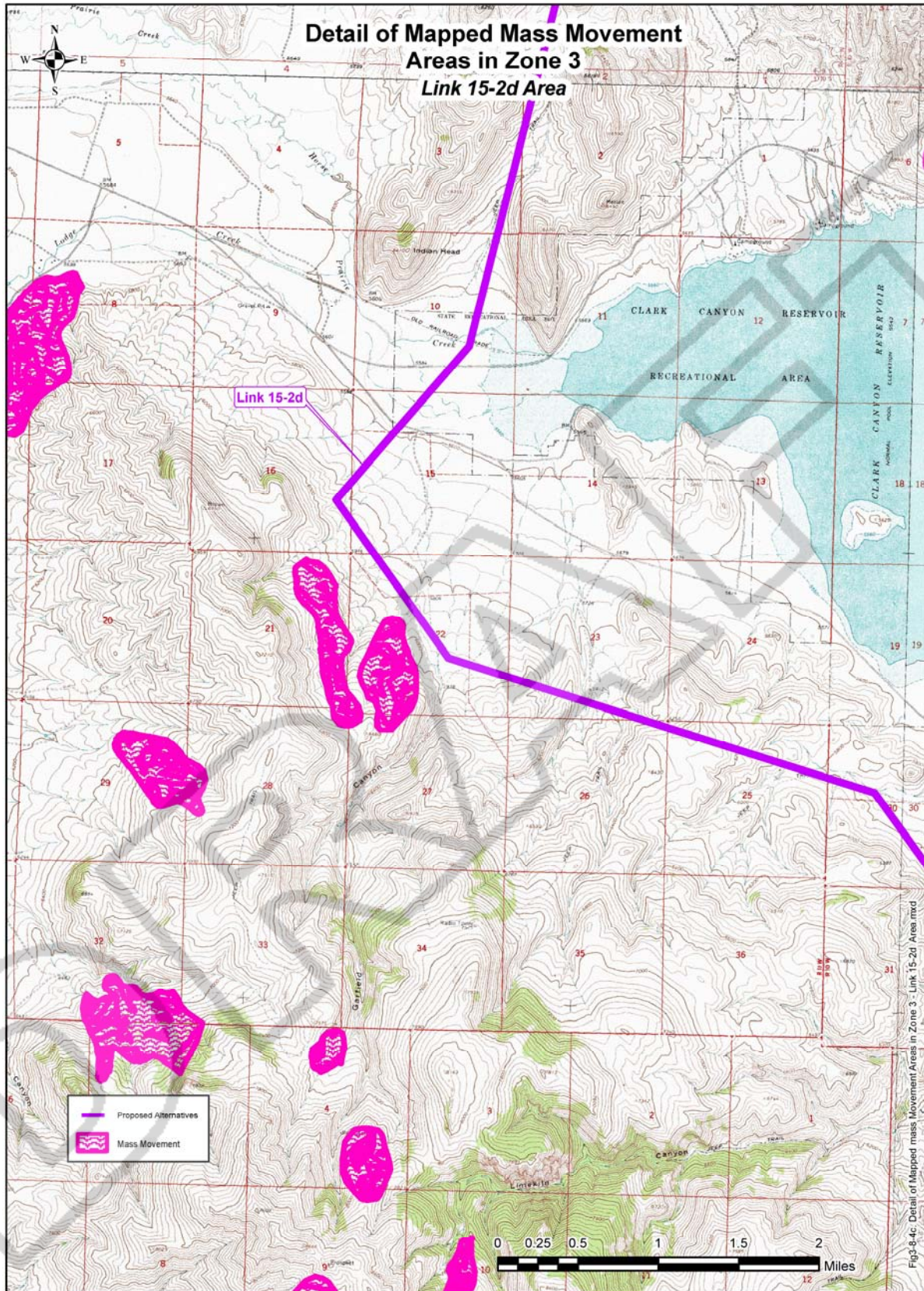


Figure 3.8-21. Detail of Mapped Mass Movement Areas in Zone 3 – Link 15-2d Area

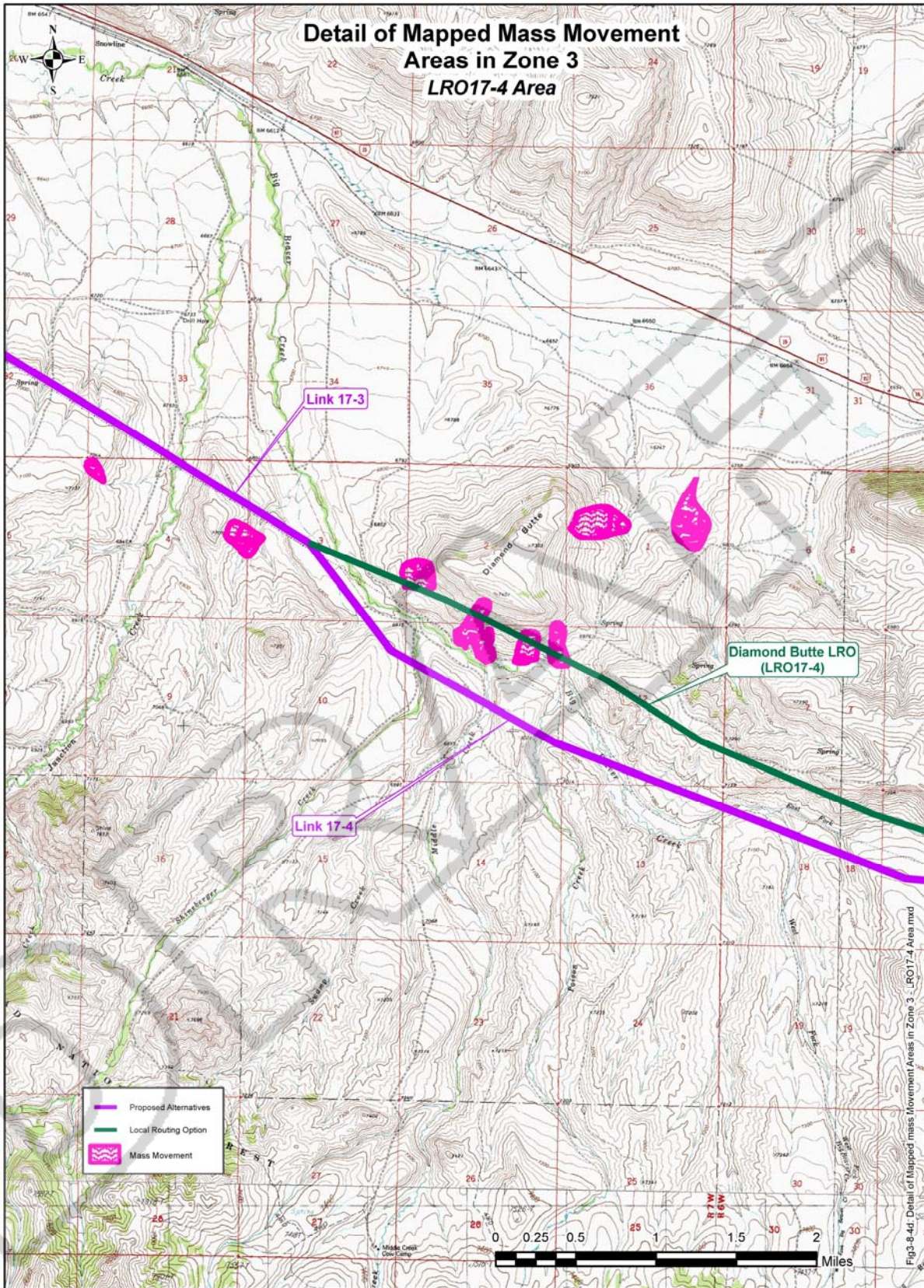


Figure 3.8-22. Detail of Mapped Mass Movement Areas in Zone 3 – LRO17-4 Area