# EDDY GULCH LATE-SUCCESSIONAL RESERVE FUELS / HABITAT PROTECTION PROJECT

## SOILS REPORT

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## Supporting Documents in the Project Record

The project record contains unit-by-unit summaries of transect and ocular estimate locations, observation narratives, and management recommendations.

# Soils Report

## 1.1 Introduction

The role of the soil scientist for the Eddy Gulch Late-Successional Reserve (LSR) Fuels / Habitat Protection Project was to ensure that the methods used to achieve project objectives would maintain the productive capacity of the soil resource, as defined in the Klamath National Forest Land and Resource Management Plan (Klamath LRMP) and regional Soil Quality Analysis Standards (SQAS). Maintaining the long-term soil productivity in the Assessment Area will be accomplished through project design features and the Resource Protection Measures (RPMs) that ensure the project will meet the Klamath LRMP's soil resource Standards and Guidelines (USFS 1995a) and the regional SQAS (USFS 1995b).

### 1.1.1 Project Location

The Eddy Gulch LSR Project Assessment Area is located on the Salmon River and Scott River Ranger Districts, Klamath National Forest, in southwestern Siskiyou County. The LSR is located mostly west of Etna Summit, south of North Russian Creek and the town of Sawyers Bar, east of Forks of Salmon, and north of Cecilville. The LSR is about 61,900 acres in size, making it one of the largest LSRs on the Klamath National Forest. The LSR encompasses much of the area between the North and South Forks of the Salmon River, as well as headwaters of Etna Creek. Elevations range from 1,100 feet to about 8,000 feet. The terrain is generally steep and dissected by sharp ridges and streams. There are a few private inholdings in the LSR and along the main Salmon River and other stream corridors adjacent to the LSR.

The legal description for the Eddy Gulch LSR includes the following (all Mount Diablo Meridian):

T38N, R11W, Sections 2-5, 8-10, and 17-19
T38N, R12W, Sections 1-3, 9-16, and 22-24
T39N, R10W, Sections 2-10, 15-21, and 29-31
T39N, R11W, Sections 1-18, 20-29, and 32-36
T39N, R12W, Sections 11-14, 23-25, and 36
T40N, R10W, Sections 3-5, 8-11, and 13-35
T40N, R11W, Sections 24-27 and 34-36
T41N, R10W, Sections 2-5, 8-17, 20-24, 26-29, and 31-34
T42N, R10W, Sections 28-29 and 32-35

### 1.1.2 Terms

**Eddy Gulch LSR** — the entire 61,900-acre LSR.

**Assessment Area** — the 37,239-acre portion of the Eddy Gulch LSR west of Etna Summit where various treatments are proposed. All roadless areas that occur in the LSR were excluded from planning efforts and are therefore not part of the Assessment Area.

**Treatment Unit** — the acres proposed for some type of treatment under a particular alternative.

**Analysis Area** — the area around treatment units considered in the effects analysis (the analysis area may be larger than the LSR Assessment Area and varies by resource). Section 1.5.2 describes the analysis area for soils.

## 1.2 Summary of the Alternatives

Chapter 2 in the environmental impact statement (EIS) for the Eddy Gulch LSR Project presents more information about the three alternatives, and Appendix A in the EIS contains project maps.

### 1.2.1 Alternative A: No Action

The no-action alternative is described as continuation of the current level of management and public use—this includes road maintenance, dispersed recreation (hunting, fishing, camping, and hiking), mining, watershed restoration projects, and the modeled wildfire. The time frame for analysis is considered to be 20 years. Given the fuel hazard in the Eddy Gulch LSR and current predictions of climate change, it is assumed at least one wildfire will escape initial attack during the 20-year period and burn under 90th percentile weather conditions (defined as 10 percent of the days in the historical weather database that had lower fuel moisture and higher wind speeds compared to the rest of the days). An analysis of a wildfire for three days that escaped initial attack in the Eddy Gulch LSR Project Assessment Area indicates that fire would burn 7,200 acres. Of those 7,200 acres, 1,355 acres (19 percent) would be surface fire; 5,065 acres (70 percent) would be a passive crown fire; and 780 acres (11 percent) would be an active crown fire.

### 1.2.2 Alternative B: Proposed Action

The Klamath National Forest proposes 25,969 acres of treatments to protect late-successional habitat and communities. Three primary treatment types were identified in the Assessment Area: Fuel Reduction Zones (FRZs), Prescribed Burn Units (Rx Units), and Roadside (RS) treatments along emergency access routes, which are described below.

- **FRZs**—strategically located on ridgetops to increase resistance to the spread of wildfires. The FRZs would be wide enough to capture most short-range spot fires, and ground, ladder, and crown fuels would be reduced so as to change crown fires to surface fires within the treated areas. The FRZs would provide safe locations for fire-suppression personnel to take fire-suppression actions during 90th percentile weather conditions, and they serve as anchor points for additional landscape-level fuel treatments, such as underburning.

  - ***Proposed Action.*** Construct 16 FRZs totaling 8,291 acres to increase resistance to wildfires. The 8,291 acres includes 931 acres in 42 M Units (thinning units) and 7,383 acres in fuel reduction areas (outside the M Units) to reduce ground and ladder fuels.

- **Rx Units**—a series of landscape-level treatments (ranging from 250 to 4,300 acres in size) designed to increase resilience to wildfires by reducing ground and ladder fuels. Most of these treatments would occur on south-facing aspects where fuels dry faster, and treatments would support the role of the FRZs.

- ***Proposed Action*. *Implement*** 17,524 acres of Rx Units to increase resiliency to wildfires.

- **RS treatments**—along 60 miles of emergency access routes identified in the Salmon River Community Wildfire Protection Plan (CWPP) (SRFSC 2007) and designed to facilitate emergency access for residents to evacuate and for suppression forces to safely enter the LSR in the event of a wildfire.

  - ***Proposed Action.*** Treat 44 miles of emergency access routes in FRZs and Rx Units (treatments would be similar to the FRZ or Rx Unit the route passes through) and 16 miles (with 154 acres of treatments) of RS treatments outside of FRZs and Rx Units—a total of 60 miles of RS treatments along emergency access routes.

#### Proposed Temporary Roads and Landings

The construction of new temporary roads and the use of former logging access routes are proposed to access treatment units.

- Approximately 1.03 miles (5,433 feet) of new temporary roads would be used to access all or portions of seven M Units. All of these temporary roads would be closed (ripped and mulched, as needed) following thinning.

- Approximately 0.98 mile (5,177 feet) of former logging access routes would be re-opened (vegetation removed and bladed) to access all or portions of five M Units. These routes would be water-barred and closed immediately after thinning is completed.

- Five short spurs, each less than 100 feet long, would be bladed for tractor or cable yarding operations in two units.

- Existing landings will be used.

### 1.2.3 Alternative C: No New Temporary Roads Constructed

Alternative C responds to public concerns regarding the environmental and economic effects of constructing new temporary roads. Alternative C is similar to the Proposed Action but approximately 1.03 miles (5,443 feet) of new temporary roads identified in the Proposed Action would not be constructed. As a result, no fuels treatments would occur in portions of seven M Units. This reduces the total acres of treatments in M Units from 931 acres under Alternative B to 832 acres in Alternative C. Fuels treatments could not be carried out in those M Units because of excessive treatment costs, high existing dead crown fuel loadings, and potential heat damage to the overstory if these untreated units were prescribed burned.

Under Alternative C, the FRZs would continue to total 8,291 acres; however, 99 acres in M Units would remain untreated. The total number of acres treated by tractor yarding would remain at 361 acres; however, the acres of cable yarding would be reduced from 570 acres under Alternative B to 471 acres under Alternative C. Reducing acres of M Units treated would also reduce the number of acres treated in two Rx Units because excessive fuels remaining in M Units would preclude safely burning portions of the two Rx Units. Six-foot-wide control lines would be constructed around the perimeter of those untreated areas to keep prescribed burns out of those portions of Rx Units. There would be no changes in the miles of emergency access routes treated, transportation plan, or RPMs.

## 1.3 Significant Issues

Public and agency comments received during collaboration and scoping efforts did not identify any significant issues related to soils. The only significant issue was in regard to construction of new temporary roads to access some of the treatment units. Alternative C was developed in response to public concerns regarding the environmental and economic impacts of constructing new temporary roads.

## 1.4 Regulatory Framework

**Soils.** The following laws, regulations, management plans, Forest Service Manual (FSM), and Forest Service Handbooks (FSH) provide the overall direction for soil resource investigations, standards and guidelines, and reasons for conducting field investigations:

- *National Environmental Policy Act (NEPA) of 1969*
- *Forest and Rangeland Renewable Resources Planning Act of 1974*
- *National Forest Management Act (NFMA) of 1976*
- *Soil and Water Conservation Act of 1976*
- FSH 2509.18 Soil Management Handbook Region 5 Supplement No. 2509.18-95-1
- FSH 2509.18 Chapter 3 Pacific Southwest Soil Interpretations
- FSH 2509.22 Soil and Water Conservation Handbook, Chapter 10 Water Quality Management for National Forest Lands in California (Best Management Practices)
- FSH 2509.22 Soil and Water Conservation Handbook Chapter 50 Soil Erosion Hazard Rating R5 Amend. 2, 1990
- FSM 2552 Soil Management Support Services
- Klamath LRMP

## 1.5 Methodology

A unit selection strategy was used to determine which units should have site-specific data collected. Selection was based on soil sensitivity and type of management activities planned. Units that had the potential to be treated with ground-based yarding systems were a priority for field review. All proposed ground-based yarding units, 50 percent of the cable units, and most of those units proposed for mastication or roadside hazard tree removal were field reviewed. Field observations were done by making one to three traverses across each treatment unit, depending on the unit's shape and size. Site and soil data were collected from plots along these traverses. The following types of existing site disturbances were identified in the field during the traverses: landings, skid trails, full-bench skid trails, skid-trail displacement, old roads, and skid roads. The level of detrimental soil disturbance was estimated for each soil disturbance type. This data was used to develop the existing condition, as well as the cumulative effects of the Proposed Action. Soil data noted during the field assessment included shallow soil areas, rock outcrops, areas of surface rock, rock lithology, general soil depth, and taxonomic features. Existing soil survey information was used unless field observations revealed significant differences between mapped soils and the actual site-specific soils.

Also included with each transect or ocular estimate was a general discussion of the treatment unit that addressed issues such as potential mass instability areas, sensitive riparian locations, or the feasibility of the treatment method proposed. These observations helped develop specific management recommendations for the assessed treatment unit.

### 1.5.1 Analysis Methods and Assumptions

Numerous data sources were provided by Klamath National Forest staff and incorporated into this analysis; some of the more relevant information specific to the soil resource included the following:

- Klamath National Forest Area Soil Survey (Foster and Lang 1994),
- Soil profile descriptions developed during the active soil survey located within the Assessment Area,
- Examples of recent soil resource assessments developed for the environmental analysis process,
- Klamath LRMP Standards and Guidelines pertaining to the soil resource,
- Estimates of basic erosion rates based on the Universal Soil Loss Equation (USLE) (Laurent 2001), and
- Soil RPMs commonly used on the Klamath National Forest (Laurent 2004).

Computer-based Geographical Information Systems (GIS) technology was used to organize and synthesize digital data provided by both the Klamath National Forest and the contractor’s (RED, Inc. Communications) GIS specialist. By incorporating numerous digital databases (such as soils, geology, slope and aspect, existing land instability, the preliminary treatment units, and 1-meter resolution digital aerial imagery), the existing condition begins to emerge. Although not a substitute for field-level assessments, this approach does provide baseline information that defines the level and extent of analysis necessary to define the environmental consequences of the Proposed Action.

Once generated, digital background images of the Assessment Area were incorporated into a Global Positioning System field data logger prior to field work. This technology was especially vital in the location of treatment units, roads and skid trails, and other areas of concern such as unstable landforms and riparian complexes.

### 1.5.2 Scope of the Analysis

**Analysis Area.** The soil resource analysis area is very site specific. Unlike the broader watershed approach, individual treatment units were evaluated and the data correlated. At the time of field data collection (June and July of 2008), the soil resource analysis area was approximately 30,000 acres. Map A-1 (Appendix A of this document) graphically portrays this analysis area.

**Analysis Period**. The timeframe for the effects analysis is less than 10 years for short-term effects and up to 75+ years for long-term effects on soil productivity.

### 1.5.3 Definitions for Terms Used in this Resource Section

**Coarse Woody Debris (CWD)** — Large woody material (downed logs) that are at least 20 inches in diameter and 10 feet long. Ideally, these logs are well distributed across the treatment unit or landscape and represent the various LOG decomposition classes:

**Log Decomposition Classes** —

Class I: Fresh, hard logs or trees with little soil contact.
Class II: Hard logs in partial contact with the soil.
Class III: Intact, soft logs in full contact with the soil.
Class IV: Intact to fractured cubical heartwood and bark, mostly buried in the soil.
Class V: Totally buried, fractured cubical heartwood (low mound on the forest floor).

**Compaction Hazard** — Susceptibility of the soil to compaction based on soil properties such as soil texture in the upper 12 inches, percent by volume of cobbles and stones, percent organic carbon in the upper 6–12 inches, duff thickness in inches, and soil structure. Compaction susceptibility fluctuates with the percent of soil moisture.

**Detrimental Disturbance** — Changes in soil properties and conditions that would result in significant change or impairment of the productivity potential, hydrologic function, or buffering capacity of the soil. Generally occurs when threshold values are exceeded.

**Erosion Hazard Rating (EHR)** — Relative risk of accelerated sheet and rill erosion. Factors included in this rating are soil erodibility (soil texture and aggregate stability), runoff production (climate, water movement in the soil, runoff from adjacent lands, and slope length), and soil cover (quantity and quality) and soil cover distribution.

**Forest Survey Site Class** — Estimate of a site's suitability for commercial conifer production. Based on soil and environmental factors such as soil depth, parent material, water holding capacity of the soil profile, precipitation, temperature, aspect, pH, compaction, and depth to a standing water table.

**Soil Cover** — Amount of surface area covered by low-growing vegetation (grasses, forbs, and prostrate shrubs), plant litter and debris, and surface rock fragments larger than 0.75 inch.

**Soil Displacement Hazard** — Susceptibility of the soil to mechanical displacement. This assessment is based on soil properties such as surface texture, organic carbon in the surface 6 inches, thickness of the duff layer, percent coarse fragment content by volume, soil structure, bulk density, and cohesion. Generally defined as a loss of either 2 inches or 0.5 inch of the humus enriched topsoil, whichever is less, from a 1-meter (3.3 feet) square or larger area.

**Soil Quality Analysis Standards (SQAS)** — Established in June 1995 (USFS 1995b), these standards focus on protection and improvement of National Forest System lands for continuous forest and rangeland productivity and favorable water flows. Direction for Soil Quality found in the handbook supplements describes the standards and thresholds, provides information about monitoring, examples of practices and mitigation measures, direction for application of the standards, and responsibilities for meeting them.

### 1.5.4 Intensity of Effects

"Intensity" refers to the severity of effects or the degree to which the action may adversely or beneficially affect a resource. The intensity definitions used throughout this effects analysis are described below.

**Negligible.** Soils would not be affected, or the effects on soils would be below or at levels of detection. There would be no discernable effect on the rate of soil erosion and/or the ability of the soil to support native vegetation.

**Minor.** The effects on soils would be detectable, but effects on soil productivity or fertility would be small. There would be localized, detectable effects on the rate of soil erosion and/or the ability of the soil to support native vegetation.

**Moderate.** The effect on soil productivity or fertility would be highly variable due to differences in soil type, topography, and site-specific treatments. The rate of soil erosion and/or the ability of the soil to support native vegetation would be measurably changed, especially within the main skid trail corridors and landings. Detrimental disturbance in the form of soil compaction (over 10 percent decrease in soil porosity) and displacement (greater than 15 percent loss of soil organic matter in upper 12 inches of soil) are approaching threshold values.

**Major.** The effect on soil productivity or fertility would be highly variable due to differences in soil type, topography, and site-specific treatments, but readily apparent and would substantially change the character of the soils over a large area within the treatment unit. The actions would have substantial, highly noticeable influence on the rate of soil erosion and/or the ability of the soil to support native vegetation. The impacts would be most noticeable within main skid trails, landings, and cable corridors. Detrimental disturbance in the form of soil compaction (over 10 percent decrease in soil porosity) and displacement (greater than 15 percent loss of soil organic matter in upper 12 inches of soil) would exceed threshold values, and most likely require on-site mitigation.

### 1.5.5 Measurement Indicators

There are three measures (or indicators) that were used to assess current soil conditions in the Assessment Area. The same indicators were used to assess effects of taking no action and effects that could result from implementation of either Alternative B or Alternative C.

1. Soil cover,
2. Detrimental disturbance (detrimental compaction and detrimental soil displacement), and
3. Organic matter (includes fine organic matter and CWD).

#### Indicator: Soil Cover

Effective ground (soil) cover is necessary to prevent accelerated soil erosion. Soil cover dissipates the energy of falling raindrops by intercepting them before they strike the soil surface.

#### Indicator: Detrimental Disturbance (Detrimental Compaction and Detrimental Soil Displacement)

Ground-based management activities can potentially reduce porosity or compact the soil. Soil porosity is the volume of voids compared to solids for a given volume of soil. The porosity of the soil is important for gas exchange and water movement into and through the soil. The actual effects depend upon many soil, equipment, and operational factors.

#### Indicator: Organic Matter (Includes Fine Organic Matter and CWD)

Surface organic matter serves as a nutrient reservoir for plants and other organisms that inhabit the soil. Because it is incorporated into the soil, it contributes positively to water-holding capacity, nutrient retention, infiltration, and hydrologic function of the soil. Surface organic matter acts as a buffer to moderate extremes of soil temperature. CWD contributes to forest biodiversity and ecosystem function.

#### SQAS and the Klamath LRMP Soil Standards and Threshold Values

The effects of individual management activities on the soil resource (soil productivity) were assessed for detrimental soil disturbance (soil compaction and soil displacement) and organic matter removal using the following Forest Service Region 5 SQAS and the Klamath LRMP Standards and Guidelines. The six standards (refer to Table 1) contain measurable indicators, most of which can be defined as threshold values. These representative values were used in the environmental analysis as an indication of the effects on the soil resource that could result from implementation of Alternative B or C or the no-action alternative (Alternative A). The following is a summary, by Standard and Guideline, of the environmental indictors:

## 1.6 Affected Environment (Existing Conditions)

Soils in the Eddy Gulch LSR Project Assessment Area were dominantly developed from metasedimentary or metaschist parent materials, with inclusions of serpentinized peridotite (ultramafics) and metavolcanics or andesites. The Assessment Area is characterized by gently to very steeply sloping topography, including stabilized landslide benches and scarps. The major soils formed from the metasedimentary materials ranged from the shallow Woodseye family to the moderately deep Jayar and deep Clallam families. Of lesser extent are the Inville and Wintoner families that developed in the metavolcanics, and the lithic mollic haploxeralfs-Dubakella families complex that developed from the ultramafics. Soil textures in the Assessment Area were dominated by gravelly to very gravelly loams, sandy loams, or sandy clay loams.

**Table 1.** Soil standards and threshold values.

| Soil Properties | Environmental Indicators | Conditions and Associated Thresholds |
|---|---|---|
| **Standard 1.** Maintain soil productivity by retaining both organic matter on the soil surface and organic matter in the soil profile | | |
| Long-term site productivity | Surface soil erosion ≤2,000 pounds (lbs) / acre | Maintain surface soil cover at 70%–80% |
| | Retain fine organic matter | 50% of cover in <3-inch diameter material |
| | Organic matter fraction in upper 12 inches of soil | Maintain at least 85% |
| | 85% of treatment unit to meet SQAS for total porosity, soil displacement, soil organic matter, hydrologic function, erosion and buffering capacity | ≤15% of treatment unit in primary skid trails, landings, and cable corridors |
| **Standard 2.** Minimize changes in the site's ability to cycle nutrients and maintain site productivity | | |
| Long-term site productivity | Nutrient cycling potential | Maintain surface soil cover at 70%–80% |
| | | 50% of surface cover in <3-inch diameter materials |
| | | Maintain at least 85% of organic fraction in upper 12 inches of soil |
| | | Maintain 30%–50% of existing duff mat (spatially) |
| **Standard 3.** Retain CWD and protect existing CWD | | |
| Long-term site productivity | Retain CWD. Logs at least 20 inches in diameter and 10 feet long | At least 5 well-distributed logs per acre in various decomposition classes |
| **Standard 4.** Minimize soil and litter disturbances resulting from ground-based yarding and heavy equipment | | |
| Long-term site productivity | Soil and surface litter disturbance | ≤15% of treatment unit in primary skid trails, landings, and cable corridors |
| **Standard 5.** Prescribed fire should be planned to minimize the consumption of litter and CWD | | |
| Long-term site productivity | Organic matter (<3-inch fraction), materials >3 inches, including CWD | 50% retention in less than 3-inch materials with 20%–30% in other organic fraction |
| **Standard 6.** Maintain the functionality of the soil ecosystem by maintaining a site's ability to cycle nutrients and maintaining the biological components (fungi, arthropods, bryophytes) | | |
| Long-term site productivity | Retain fine organic matter | ≥50% of surface cover in <3-inch diameter material, and 30%–50% retention of surface duff |
| | 85% of treatment unit to meet SQAS for total porosity, soil displacement, soil organic matter, hydrologic function, erosion and buffering capacity | ≤15% of treatment unit in primary skid trails and landings |

**Notes:** ≤ less than or equal to; ≥ greater than or equal to; < less than; > greater than

## 1.6.1 Soil Cover

Calculated from approximately 1,200 data plots, 28.7 percent of the Assessment Area has been disturbed from past activities, excluding system roads. Approximately 2.6 percent of this disturbance exceeds the Forest's soil quality thresholds for detrimental disturbance. The majority of the disturbance was in main or constructed skid trails and landings. Percent soil cover range was 10–100 percent (Klamath LRMP Standards and Guidelines for effective soil cover ranges between 70 and 80 percent), with an overall average of 72 percent in the proposed treatment units. There was a variation in soil cover between transects sampled, but when averaged with other transects, the forest standard was met in most cases. The following M Units averaged well below the 70 percent ground cover minimum: 19 (cable), 21 (cable and tractor), 24 (cable), 35, and 36. Slope range was 2–80 percent, with an average percent slope of 42 percent. Using calculated soil erosion rates for average soil cover and slope developed for the Klamath National Forest (Laurent 2001), the estimated soil erosion rates ranged 0.4–0.8 ton per acre per year. Based on the small percentage of sheet and rill erosion observed during the field assessment, the actual range would be closer to 0.15–0.25 tons per acre per year.

### 1.6.2 Detrimental Disturbance

The current detrimental disturbance threshold (in existing landings and skid trails and new temporary roads) is 15 percent. If skid trails and landings occupy greater than 15 percent of a unit, then the unit exceeds the detrimental disturbance threshold. Table B-1 (Appendix B) shows the current extent of detrimental disturbance (mainly skid trails and landings) within the treatment units. At the time of the field assessment, M Unit 21 exceeded threshold standards, while M Units 17, 22, 30, and 80 were at or near threshold values.

### 1.6.3 Organic Matter

The Region 5 Supplement to the Soil Management Handbook recommends that 50 percent cover of surface fine organic matter (less than 3-inch diameter fraction) should be retained in all stands. Table B-1 (Appendix B) displays the results of percent soil cover, a portion of which is made up of fine organic matter and CWD. Currently, on average, all treatment units would meet the recommended threshold for fine organic matter.

Standards and Guidelines for down wood (CWD) in the Eddy Gulch LSR Project are based on Klamath LRMP direction. These Standards are to “generally retain and protect over the treatment unit at least five well-distributed logs of various decomposition classes per acre.” The Klamath LRMP incorporates the Region 5 Supplement to the Soil Management Handbook (USFS 1995b), which recommends that large woody material occurs as five well-distributed logs per acre, representing the range of decomposition classes (refer to Section 1.5.3 above). Desired logs would be at least 20 inches in diameter and 10 feet long. These thresholds may be supplemented with local analyses.

The historic median composite fire-return intervals for the Northern Klamath Mountains varies by elevation, aspect, and tree species composition, but generally ranged from 8 years on south-facing slopes to 16.5 years on east-facing slopes (Taylor and Skinner 1998). This frequency of fire would have likely consumed much of the CWD, particularly on south-facing slopes, which comprise most of the Eddy Gulch LSR Project Assessment Area. Coarse woody material was assessed on an average logs-per-acre basis, as well as by decomposition class. Table B-2 (Appendix B) displays the results of field data collected on a treatment-unit basis. In virtually all of the treatment units assessed, coarse woody material was lacking spatially and in the range of decomposition classes. The importance of CWD to forest biodiversity and ecosystem function is well established (Stevens 1997). Studies in the Oregon Cascades reported the total CWD mass was almost twice as high in landscapes having infrequent, stand-replacing fire regimes, as in landscapes having a moderately frequent, mixed-severity fire regimes (Wright et al. 2002). The nature and timing of disturbances (such as fire) plays a key role in the distribution and quality of CWD (Spies et al. 1988).

Appendix B summarizes data collected during July and August of 2008. Table B-1 shows the current effective ground cover assessment in the treatment units and includes the treatment unit by prescription and method, soil cover percentage, erosion hazard rating, percent detrimental disturbance, and slope distribution. Table B-2 lists (by treatment unit) CWD distribution and decomposition class. Table B-3 is a compilation of soil survey information and is summarized by treatment unit. Information includes field-verified soil map unit, soil depth group, surface textures, existing and maximum erosion hazard rating, compaction hazard, soil displacement hazard rating, suitability for subsoiling, and soil productivity based on Forest Survey Site Class.

## 1.7 Desired Conditions

The desired soil conditions are where soil cover is 70–80 percent, most of the duff layer is sufficiently intact in order to maintain a functioning biological ecosystem, existing CWD is maintained and potentially increased over time through natural processes, detrimental soil disturbance is less than 15 percent of the area dedicated to growing vegetation, and soil erosion rates are less than 2,000 pounds per acre.

## 1.8 Environmental Consequences

This section describes the anticipated effects on the environmental indicators. As can be seen in that section, many of the conditions and thresholds are the same for the various indicators; therefore, the effects on the soil resource from the alternatives were synthesized into three primary indicators (refer to Section 1.5.5 above).

### 1.8.1 Alternative A: No Action

#### 1.8.1.1 Indicator: Soil Cover

**Direct and Indirect Effects**

A wildfire would result in loss of soil cover, which would adversely affect soil productivity and water quality. The continued accumulation of organic matter on the forest floor would contribute to increased ground fuel loads. No mechanical treatment or prescribed fire would occur, leading to increased fire severity and intensity during a fire event. Fire simulation models predict that under 90th percentile weather conditions, approximately 7,200 acres could potentially be affected by various burn intensities. As a result of decreased soil cover following a fire, the risk of soil erosion would increase on forested hill slopes. Soil erosion would contribute to a loss of soil nutrients and favorable growth medium on site and increased sediment delivery to stream channels.

**Conclusion.** There would be a higher risk of wildfire occurrence because no treatments would be implemented to reduce fuel loading. A wildfire would create short-term adverse effects on soil productivity and water quality due to the immediate loss of soil cover, causing a measurable increase in surface erosion and delivered sediment.

**Cumulative Effects**

A loss of soil cover would adversely affect long-term soil productivity. Soil cover can be expected to increase as organic materials accumulate on the soil surface. However, a future high-severity wildfire would likely consume organic materials on the forest floor and reduce soil cover below the Klamath LRMP Standard in the affected area. If soil cover is reduced to bare soil following a wildfire, the soil would be more susceptible to erosion. In addition, fire can volatilize organic compounds in the soil, some of which migrate down a temperature gradient and condense on soil particles below the surface. As a result, a non-wettable layer can develop below the surface. Creation of a water-repellant layer has been described as a “tin roof” effect because infiltration rates are greatly reduced at the water repellant layer. During a precipitation event, soil above the non-wettable layer can become saturated and erode downslope due to rill formation and raindrop splash. Factors such as soil texture, slope, and post-burn precipitation intensity can affect the degree and type of post-fire erosion. Dry, coarse-grained soils are particularly susceptible to this type of fire-induced hydrophobic condition (not absorbing or mixing easily with water) (USFS 2005).

**Conclusion.** There would be a higher risk of wildland fire occurrence because no treatments would be implemented to reduce fuel loading. Taking no action would lead to long-term adverse effects on soil productivity in the uncontrolled fire-affected areas. Recovery from measurable surface erosion and subsequent delivered sediment would take approximately 5–6 years (USFS 1981). Full recovery of the organic fraction of ground cover would take decades.

### 1.8.1.2 Indicator: Detrimental Disturbance (Detrimental Compaction and Detrimental Soil Displacement)

#### Direct and Indirect Effects

The extent and degree of detrimental disturbance (especially detrimental compaction) are expected to decline slowly over time. This process may take several decades in forested environments (USFS 2002). Root penetration, extension, and decay, along with the burrowing action of soil-dwelling animals, would contribute to the increase in soil porosity and decrease in compaction. In addition, incorporation of organic matter into the soil by biological processes (such as invertebrate and vertebrate soil mixing and decomposition) would help reduce soil bulk density and the degree of compaction in affected areas over time. As the degree and extent of soil compaction is reduced slowly, soil productivity would increase. Soil infiltration would be enhanced as porosity is increased. Increased infiltration may reduce surface runoff and subsequent erosion and sedimentation.

**Conclusion.** There would be a higher risk of wildland fire occurrence because no treatments would be implemented to reduce fuel loading. The effects of soil compaction would remain short term, localized, and negligible, mostly related to minor activities outside those areas identified under the existing condition. In the event of a future wildfire of moderate severity (up to 40 percent of an area where surface litter and humus have been consumed and surface soil horizons subjected to intensive heating), severe soil heating would cause physical changes in soils, including a reduction in soil porosity, mirroring the effects of soil compaction (Debano et al. 2005). This affect would occur primarily in locations where 1,000-hour fuels exceed 5–10 tons per acre (the current condition for the Eddy Gulch LSR Project Assessment Area is 5–30 tons per acre). This would lead to short-term adverse effects on soil productivity and water quality due to the immediate loss of infiltration capacity, causing a measurable increase in surface erosion and delivered sediment.

#### Cumulative Effects

The extent and degree of detrimental disturbance are expected to continue to decline in the absence of future timber harvests, road construction, or other ground-disturbing activities.

**Conclusion.** Recovery from detrimental disturbance, especially soil compaction would continue in areas previously affected, with short-term localized negligible compaction occurring due to activities such as roadside hazard tree removal. There would be a higher risk of wildfire occurrence because no treatments would be implemented to reduce fuel loading, leading to long-term adverse effects on soil productivity and water quality due to the loss of infiltration capacity and causing a measurable increase in surface erosion and delivered sediment. Recovery from measurable surface erosion and subsequent delivered sediment would take approximately 5–6 years (USFS 1981).

### 1.8.1.3 Indicator: Organic Matter (Fine Organic Matter and CWD)

#### Direct and Indirect Effects

A wildfire would result in loss of organic matter, which would adversely affect soil productivity and water quality. Surface organic matter, including fine organic matter and CWD, can be expected to increase as organic materials accumulate on the soil surface.

**Conclusion.** The continued accumulation of organic matter on the forest floor would contribute to increased ground fuel loads, leading to increased fire severity and intensity during a fire event. Based on fire-return intervals stated above in Section 1.6.3, the loss of surface organic matter and CWD would have short-term adverse effects on both soil productivity and water quality because organic matter and CWD are essential elements for both soil fertility and ground cover.

#### Cumulative Effects

A loss of organic matter would adversely affect long-term soil productivity. Surface organic matter can be expected to increase as organic materials accumulate on the soil surface. Referring to the earlier discussion of direct and indirect effects for detrimental disturbance, areas within a wildfire that are subjected to moderate fire intensity would have at least 40 percent of the affected area where all surface litter and humus would be consumed and would likely fall below the 50 percent desired condition for fine organic matter (USFS 1981). Under the moderate intensity scenario, it can be expected that some passive crown fire would also occur, leaving pockets of scorched trees and shrubs. Within several months, a thin layer of needle cast and leaf fall from scorched trees would begin to increase the percent of organic matter in the affected areas (Pannkuk and Robichaud 2003). Fires short-circuit the decomposition pathway, rapidly oxidizing organic matter and releasing available nutrients to plants and soil organisms. When organic matter burns, essential nutrients can be transferred to the atmosphere through volatilization and ash convection (Raison et al. 1985). Nutrients may also be lost following fire due to leaching (Miller et al. 2006). Some nutrients are returned relatively quickly by terrestrial cycling pathways. Compared to the pre-burn condition, a large reduction in the organic matter covering the soil would reduce the insulating effect this layer has on soil temperature. Under a reduced organic layer, soils experience greater temperature extremes. Soil temperatures may be elevated for months or years, depending on the degree of organic matter consumed by a wildfire (Debano et al. 2005). Such changes in the soil temperature regime would affect rates of biological activity in the soil, resulting in altered nutrient cycling regimes.

**Conclusion.** There would be a higher risk of wildland fire occurrence because no treatments would be implemented to reduce fuel loading, leading to long-term adverse effects on soil productivity in the areas affected by uncontrolled wildfire. Recovery from measurable surface erosion and subsequent delivered sediment would take approximately 5–6 years (USFS 1981), but full recovery of the organic fraction of ground cover would take decades. The amount of CWD as a result of fire, would begin to increase due to snag fall and would further increase total fuel loads.

### 1.8.2 Alternative B: Proposed Action

By following the Standards contained in the Klamath LRMP, and staying at or below the disturbance thresholds described in Section 1.6.2, there would be a low risk that soil productivity would be impaired. Alternative B proposes a moderate amount of mechanical treatments, so there would be a measurable amount of ground disturbance from equipment, skid trails, and landings. A combination of soil protection measures, normal erosion control, and conduct of logging timber sale contract provisions, are expected to provide adequate soil protection so that productivity is maintained.

#### 1.8.2.1 Indicator: Soil Cover

**Direct and Indirect Effects**

It is difficult to accurately predict treatment effects on effective ground cover, and is reliant on professional experience and available post-harvest evaluations in similar settings Thinning operations may increase activity fuels and effective ground cover, while pile burning and underburning would reduce the cover of these materials. Mastication would increase soil cover as materials are broadcast away from the equipment. Post-activity monitoring (from 1998 to 2004) on various treatment areas on the Klamath National Forest had a percent ground cover range between 45 and 96 percent, with an overall average of 79 percent (Laurent 2007). Present percent soil cover average for all treatment units evaluated in the Eddy Gulch LSR Project Assessment Area is 72 percent. Comparing this value to the 79 percent average for previously monitored areas on the Klamath National Forest, one could reasonably expect soil cover to remain static or slightly increase (due to needle cast and leaf fall) for the mechanically treated units that will also be underburned. Presently, M Units 19 (cable), 21 (cable and tractor), 24 (cable), 35, and 36 fall well below the 70 percent desired ground cover standard and would likely see further reductions. Additionally, M Units 3, 4 (cable and tractor), 15 (cable and tractor), 17 (cable), 23, 38 (cable), 52, 54, and 65 are border-line and would likely fall below the 70–80 percent standard after treatment. For the FRZs, especially those areas that are to be masticated, percent ground cover would likely increase. A 2001 masticated plantation in the Shadow Creek area averaged 88 percent ground cover after completion (Laurent 2007). Because of the size and landscape diversity of the underburn-only treatment units (the Rx Units), the introduction of low-intensity prescribed fire would create a burn mosaic of variable ground-cover percentages. Overall, the entire Assessment Area would meet or exceed ground cover standards. Ground cover in all treatment units would recover quickly as leaf fall and needle cast contribute to the litter layer. A reduction in effective ground cover would increase the risk of erosion in affected areas. The amount and type of erosion depends on the character of the area. For example, patches of ground cover across a large area would be more effective at intercepting surface water than large areas devoid of cover. Table B-4 discusses recommended soil cover levels and post-treatment erosion hazard rating.

**Conclusion.** Treatment activities would result in short-term localized negligible adverse effects on soil cover because the Proposed Action is designed to limit or restrict ground disturbance. This is particularly true with the use of prescribed fire because it is used under a more controlled environment, lessening the probability of higher intensity burns. The effects of wildland fire, on the other hand, would create long-term adverse effects on soil productivity and water quality due to the immediate and substantial loss of soil cover, causing a measurable increase in surface erosion and delivered sediment.

### Cumulative Effects

A reduction in ground cover, as a result of the proposed treatments, would likely be short-lived because nearby overstory trees will remain intact. Over time, litter from trees and shrubs would contribute to the development of effective ground cover in bare areas. A wildfire entering a treated area would result in a greater reduction in ground cover than the proposed treatments alone. See the soil cover discussion under Alternative A above (Section 1.8.1.1).

**Conclusion.** Effects on soil cover related to the Proposed Action would be significantly reduced in less than 5 years, with the exception of some of the treatment units mentioned in the earlier narrative, where the effects would be long term but localized and negligible.

## 1.8.2.2 Detrimental Disturbance (Detrimental Compaction and Detrimental Soil Displacement)

### Direct and Indirect Effects

**Implementation of the Proposed Action would not significantly increase detrimental disturbance.** The Eddy Gulch LSR Project includes project design criteria and other soil protection measures to minimize detrimental soil compaction and detrimental soil displacement. However, the use of heavy ground-based equipment and frequent stand entries would increase the potential for soil compaction (Powers 2002). Compacted and heavily disturbed ground can cause soil productivity to decline over time (Grigal 2000). Recent research suggests however, that compaction does not necessarily lead to productivity declines (Gomez et al. 2002; Powers et al. 2005). These studies show that in California's Mediterranean climate, the effects of compaction are dependent on soil texture. The studies show that compaction of sandy loam and coarser-textured soils can actually increase productivity because compaction increases available water-holding capacity. Compaction in loamy soils can have a neutral or insignificant effect, but in clayey soils, compaction has a detrimental effect. Since the project soils are mostly gravelly sandy loams to clay loams, the applicable standard limiting skid trails and landings to 15 percent of an area are relatively conservative in protecting the soils from productivity loss due to compaction.

For any mechanical harvest, the extent and degree of detrimental soil disturbance (especially compaction) depends on site-specific soil conditions such as texture and stoniness, moisture content at the time of operations, and harvest equipment features. For the Eddy Gulch LSR Project, the detrimental disturbance threshold is 15 percent. If skid trails and landings occupy greater than 15 percent of a treatment unit, then the unit exceeds the detrimental disturbance threshold. As part of the project design, units that are predicted to exceed 15 percent would be reevaluated after treatment. Currently, the following M Units are at or exceed the 15 percent threshold standard: 15, 17, 21, 22, 30, and 80. Some compaction (reduced soil porosity) would occur in other areas where equipment makes one or two passes, but this increased compaction would not exceed threshold values (Powers 2002). Subsoiling has been shown to be an effective method of reducing compaction and restoring porosity to the soil (Andrus and Froehlich 1983; Kolka and Smidt 2004). Mechanical ground disturbance in the remaining treatment units has a high probability of not significantly impairing soil productivity because only those areas with slopes generally less than 35 percent would be treated using ground-based equipment.

**Conclusion.** Mechanical treatments would result in short-term site-specific adverse negligible effects on the soil resource as a result of heavy equipment operations outside of existing skid trails and landings. This action alternative will protect long-term soil productivity by measurably reducing fire severity through the reduction of existing fuel loading.

#### Cumulative Effects

Long-term soil productivity would be maintained with implementation of the Proposed Action. With the implementation of project design criteria, especially the use of existing skid trails and landings, all treatment units are expected to remain at existing levels. Table B-5 displays the cumulative detrimental disturbance by treatment unit.

**Conclusion.** Through the use of existing skid trails and landings (especially when landings are existing road surfaces), the total affected area would remain at background levels, and overall adverse effects would be long term but localized and negligible.

### 1.8.2.3 Organic Matter (Fine Organic Matter and CWD)

#### Direct and Indirect Effects

It can be difficult to accurately predict treatment effects on surface fine organic matter or CWD, and is reliant on professional experience and available post-harvest evaluations in similar settings. Mastication treatments are expected to increase cover of organic matter as masticated debris is broadcast away from the equipment. Underburn treatments may reduce organic matter, but burning is expected to occur under prescribed conditions that would not result in complete combustion of the duff and litter layers, or measurable reduction in existing CWD. Pile burning would decrease surface fine organic matter locally, but over time, adjacent trees and shrubs would provide litter to cover the burned area. Fire line construction around prescribed burn areas and hand piles would create bare soil conditions. Cover of fine organic matter is expected to remain within acceptable threshold values. Local reductions in surface fine organic matter would have local short-term minor adverse effects on soil temperature. Large reductions in organic matter would result in greater temperature extremes in the soil, as previously discussed in Section 1.8.1.3. Removal of canopy cover may result in increased temperatures at the forest floor, as well as reduced moisture content of surface fine organic matter (Erickson et al. 1985).

**Conclusion.** Implementation of the Proposed Action would result in short-term negligible adverse effects on the soil resource due to localized removal of organic matter by heavy equipment and prescribed fire. Without implementation, continued accumulation of organic matter on the forest floor would contribute to increased ground fuel loads, which may lead to increased fire severity during a fire event. Based on the fire-return intervals stated in above in Section 1.6.3, the loss of surface organic matter and CWD would have short-term adverse effects on both soil productivity and water quality because organic matter and CWD are essential for both soil fertility and ground cover.

#### Cumulative Effects

Loss of organic matter would adversely affect long-term soil productivity. Following implementation of the proposed treatments, organic matter on the soil surface would decrease in some areas due to mechanical displacement or consumption by fire, while organic matter would increase in other areas due to additions of masticated material, needle and leaf cast, and some increase in CWD due to the collapse of standing dead or dying trees. This may result in greater heterogeneity (diversity) of the forest floor. Patches of organic matter would provide habitat for soil invertebrates and microorganisms, and patches of bare areas would be susceptible to local erosion. Increases in woody materials on the forest floor due to mastication may cause short-term changes in decomposition, carbon, and nutrient dynamics in affected areas. Microorganisms that decompose wood would immobilize nitrogen and other nutrients while decaying the woody material. As the wood decomposes, those nutrients would be released and made available to plants and other organisms (Swift 1977). Microclimate changes at the forest floor (due to reduced canopy cover) can alter rates of decomposition and nutrient turnover in the surface fine organic matter of harvested stands (Erickson et al. 1985).

**Conclusion.** The effects of mechanical treatment and prescribed fire on the organic matter component would have localized minor to negligible adverse effects on the soil resource due to the continuous recruitment of organic matter from needle cast, leaf fall, and snags falling to the ground. This action alternative will protect long-term soil productivity by measurably reducing fire severity through the reduction of existing fuel loading.

## 1.8.3 Alternative C: No New Temporary Roads Constructed

By following the standards contained in the Klamath LRMP, and staying at or below the disturbance thresholds described in Section 1.6.2, there would be a low risk that soil productivity would be impaired. Alternative C would have a moderate amount of mechanical treatments, so there would be a measurable amount of ground disturbance from equipment, skid trails, and landings. A combination of soil protection measures in the project design criteria, normal erosion control and conduct of logging timber sale contract provisions are expected to provide adequate soil protection so that productivity is maintained.

### 1.8.3.1 Indicator: Soil Cover

#### Direct and Indirect Effects

Implementation of this alternative would treat slightly less acres than Alternative B by mechanical methods, but the overall fuel reduction would be similar.

**Conclusion.** Treatment activities would have localized short-term negligible effects on soil cover because, as with Alternative B, Alternative C is designed to limit or restrict ground disturbance. This is particularly true with the use of prescribed fire because it is used under a more controlled environment, lessening the probability of higher intensity burns. The effects of wildfire, on the other hand, would create long-term adverse effects on soil productivity and water quality due to the immediate and substantial loss of soil cover, causing a measurable increase in surface erosion and delivered sediment.

#### Cumulative Effects

A reduction in ground cover as a result of the proposed treatments is likely to be short-lived because nearby overstory trees would remain intact. Over time, litter from trees and shrubs would contribute to the development of effective ground cover in bare areas. A wildfire entering a treated area would result in a greater reduction in ground cover than the proposed treatments alone. See the soil cover discussion under Alternative A (Section 1.8.1.1).

**Conclusion.** Effects on soil cover related to the Alternative C would be significantly reduced in less than five years, with the exception of some of the treatment units mentioned in the earlier discussion in Alternative B, where the effects would be long term but localized and negligible.

### 1.8.3.2 Detrimental Disturbance (Detrimental Compaction and Detrimental Soil Displacement)

#### Direct and Indirect Effects

Implementation of Alternative C would not significantly increase detrimental disturbance. This alternative would treat fewer acres by mechanical methods because new temporary roads would not be constructed, resulting in less potential for disturbance in the form of soil compaction and measurable soil displacement.

**Conclusion.** Mechanical treatments would result in site-specific short-term negligible adverse effects on the soil resource as a result of heavy equipment operations outside of existing skid trails and landings. Detrimental disturbance is estimated to be approximately 5–8 percent less than under Alternative B.

#### Cumulative Effects

Long-term soil productivity would be maintained with implementation of Alternative C. With the implementation of project design criteria, especially the use of existing skid trails and landings. All treatment units are expected to remain at existing levels.

**Conclusion.** Through the use of existing skid trails and subsoiling of identified areas that exceed the 15 percent skid trail density standards, total affected area would be reduced, and overall adverse effects would be long term but localized and negligible. Through the use of existing skid trails and landings (especially when landings are existing road surfaces), total affected area would remain at background levels, and overall adverse effects would be long term but localized and negligible.

### 1.8.3.3 Indicator: Organic Matter

#### Direct and Indirect

Implementation of this alternative would have similar effects on soil productivity and water quality as discussed under Alternative B (Section 1.8.2.3).

**Conclusion.** Implementation of Alternative C would result in short-term negligible adverse effects on the soil resource due to localized removal of organic matter by heavy equipment and prescribed fire. Without implementation, continued accumulation of organic matter on the forest floor would contribute to increased ground fuel loads, which would lead to increased fire severity during a fire event. Based on fire-return intervals stated in Alternative A, the loss of surface organic matter and CWD would have short-term adverse effects on both soil productivity and water quality because organic matter and CWD are essential for both soil fertility and surface ground cover.

#### Cumulative Effects

Implementation of this alternative would have similar effects as discussed under Alternative B.

**Conclusion.** The effects of mechanical treatment and prescribed fire on the organic matter component would have localized minor to negligible adverse effects on the soil resource due to the continuous recruitment of organic matter from needle cast, leaf fall, and snags falling to the ground. This action alternative will protect long-term soil productivity by measurably reducing fire severity through the reduction of existing fuel loading.

## 1.9 Resource Protection Measures

- Reuse existing skid trails and landings.
- No new full-bench skid trails will be built.
- Skid trail locations will be agreed to by the Forest Service.
- Prevent road or landing runoff from entering skid trails.
- Minimize soil erosion by water barring all skid trails.
- Ground-based yarding equipment is restricted to slopes less than 35 percent; however, there may be short sections of skid trails that could be over 35 percent slope and could use the scarps (the steeper slope) to connect one flat bench to another flat bench.
- Mulch or slash those short sections of skid trails on slopes over 35 percent. Slash or certified straw will be placed on them to achieve a 70–80 percent soil cover.
- No more than 15 percent of any treatment unit should be disturbed by primary skid trails, cable corridors, and landings.
- Conduct skidding operations during dry soil conditions (sufficiently dry to 10-inch depth) or follow wet weather logging guidelines.
- Track-mounted masticators can operate up to 45 percent slopes when soil is dry down to 10 inches or follow wet weather logging guidelines.
- Deck logs on existing road prism versus constructing new landings.
- Burn during spring-like conditions, in any season, to minimize the consumption of litter and coarse woody debris (down logs greater than 20-inch diameter). No direct firing on coarse woody debris.
- Retain existing levels or a minimum of 5 logs/acre of coarse woody debris (down logs great than 20-inch diameter) for soil productivity needs.
- Protect existing coarse woody debris by having ground-based equipment avoid the larger-diameter logs as much as practical.
- Post-treatment total soil cover will be 70–80 percent, depending on slope steepness and soil texture.

- Retain at least 50 percent soil cover as fine organic matter (less than 3-inch materials) in all treatment units.
- M Units 15, 17, 21, 22, 30, and 80 will be monitored for detrimental disturbance and/or compaction and will be subsoiled if detrimental disturbance exceeds 15 percent in each unit.
- Coordination. During implementation of this project, the project leader will coordinate with personnel from earth science and fire/fuels regarding protection of soils and unstable areas.

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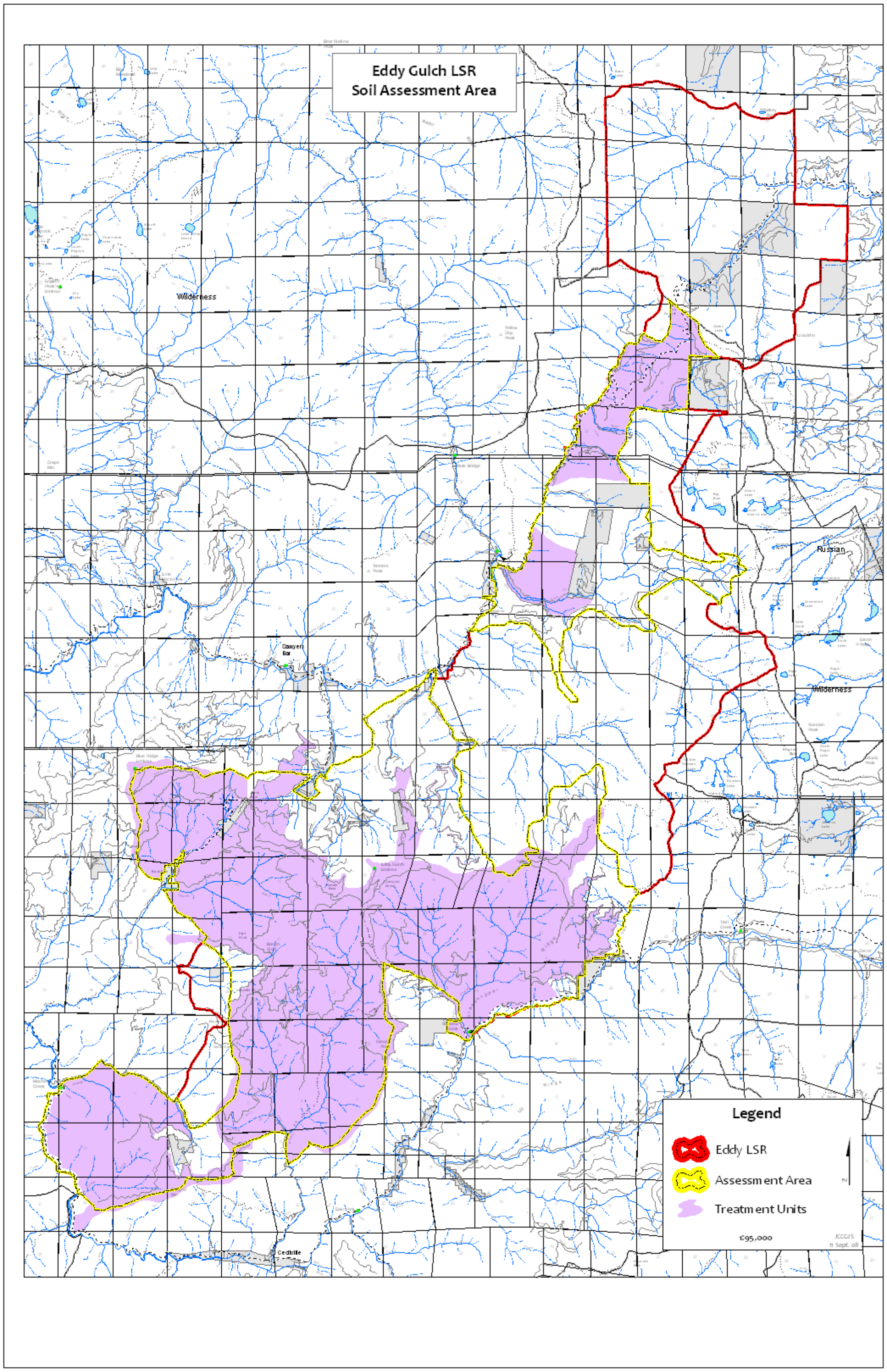
# Appendix A

# Map of Analysis Area for Soil Resources

**Map A-1.** Soil resource analysis area.



# Appendix B

## Summary of Data Collected During July and August 2008

# Appendix B
# Summary of Data Collected During July and August 2008

**Table B-1.** Field-reviewed treatment unit summary: existing condition.

| Treatment | | | | Soil Cover | | | | Slope Distribution | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Range | Average | | Detrimental Disturbance | Range | Average | Slope ≤35 | Slope 36–49 | Slope ≥50 |
| Area | Acres | Rx[a] | Method[b] | (Percent) | | EHR[c] | (Percent) | | | | | |
| M Unit 3 | 7 | T | T/UB | 30–100 | 66 | L-M | 5 | 15–45 | 36 | 45 | 45 | 10 |
| M Unit 4 | 3 | T | T/UB | 20–100 | 73 | L-M | 10 | 5–50 | 23 | 95 | 0 | 5 |
| | 30 | T | C/UB | 80–100 | 90 | M-H | 0 | 40–65 | 53 | 0 | 50 | 50 |
| M Unit 7S | — | T | T/UB | 40–100 | 93 | L | 0 | 5–20 | 11 | 100 | 0 | 0 |
| | — | T | C/UB | 70–100 | 85 | M-H | 0 | 45–65 | 55 | 0 | 60 | 40 |
| M Unit 7N | — | T | T/UB | 40–100 | 83 | L-M | 10 | 10–60 | 25 | 85 | 10 | 5 |
| M Unit 8 | 17 | T | C/UB | 50–100 | 75 | M-H | 0 | 35–70 | 53 | 0 | 40 | 60 |
| M Unit 9 | 36 | T | C/UB | 50–90 | 70 | M-H | 0 | 45–60 | 53 | 0 | 45 | 35 |
| M Unit 10 | 9 | T | T/UB | 50–100 | 93 | L | 0 | 5–25 | 17 | 100 | 0 | 0 |
| | 83 | T | C/UB | 80–100 | 97 | M-H | 0 | 35–75 | 61 | 5 | 5 | 90 |
| M Unit 11 | 9 | T | T/UB | 70–100 | 93 | L | 5 | 15–35 | 24 | 100 | 0 | 0 |
| M Unit 12 | 57 | T | C/UB | 60–100 | 91 | M-H | 5 | 10–65 | 41 | 40 | 5 | 55 |
| M Unit 13 | 23 | T | C/UB | 60–100 | 70 | L-M | 0 | 15–30 | 20 | 100 | 0 | 0 |
| M Unit 15 | 59 | T | T/UB | 30–100 | 80 | L | 13 | 5–35 | 18 | 100 | 0 | 0 |
| | 100 | T | C/UB | 20–90 | 62 | M-H | 0 | 35–50 | 44 | 0 | 100 | 0 |
| M Unit 16 | 26 | T | C/UB | 40–90 | 68 | M-H | 0 | 40–65 | 53 | 0 | 25 | 75 |
| M Unit 17 | 2 | T | T/UB | 50–70 | 60 | M-H | 0 | 60–70 | 65 | 0 | 0 | 100 |
| | 17 | T | C/UB | 20–100 | 69 | L-M | 15 | 10–45 | 32 | 65 | 25 | 10 |
| M Unit 19 | 4 | T | T/UB | 20–90 | 66 | L | 15 | 5–40 | 11 | 95 | 5 | 0 |
| | 49 | T | C/UB | 40–60 | 50 | M-H | 0 | 60–70 | 65 | 0 | 0 | 100 |
| M Unit 20 | 33 | T | T/UB | 20–100 | 77 | L-M | 0 | 10–40 | 20 | 95 | 5 | 0 |
| | 30 | T | C/UB | 30–100 | 79 | L-M | 5 | 15–60 | 36 | 55 | 15 | 30 |
| M Unit 21 | 100 | T | T/UB | 50–100 | 78 | L-M | 27 | 5–35 | 20 | 100 | 0 | 0 |
| | 30 | T | C/UB | 25–50 | 38 | M | 0 | 40–50 | 46 | 0 | 50 | 50 |

**Table B-1.** Field-reviewed treatment unit summary: existing condition (continued).

| Treatment | | | | Soil Cover | | | | Slope Distribution | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Range | Average | | Detrimental Disturbance | Range | Average | Slope ≤35 | Slope 36–49 | Slope ≥50 |
| Area | Acres | Rx[a] | Method[b] | (Percent) | | EHR[c] | (Percent) | | | | | |
| M Unit 22 | 53 | T | C/UB | 55–90 | 74 | L-M | 15 | 25–60 | 46 | 25 | 40 | 35 |
| M Unit 23 | 36 | T | C/UB | 10–90 | 62 | L-H | 5 | 5–80 | 59 | 10 | 10 | 80 |
| M Unit 24 | 4 | T | T/UB | 15–80 | 59 | L-M | 20 | 15–35 | 23 | 100 | 0 | 0 |
| | 38 | T | C/UB | 60–70 | 65 | M-H | 0 | 55–70 | 63 | 0 | 0 | 100 |
| M Unit 25 | 48 | T | C/UB | 40–100 | 67 | M-H | 0 | 50–70 | 61 | 0 | 0 | 100 |
| M Unit 30 | 37 | T | T/UB | 10–100 | 68 | L | 15 | 2–20 | 10 | 100 | 0 | 0 |
| M Unit 31 | 45 | T | C/UB | 40–100 | 72 | M-H | 0 | 40–80 | 67 | 0 | 5 | 95 |
| M Unit 32 | 5 | | | | | | | | | | | |
| M Unit 35 | 14 | T | C/UB | 40–50 | 45 | M-H | 0 | 40–60 | 50 | 0 | 0 | 100 |
| M Unit 36 | 21 | T | C/UB | 30–50 | 40 | M-H | 0 | 45–65 | 55 | 0 | 15 | 85 |
| M Unit 37 | 12 | T | C/UB | 60–80 | 70 | M-H | 0 | 45–65 | 55 | 0 | 20 | 80 |
| M Unit 38 | 2 | T | T/UB | 10–80 | 54 | L | 10 | 5–35 | 22 | 100 | 0 | 0 |
| | 15 | T | C/UB | 80–100 | 90 | M-H | 0 | 20–70 | 50 | 6 | 27 | 67 |
| M Unit 39 | 20 | T | C/UB | 70–100 | 92 | M-H | 5 | 40–65 | 54 | 0 | 10 | 90 |
| M Unit 43 | 16 | T | T/UB | 30–100 | 80 | L-H | 5 | 15–80 | 41 | 40 | 25 | 35 |
| M Unit 51 | 13 | T | C/UB | 60–80 | 70 | M-H | 0 | 40–60 | 50 | 0 | 30 | 70 |
| M Unit 52 | 13 | T | C/UB | 60–70 | 65 | M-H | 0 | 50–60 | 55 | 0 | 10 | 90 |
| M Unit 54 | 23 | T | T/UB | 15–90 | 58 | L-M | 7 | 15–60 | 24 | 97 | 0 | 3 |
| M Unit 60 | 17 | T | C/UB | 70–100 | 88 | M-H | 10 | 55–75 | 62 | 0 | 0 | 100 |
| M Unit 61 | 25 | T | C/UB | 70–90 | 80 | M-H | 0 | 50–70 | 60 | 0 | 0 | 100 |
| M Unit 65 | 6 | T | C/UB | 50–70 | 60 | H | 0 | 65–70 | 68 | 0 | 0 | 100 |
| M Unit 66 | 6 | T | C/UB | 50–90 | 70 | M-H | 0 | 50–75 | 64 | 0 | 30 | 70 |
| M Unit 69 | 17 | T | T/S/UB | 50–100 | 88 | L-H | 0 | 25–85 | 54 | 40 | 5 | 55 |
| M Unit 73 | 36 | T | C/UB | 60–100 | 91 | M-H | 0 | 50–90 | 70 | 0 | 0 | 100 |
| M Unit 76 | 2 | T | C/UB | 90–100 | 95 | M | 0 | 40–50 | 44 | 0 | 75 | 25 |
| M Unit 79 | 13 | T | T/UB | 30–100 | 67 | L-M | 10 | 2–30 | 17 | 100 | 0 | 0 |
| M Unit 80 | 7 | T | C/UB | 40–100 | 86 | L-M | 15 | 10–80 | 33 | 65 | 5 | 30 |
| FRZ 2 | 366 | FR | M/UB | 10–100 | 68 | L | 5–10 | 2–20 | 10 | 100 | 0 | 0 |

**Table B-1.** Field-reviewed treatment unit summary: existing condition (continued).

| Treatment | | | | Soil Cover | | | | Slope Distribution | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Range | Average | | Detrimental Disturbance | Range | Average | Slope ≤35 | Slope 36–49 | Slope ≥50 |
| Area | Acres | Rx[a] | Method[b] | (Percent) | | EHR[c] | (Percent) | | | | | |
| | 477 | FR | UB | 60–100 | 80 | M-H | 0 | 45–65 | 55 | 0 | 50 | 50 |
| FRZ 3 | 141 | FR | M/UB | 15–100 | 56 | L-M | 10–15 | 10–40 | 26 | 90 | 10 | 0 |
| | 404 | FR | UB | 60–100 | 91 | M-H | 0 | 50–90 | 70 | 0 | 0 | 100 |
| FRZ 4 | 70 | FR | M/UB | 80–100 | 94 | L | 0 | 10–25 | 12 | 100 | 0 | 0 |
| | 193 | FR | UB | 50–90 | 70 | M-H | 0 | 45–60 | 53 | 0 | 45 | 55 |
| FRZ 5 | 58 | FR | M/UB | 50–100 | 82 | L-M | 15 | 10–55 | 32 | 65 | 20 | 15 |
| | 314 | FR | UB | 80–100 | 97 | M-H | 5 | 61 | 5 | 5 | 90 | |
| FRZ 6 | 148 | FR | M/UB | 20–100 | 73 | L-M | 10 | 5–50 | 23 | 95 | 0 | 5 |
| | 341 | FR | UB | 80–100 | 90 | M-H | 0 | 40–65 | 53 | 0 | 50 | 50 |
| FRZ 7 | 144 | FR | M/UB | 20–100 | 73 | L-M | 10 | 5–50 | 25 | 95 | 0 | 5 |
| | 591 | FR | UB | 80–100 | 90 | M-H | 0 | 40–65 | 53 | 0 | 50 | 50 |
| FRZ 9 | 46 | FR | M/UB | 40–100 | 83 | L-M | 5–10 | 10–60 | 25 | 85 | 10 | 5 |
| | 272 | FR | UB | 70–100 | 85 | M-H | 0 | 45–65 | 55 | 0 | 60 | 40 |
| FRZ 10 | 106 | FR | M/UB | 60–100 | 79 | L-M | 5–10 | 5–30 | 17 | 100 | 0 | 0 |
| | 276 | FR | UB | 60–70 | 65 | M-H | 0 | 50–60 | 55 | 0 | 10 | 90 |
| FRZ 11 | 46 | FR | M/UB | 10–90 | 62 | L | 0 | 5–40 | 17 | 95 | 5 | 0 |
| | 229 | FR | UB | 40–60 | 50 | M-H | 0 | 60–70 | 65 | 0 | 0 | 100 |
| FRZ 12 | 67 | FR | M/UB | 15–100 | 83 | L | 0 | 15–40 | 27 | 95 | 5 | 0 |
| | 289 | FR | UB | 60–80 | 70 | M-H | 0 | 45–65 | 55 | 0 | 20 | 80 |
| FRZ 13 | 157 | FR | M/UB | 20–90 | 54 | L-M | 5 | 15–60 | 27 | 85 | 10 | 5 |
| | 518 | FR | UB | 70–100 | 88 | M-H | 0 | 45–65 | 60 | 0 | 15 | 55 |
| FRZ 14 | 39 | FR | M/UB | 15–80 | 59 | L-M | 5–20 | 15–35 | 23 | 100 | 0 | 0 |
| | 254 | FR | UB | 10–90 | 62 | L-H | 5 | 5–80 | 59 | 10 | 10 | 80 |
| FRZ 15 | 118 | FR | M/UB | 15–80 | 59 | L-M | 5–20 | 15–35 | 23 | 100 | 0 | 0 |
| | 560 | FR | UB | 55–90 | 74 | L-M | 5 | 5–80 | 59 | 10 | 10 | 80 |
| FRZ 16 | 59 | FR | M/UB | 40–100 | 74 | L | 10 | 5–30 | 16 | 100 | 0 | 0 |
| | 229 | FR | UB | 25–50 | 38 | M | 0 | 40–50 | 46 | 0 | 50 | 50 |
| FRZ 17 | 68 | FR | M/UB | 30–100 | 80 | L | 5–10 | 5–35 | 18 | 100 | 0 | 0 |

**Table B-1.** Field-reviewed treatment unit summary: existing condition (continued).

| Treatment | | | | Soil Cover | | | | Slope Distribution | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Range | Average | | Detrimental Disturbance | Range | Average | Slope ≤35 | Slope 36–49 | Slope ≥50 |
| Area | Acres | Rx[a] | Method[b] | (Percent) | | EHR[c] | (Percent) | | | | | |
| | 125 | FR | UB | 20–90 | 62 | M-H | 0 | 35–50 | 44 | 0 | 100 | 0 |
| FRZ 20 | 114 | FR | M/UB | 70–80 | 75 | M-H | 0 | 25–45 | 35 | 80 | 20 | 0 |
| | 884 | FR | UB | 40–100 | 72 | M-H | 0 | 40–80 | 67 | 0 | 5 | 95 |
| Rx Unit 4 | 4330 | FR | UB | 20–75 | 46 | M-H | 0–5 | 45–65 | 55 | 0 | 10 | 90 |
| Rx Unit 5 | 1610 | FR | UB | 60–100 | 78 | M-H | 0–5 | 45–70 | 55 | 0 | 20 | 80 |

**Notes:**

a. Rx (Treatment Type): T = Thin
FR = Fuels Reduction.

b. Treatment Method: T = Tractor
C = Cable
UB = Underburn
M = Mastication.

c. EHR = Erosion Hazard Rating.

**Table B-2.** Coarse woody debris and decomposition class summary by treatment unit.

| Treatment Unit | Coarse Woody Debris Distribution and Decomposition (Decomp) Class | | | | | |
|---|---|---|---|---|---|---|
| | Average Logs/Acre[a] | Decomp Class 1 | Decomp Class 2 | Decomp Class 3 | Decomp Class 4 | Decomp Class 5 |
| M Unit 3 | 0.3 | 0 | 3 | 0 | 0 | 0 |
| M Unit 4 | 0.1 | 0 | 1 | 2 | 0 | 0 |
| M Unit 7-S | 0.5 | 0 | 3 | 3 | 4 | 0 |
| M Unit 7-N | 0.1 | 0 | 0 | 0 | 1 | 0 |
| M Unit 8 | 0 | — | — | — | — | — |
| M Unit 9 | 0.1 | 0 | 3 | 0 | 0 | 0 |
| M Unit 10 | 0.1 | 0 | 6 | 2 | 3 | 1 |
| M Unit 11 | 0.3 | 0 | 1 | 0 | 0 | 0 |
| M Unit 12 | 0.04 | 0 | 1 | 1 | 0 | 0 |
| M Unit 13 | 0.3 | 0 | 3 | 3 | 0 | 0 |
| M Unit 15 | 0.01 | 0 | 2 | 0 | 0 | 0 |
| M Unit 16 | 0.2 | 1 | 2 | 2 | 0 | 0 |
| M Unit 17 | 0.4 | 0 | 3 | 3 | 1 | 0 |
| M Unit 19 | 0 | — | — | — | — | — |
| M Unit 20 | 0.2 | 1 | 5 | 4 | 0 | 1 |
| M Unit 21 | 0.1 | 2 | 3 | 3 | 0 | 0 |
| M Unit 22 | 0.2 | 1 | 4 | 4 | 0 | 0 |
| M Unit 23 | 0.02 | 0 | 0 | 1 | 0 | 0 |
| M Unit 24 | 0.5 | 0 | 4 | 11 | 0 | 0 |
| M Unit 25 | 0 | — | — | — | — | — |
| M Unit 30 | 0.2 | 0 | 4 | 3 | 0 | 1 |
| M Unit 31 | 0.2 | 0 | 4 | 3 | 0 | 0 |
| M Unit 35 | 0.1 | 0 | 2 | 0 | 0 | 0 |
| M Unit 36 | 0 | — | — | — | — | — |
| M Unit 37 | 0 | — | — | — | — | — |
| M Unit 38 | 0.1 | 0 | 1 | 1 | 0 | 1 |
| M Unit 39 | 0.1 | 0 | 0 | 1 | 1 | 0 |
| M Unit 43 | 0.4 | 1 | 3 | 3 | 0 | 0 |
| M Unit 51 | 0.1 | 0 | 0 | 1 | 0 | 0 |

**Table B-2.** Coarse woody debris and decomposition class summary by treatment unit (continued).

| Treatment Unit | Coarse Woody Debris Distribution and Decomposition (Decomp) Class | | | | | |
|---|---|---|---|---|---|---|
| | Average Logs/Acre[a] | Decomp Class 1 | Decomp Class 2 | Decomp Class 3 | Decomp Class 4 | Decomp Class 5 |
| M Unit 52 | 0.3 | 0 | 3 | 1 | 0 | 0 |
| M Unit 54 | 0.1 | 0 | 1 | 1 | 0 | 0 |
| M Unit 60 | 0.7 | 0 | 8 | 2 | 0 | 0 |
| M Unit 61 | 0.1 | 0 | 2 | 0 | 0 | 0 |
| M Unit 65 | 0 | — | — | — | — | — |
| M Unit 66 | 0.2 | 0 | 1 | 0 | 0 | 0 |
| M Unit 73 | 0.2 | 2 | 5 | 1 | 0 | 0 |
| M Unit 75 | 0.1 | 0 | 7 | 1 | 0 | 0 |
| M Unit 76 | 0 | — | — | — | — | — |
| M Unit 79 | 0.7 | 0 | 2 | 1 | 5 | 1 |
| M Unit 80 | 0.9 | 0 | 1 | 2 | 3 | 0 |
| FRZ 2 | 0.01 | 0 | 6 | 4 | 0 | 1 |
| FRZ 3 | 0.01 | 0 | 2 | 4 | 1 | 0 |
| FRZ 4 | 0.03 | 0 | 5 | 0 | 1 | 0 |
| FRZ 5 | 0.01 | 0 | 2 | 0 | 0 | 0 |
| FRZ 6 | 0.01 | 0 | 1 | 2 | 0 | 0 |
| FRZ 7 | 0.004 | 0 | 1 | 2 | 0 | 0 |
| FRZ 9 | 0.03 | 0 | 3 | 3 | 5 | 0 |
| FRZ 10 | 0.05 | 0 | 11 | 7 | 0 | 0 |
| FRZ 11 | 0.02 | 0 | 0 | 3 | 1 | 1 |
| FRZ 12 | 0 | — | — | — | — | — |
| FRZ 13 | 0.02 | 0 | 9 | 2 | 0 | 0 |
| FRZ 14 | 0.01 | 0 | 4 | 12 | 0 | 0 |
| FRZ 15 | 0.04 | 1 | 8 | 15 | 0 | 0 |
| FRZ 16 | 0.05 | 2 | 3 | 3 | 4 | 1 |
| FRZ 17 | 0.01 | 0 | 2 | 0 | 0 | 0 |
| FRZ 20 | 0.01 | 0 | 6 | 3 | 0 | 0 |
| RX Unit 4 | 0 | — | — | — | — | — |
| RX Unit 5 | 0 | — | — | — | — | — |

**Table B-3.** Soil survey information and interpretations.

| Treatment Unit | Soil Map Unit No. | | Soil Depth Group[a] | Surface Textures | EHR | | Compaction[b] Hazard | | Soil Displace[c] Hazard Rating | Suitability for Subsoiling[d] | Soil Productivity (FSSC Rating) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Order 3 | Field Verified | | | Exist | Max | Moist | Dry | | | |
| M Unit 3 | 113 | 112 | SH-MD | GSCL | L-M | M | M | S | L | M | 3, 4–5 |
| M Unit 4 | 113, 118 | 118 | SH-MD | GSL/SCL | L | M | SE-M | S | L | S-M | 4–5, 3 |
| M Unit 7 | 106, 113, 144 | 155 | MD-D | GSCL | L | M | SE-M | S | M | M | 5, 3–4 |
| M Unit 8 | 106, 113 | 106 | MD | GSL | M | H | M | S | M | M | 2–4, 5 |
| M Unit 9 | 113 | 113 | MD | G-VGSL | M | H | M | S | M | M | 3, 2–3 |
| M Unit 10 | 115, 150, 199 | 150 | MD | G-VGSL | L-H | H | M | S | M | S-M | 2–3, 5 |
| M Unit 11 | 106, 113, 198 | 150 | MD | GSL | L | M | M | S | M | M | 2–3, 5 |
| M Unit 12 | 113 | 113 | MD-D | GSCL | L-M | M | M | S | M | M | 3, 2–3 |
| M Unit 13 | 147 | 150 | MD | G-VGSL | L | M | M | S | M | S-M | 2–3, 5 |
| M Unit 15 | 147 | 150 | MD | VGSL | L | L-M | M | S | M | M | 2–3, 5 |
| M Unit 16 | 147 | 150 | SH-MD | G-VGSL | M | M-H | S | S | M | S | 2–3, 5 |
| M Unit 17 | 147 | 150 | MD | G-VGSL | L-M | M-H | L | S | M | M | 2–3, 5 |
| M Unit 19 | 106, 113 | 118 | SH-MD | G-VGSL | L-M | M-H | S-M | S | M-S | M-S | 4–5, 3 |
| M Unit 20 | 147 | 150 | SH-MD | G-VGSL | L-M | M-H | S | S | M-S | S | 2–3, 5 |
| M Unit 21 | 112, 113 | 112 | SH-MD | G-VGSL | L-M | M | S-M | S | M | S | 3, 4–5 |
| M Unit 22 | 112 | 112 | SH-MD | G-VGSL | L-M | M | S-M | S | M | S | 3, 4–5 |
| M Unit 23 | 150, 198 | 198 | SH-MD | G-VGSL | L-H | H | M | S | M | M-S | 5, 3–4 |
| M Unit 24 | 150 | 150 | SH-D | G-VGSL | L-M | M-H | M | S | M | M-S | 2–3, 5 |
| M Unit 25 | 150 | 112 | SH-MD | G-VGSL | M-H | H | S-M | S | M | S | 3, 4–5 |
| M Unit 30 | 147 | 155 | SH-MD | GSCL | L | L-M | S-M | S | M | M | 5, 3–4 |
| M Unit 31 | 197 | 150 | SH-MD | GSL | M | H | M | S | M | S-M | 2–3, 5 |
| M 35 | 150 | 150 | SH-MD | G-VGSL | M-H | H | M | S | M | M-S | 2–3, 5 |
| M Unit 36 | 150 | 150 | SH-MD | G-VGSL | M-H | H | M | S | M | M-S | 2–3, 5 |
| M Unit 37 | 147 | 150 | SH-MD | G-VGSL | M-H | H | M | S | M | M-S | 2–3, 5 |
| M Unit 38 | 147 | 150 | SH-MD | G-VGSL | L-M | M | M | S | M | M-S | 2–3, 5 |
| M Unit 39 | 113 | 113 | MD-D | GSCL | M | H | M | S | M | M | 3, 2–3 |
| M Unit 43 | 106, 113 | 113 | SH-D | GSL | M | M-H | M | S | H | M | 3, 2–3 |
| M Unit 51 | 141 | 141 | D | GSCL | M-H | H | S | M | M | M | 2–4, 3, 2–3 |

**Table B-3.** Soil survey information and interpretations (continued).

| Treatment Unit | Soil Map Unit No. | | Soil Depth Group[a] | Surface Textures | EHR | | Compaction[b] Hazard | | Soil Displace[c] Hazard Rating | Suitability for Subsoiling[d] | Soil Productivity (FSSC Rating) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Order 3 | Field Verified | | | Exist | Max | Moist | Dry | | | |
| M Unit 52 | 106 | 106 | SH-MD | GSL-CL | M-H | H | M | S | M | M-S | 2, 4–5 |
| M Unit 54 | 147 | 150 | SH-MD | G-VGSL | L-M | M | M | S | M | M-S | 2–3, 5 |
| M Unit 60 | 150 | 150 | SH-MD | G-VGSL | M-H | H | M | S | M | M-S | 2–3, 5 |
| M Unit 61 | 150 | 112 | SH-D | GSL | M-H | H | S-M | S | M | S | 3, 4–5 |
| M Unit 65 | 147 | 150 | SH-MD | G-VGSL | H | H | M | S | M | M-S | 2–3, 5 |
| M Unit 66 | 106, 144 | 144 | MD-D | G-VGSL | M | H | S-M | S | M | M | 2–4, 3–5 |
| M Unit 69 | 106, 113 | 106 | MD | G-VGSL | M | H | M | S | M | M | 2–4, 5 |
| M Unit 73 | 147 | 118 | SH-MD | GSL-CL | M | H | SE-M | S | L-M | M | 4–5, 3 |
| M Unit 75 | 113, 153 | 113 | SH-D | GSCL | M | H | M | S | H | M | 3, 2–3 |
| M Unit 76 | 113 | 113 | MD | G-VGSL | M | H | M | S | H | M | 3, 2–3 |
| M Unit 79 | 147 | 150 | SH-MD | GSL | M | H | S-M | S | M | S-M | 2–3, 5 |
| M Unit 80 | 106, 113 | 106 | MD | G-VGSL | M | H | M | S | M | M | 2–4, 5 |
| FRZ 2 | 113, 118, 141, 144, 147, 155, 198 | 113, 147, 185 | SH-D | G-VGSL | L-H | M-H | M-SE | S-M | L-H | S-SE | 2–5 |
| FRZ 3 | 113, 141, 147, 198 | 113, 141, 198 | SH-D | G-VGSL | L-M | M-H | S-M | S | M | S-M | 2–5 |
| FRZ 4 | 113, 119, 150, 153 | 113, 150, 198 | SH-D | G-VGSL | L-M | M-H | S-M | S | M | S-M | 2–5 |
| FRZ 5 | 106, 113, 147, 150, 198 | 106, 113, 150, 198 | SH-D | G-VGSL | L-M | M-H | S-M | S | M | S-M | 2–5 |
| FRZ 6 | 106, 113, 144, 154, 185 | 113, 144, 150 | SH-D | G-VGSL | L-H | M-H | S-M | S-M | M | S-M | 2–5 |
| FRZ 7 | 112, 113, 118, 141, 153, 154 | 113, 118, 141 | SH-D | G-VGSL | L-H | M-H | S-M | S-M | M | S-M | 2–5 |
| FRZ 9 | 106, 113, 141, 144, 151 | 106, 113, 144 | SH-D | G-VGSL | L-H | M-H | S-M | S-M | L-M | S-M | 2–5 |
| FRZ 10 | 106, 119, 151 | 106, 119 | SH-MD | G-VGSL | L-M | M-H | S-M | S | M | S | 2–4, 5 |
| FRZ 11 | 113, 106, 147 | 106 | SH-MD | G-VGSL | L-M | M | M | S | S | 2-4, 5 | |
| FRZ 12 | 112, 147, 198 | 112, 198 | SH-MD | G-VGSL | L-M | M | S-M | S | M | S-M | 3–4, 5 |
| FRZ 13 | 112, 147, 187 | 112, 197 | SH-MD | G-VGSL | L-M | M | M | S | M | S-M | 3–4, 5 |
| FRZ 14 | 118, 150, 198 | 150, 198 | SH-MD | G-VGSL | L-H | M-H | S-M | S | M | S-M | 2–5 |

**Table B-3.** Soil survey information and interpretations (continued).

| Treatment Unit | Soil Map Unit No. | | Soil Depth Group[a] | Surface Textures | EHR | | Compaction[b] Hazard | | Soil Displace[c] Hazard Rating | Suitability for Subsoiling[d] | Soil Productivity (FSSC Rating) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Order 3 | Field Verified | | | Exist | Max | Moist | Dry | | | |
| FRZ 15 | 112, 113, 116, 118, 141, 153 | 112, 150 | SH-MD | G-VGSL | L-H | M-H | S-M | S | M | S-M | 2–5 |
| FRZ 16 | 113 | 112 | SH-MD | GSL-CL | L-M | M | M | S | L | M | 3–4, 5 |
| FRZ 17 | 144, 147, 198 | 147, 150 | SH-MD | G-VGSL | L-H | M-H | S-M | S | L-M | S-M | 2–3, 5 |
| FRZ 20 | 112, 113, 118 | 112, 113, 118 | SH-D | G-VGSL | L-M | M-H | S-M | S | M | S-M | 2–5 |
| FRZ 20 | 141, 150, 197, 198 | 150, 197 | | | | | | | | | |
| Rx Unit 4 | 106, 113, 118, 141, 144, 151 | 113, 118, 147 | SH-D | G-VGSL | L-H | M-H | S-SE | S-M | L-H | S-SE | 2–5 |
| Rx Unit 5 | 106, 112, 113, 118, 141, 147 | 106, 112, 147 | SH-D | G-VGSL | L-H | M-H | S-SE | S-M | L-H | S-SE | 2–5 |

**Table B-4.** Recommended soil cover levels and post-treatment erosion hazard rating.

| Treatment | | | | Soil Cover | | | | |
|---|---|---|---|---|---|---|---|---|
| Area | Acres | Rx | Method | Range | Average | EHR* | LRMP Minimum Post-Treatment Soil Cover (percent) | Post-Treatment EHR |
| M3 | 5 | T | T/UB | 30–100 | 66 | L-M | 70–80 | L-M |
| | 2 | T | S/UB | 30–80 | 66 | M-H | 80 | M-H |
| M4 | 18 | T | T/UB | 20–100 | 73 | L-M | 70–80 | L-M |
| | 15 | T | S/UB | 80–100 | 90 | M-H | 80 | M-H |
| M7S | 8 | T | T/UB | 40–100 | 93 | L | 70–80 | L |
| | 11 | T | S/UB | 70–100 | 85 | M-H | 80 | M |
| M7N | 10 | T | T/UB | 40–100 | 83 | L-M | 70–80 | L-M |
| | 4 | T | S/UB | 40–100 | 83 | M | 80 | M |
| M8 | 5 | T | S/UB | 50–100 | 75 | M-H | 80 | M-H |
| M9 | 14 | T | T/UB | 50–90 | 70 | M | 70–80 | M |
| | 15 | T | S/UB | 50–90 | 70 | M-H | 80 | M-H |
| M10 | 32 | T | T/UB | 50–100 | 93 | L | 70–80 | L |
| M11 | 3 | T | T/UB | 70–100 | 93 | L | 70–80 | L |
| M12 | 8 | T | T/UB | 60–100 | 91 | M | 70–80 | M |
| | 14 | T | S/UB | 60–100 | 91 | M-H | 80 | M-H |
| M13 | 30 | T | T/UB | 60-100 | 70 | L | 70–80 | L-M |
| | 2 | T | S/UB | 60–100 | 70 | L-M | 80 | L-M |
| M15 | 86 | T | T/UB | 30–100 | 80 | L | 70–80 | L |
| | 52 | T | S/UB | 20–90 | 62 | M-H | 80 | M-H |
| M16 | 4 | T | S/UB | 40–90 | 68 | M-H | 80 | M-H |
| M17 | 12 | T | S/UB | 20–100 | 69 | M-M | 80 | M-H |
| M19 | 46 | T | S/UB | 40–60 | 50 | M-H | 80 | M-H |
| M20 | 13 | T | T/UB | 20–100 | 77 | L-M | 70–80 | L-M |
| M21 | 61 | T | T/UB | 50–100 | 78 | L-M | 70–80 | L-M |
| | 47 | T | S/UB | 25–50 | 38 | M | 80 | M |
| M22 | 5 | T | T/UB | 55–90 | 74 | L-M | 70–80 | M |
| | 2 | T | S/UB | 55–90 | 74 | L-M | 80 | L-M |
| M23 | 42 | T | S/UB | 10–90 | 62 | L-H | 80 | M |
| M24 | 45 | T | S/UB | 60–70 | 65 | M-H | 80 | M-H |
| M25 | 4 | T | T/UB | 40-100 | 67 | L-M | 70–80 | L-M |
| | 23 | T | S/UB | 40–100 | 67 | M-H | 80 | M-H |
| M30 | 9 | T | S/UB | 10–100 | 68 | L | 70–80 | L |
| M31 | 20 | T | S/UB | 40–100 | 72 | M-H | 80 | M-H |
| M32 | 5 | T | T/UB | 10-100 | 68 | L | 70–80 | L |
| M35 | 14 | T | S/UB | 40–50 | 45 | M-H | 80 | M-H |
| M36 | 21 | T | S/UB | 30–50 | 40 | M-H | 80 | M-H |
| M37 | 12 | T | S/UB | 60–80 | 70 | M-H | 80 | M-H |
| M38 | 12 | T | S/UB | 80–100 | 90 | M-H | 80 | M-H |
| M39 | 14 | T | S/UB | 70–100 | 92 | M-H | 80 | M-H |
| M40 | 7 | T | S/UB | 40-100 | 80 | M-H | 80 | M-H |
| M43 | 6 | T | T/UB | 30–100 | 80 | L-M | 70–80 | M |
| | 6 | T | S/UB | 30-100 | 80 | M-H | 80 | M-H |
| M51 | 12 | T | S/UB | 60–80 | 70 | M-H | 80 | M-H |
| M52 | 19 | T | S/UB | 60–70 | 65 | M-H | 80 | M-H |
| M54 | 37 | T | T/UB | 15–90 | 58 | L-M | 70–80 | L-M |
| M60 | 17 | T | S/UB | 70–100 | 88 | M-H | 80 | M-H |

**Table B-4.** Recommended soil cover levels and post-treatment erosion hazard rating (continued).

| Treatment | | | | Soil Cover | | | LRMP Minimum | |
|---|---|---|---|---|---|---|---|---|
| Area | Acres | Rx | Method | Range | Average | EHR* | Post-Treatment Soil Cover (percent) | Post-Treatment EHR |
| M61 | 25 | T | S/UB | 70–90 | 80 | M-H | 80 | M-H |
| M65 | 6 | T | S/UB | 50–70 | 60 | H | 80 | H |
| M66 | 2 | T | S/UB | 50–90 | 70 | M-H | 80 | M-H |
| M73 | 26 | T | S/UB | 60–100 | 91 | M-H | 80 | M-H |
| M75 | 3 | T | T/UB | 60–100 | 83 | M | 70–80 | M |
| | 6 | T | S/UB | 60–100 | 83 | M-H | 80 | M-H |
| M76 | 8 | T | S/UB | 90–100 | 95 | M | 80 | M |
| M79 | 13 | T | T/UB | 30–100 | 67 | L-M | 70–80 | L-M |
| M80 | 3 | T | S/UB | 40–100 | 86 | L-M | 80 | L-M |
| FRZ 2 | 645 | FR | M/UB | 10–100 | 68 | L | 70–80 | L |
| | 302 | FR | UB | 60–100 | 80 | M-H | 70–80 | M-H |
| FRZ 3 | 277 | FR | M/UB | 15–100 | 56 | L-M | 70–80 | L-M |
| | 427 | FR | UB | 60–100 | 91 | M-H | 70–80 | M-H |
| FRZ 4 | 142 | FR | M/UB | 80–100 | 94 | L | 70–80 | L |
| | 184 | FR | UB | 50–90 | 70 | M-H | 70–80 | M-H |
| FRZ 5 | 185 | FR | M/UB | 50–100 | 82 | L-M | 70–80 | L-M |
| | 355 | FR | UB | 80–100 | 97 | M-H | 70–80 | M-H |
| FRZ 6 | 268 | FR | M/UB | 20–100 | 73 | L-M | 70–80 | L-M |
| | 307 | FR | UB | 80–100 | 90 | M-H | 70–80 | M-H |
| FRZ 7 | 238 | FR | M/UB | 20–100 | 73 | L-M | 70–80 | L-M |
| | 485 | FR | UB | 80–100 | 90 | M-H | 70–80 | M-H |
| FRZ 9 | 132 | FR | M/UB | 40–100 | 83 | L-M | 70–80 | L-M |
| | 317 | FR | UB | 70–100 | 85 | M-H | 70–80 | M-H |
| FRZ 10 | 179 | FR | M/UB | 60–100 | 79 | L-M | 70–80 | L-M |
| | 205 | FR | UB | 60–70 | 65 | M-H | 70–80 | M-H |
| FRZ 11 | 101 | FR | M/UB | 10–90 | 62 | L | 70–80 | L |
| | 233 | FR | UB | 40–60 | 50 | M-H | 70–80 | M-H |
| FRZ 12 | 193 | FR | M/UB | 15–100 | 83 | L | 70–80 | L |
| | 254 | FR | UB | 60–80 | 70 | M-H | 70–80 | M-H |
| FRZ 13 | 287 | FR | M/UB | 20–90 | 54 | L-M | 70–80 | L-M |
| | 407 | FR | UB | 70–100 | 88 | M-H | 70–80 | M-H |
| FRZ 14 | 103 | FR | M/UB | 15–80 | 59 | L-M | 70–80 | L-M |
| | 151 | FR | UB | 10–90 | 62 | L-H | 70–80 | L-H |
| FRZ 15 | 56 | FR | M/UB | 15–80 | 59 | L-M | 70–80 | L-M |
| | 261 | FR | UB | 55–90 | 74 | L-M | 70–80 | L-M |
| FRZ 16 | 102 | FR | M/UB | 40–100 | 74 | L | 70–80 | L |
| | 212 | FR | UB | 25–50 | 38 | M | 70–80 | M |
| FRZ 17 | 145 | FR | M/UB | 30–100 | 80 | L | 70–80 | L |
| | 138 | FR | UB | 20–90 | 62 | M-H | 70–80 | M-H |
| FRZ 20 | 131 | FR | M/UB | 70–80 | 75 | M-H | 70–80 | M-H |
| | 869 | FR | UB | 40–100 | 72 | M-H | 70–80 | M-H |
| Rx Unit 4 | 4,339 | FR | UB | 20–75 | 46 | M-H | 70–80 | M-H |
| Rx Unit 5 | 1,608 | FR | UB | 60–100 | 78 | M-H | 70–80 | M-H |

**Note: ***Erosion Hazard Rating (EHR): 70–80% cover is required for slopes 0–25%, and 80% cover is required for slopes >25%.

**Table B-5.** Cumulative effects by unit (based on Alternative B).

| Treatment | | | | Existing Detrimental Disturbance (Percent) | Detrimental Disturbance Threshold @ 15% (Acres) | Cumulative Detrimental Disturbance (Acres) | Cumulative Detrimental Disturbance (Percent) |
|---|---|---|---|---|---|---|---|
| Area | Acres | Rx[a] | Method[b] | | | | |
| M3 | 5 | T | T/UB | 5 | 1.4 | 0.4 | 8.0 |
| | 2 | T | S/UB | 5 | 0.3 | 0.1 | 5.0 |
| M4 | 18 | T | T/UB | 10 | 0.5 | 2.3 | 13.0 |
| | 15 | T | S/UB | 0 | 5.9 | 0.001 | 0.03 |
| M7-S | 8 | T | T/UB | 0 | 1.2 | 0.24 | 3.0 |
| | 11 | T | S/UB | 0 | 1.7 | 0.003 | 0.03 |
| M7-N | 10 | T | T/UB | 10 | 1.5 | 1.3 | 13.0 |
| | 4 | T | S/UB | 10 | 0.6 | 0.4 | 10.0 |
| M8 | 5 | T | S/UB | 0 | 0.8 | 0.2 | 3.0 |
| M9 | 14 | T | T/UB | 0 | 2.1 | .42 | 3.0 |
| | 15 | T | S/UB | 0 | 2.3 | 0.001 | 0.03 |
| M10 | 32 | T | T/UB | 0 | 4.8 | 1.0 | 3.0 |
| M11 | 3 | T | T/UB | 5 | 0.5 | 0.24 | 8.0 |
| M12 | 8 | T | T/UB | 5 | 1.2 | 0.64 | 8.0 |
| | 14 | T | S/UB | 5 | 2.1 | 0.7 | 5.0 |
| M13 | 30 | T | T/UB | 0 | 4.5 | 0.9 | 3.0 |
| | 2 | T | S/UB | 0 | 0.3 | 0.001 | 0.03 |
| M15 | 86 | T | T/UB | 13 | 12.9 | 13.8 | 16.0 |
| | 52 | T | S/UB | 0 | 7.8 | 0.02 | 0.03 |
| M16 | 4 | T | S/UB | 0 | 0.6 | 0.001 | 0.03 |
| M17 | 12 | T | S/UB | 15 | 1.8 | 1.8 | 15.0 |
| M19 | 46 | T | S/UB | 0 | 6.9 | 0.01 | 0.03 |
| M20 | 13 | T | T/UB | 0 | 2.0 | 0.4 | 3.0 |
| M21 | 61 | T | T/UB | 27 | 9.2 | 15.9 | 26.0 |
| | 47 | T | S/UB | 0 | 7.1 | 0.01 | 0.03 |
| M22 | 5 | T | T/UB | 15 | 0.8 | 0.9 | 18.0 |
| | 2 | T | S/UB | 15 | 0.3 | 0.3 | 15.0 |
| M23 | 42 | T | S/UB | 5 | 6.3 | 2.1 | 5.0 |
| M24 | 45 | T | S/UB | 0 | 6.8 | 0.01 | 0.03 |
| M25 | 4 | T | T/UB | 0 | 0.6 | 0.1 | 3.0 |
| | 23 | T | S/UB | 0 | 3.5 | 0.01 | 0.03 |
| M30 | 9 | T | S/UB | 15 | 1.4 | 1.4 | 15.0 |
| M31 | 20 | T | S/UB | 0 | 3.0 | 0.01 | 0.03 |
| M32 | 5 | T | T/UB | 15 | 0.8 | 0.9 | 18.0 |
| M35 | 14 | T | S/UB | 0 | 0.6 | 0.001 | 0.03 |
| M36 | 21 | T | S/UB | 0 | 3.2 | 0.01 | 0.03 |
| M37 | 12 | T | S/UB | 0 | 1.8 | 0.004 | 0.03 |
| M38 | 12 | T | S/UB | 0 | 1.8 | 0.004 | 0.03 |
| M39 | 14 | T | S/UB | 5 | 2.1 | 0.7 | 5.0 |
| M40 | 7 | T | S/UB | 0 | 1.1 | 0.002 | 0.03 |
| M43 | 6 | T | T/UB | 5 | 0.9 | 0.5 | 8.0 |
| | 6 | T | S/UB | 5 | 0.9 | 0.3 | 5.0 |
| M51 | 12 | T | S/UB | 0 | 1.8 | 0.004 | 0.03 |
| M52 | 19 | T | S/UB | 0 | 2.9 | 0.006 | 0.03 |
| M54 | 37 | T | T/UB | 7 | 5.5 | 3.7 | 10.0 |
| M60 | 17 | T | S/UB | 10 | 2.6 | 1.7 | 10.0 |
| M61 | 25 | T | S/UB | 0 | 3.8 | 0.001 | 0.03 |
| M65 | 6 | T | S/UB | 0 | 0.9 | 0.001 | 0.03 |
| M66 | 2 | T | S/UB | 0 | 0.3 | 0.001 | 0.03 |
| M73 | 26 | T | S/UB | 0 | 3.9 | 0.008 | 0.03 |

**Table B-5.** Cumulative effects by unit (based on Alternative B) (continued).

| Treatment | | | | Existing Detrimental Disturbance (Percent) | Detrimental Disturbance Threshold @ 15% (Acres) | Cumulative Detrimental Disturbance (Acres) | Cumulative Detrimental Disturbance (Percent) |
|---|---|---|---|---|---|---|---|
| Area | Acres | Rx[a] | Method[b] | | | | |
| M75 | 3 | T | T/UB | 0 | 0.5 | 0.1 | 3.0 |
| | 6 | T | S/UB | 0 | 0.9 | 0.002 | 0.03 |
| M76 | 8 | T | S/UB | 0 | 1.2 | 0.002 | 0.03 |
| M79 | 13 | T | T/UB | 10 | 2.0 | 1.7 | 13.0 |
| M80 | 3 | T | S/UB | 15 | 0.5 | 0.5 | 15.0 |
| FRZ2 | 645 | FR | M/UB | 5–10 | 96.8 | 51.8 | 8.0 |
| | 302 | FR | UB | 0 | 45.3 | 0.1 | 0.03 |
| FRZ3 | 277 | FR | M/UB | 10–15 | 41.6 | 33.0 | 12.0 |
| | 427 | FR | UB | 1 | 64.1 | 4.4 | 1.0 |
| FRZ4 | 142 | FR | M/UB | 0 | 21.3 | 0.04 | 0.03 |
| | 184 | FR | UB | 1 | 27.6 | 1.9 | 1.0 |
| FRZ5 | 185 | FR | M/UB | 5 | 27.8 | 9.3 | 5.0 |
| | 355 | FR | UB | 5 | 53.3 | 17.9 | 5.0 |
| FRZ6 | 268 | FR | M/UB | 10 | 40.2 | 26.7 | 10.0 |
| | 307 | FR | UB | 1 | 46.1 | 3.2 | 1.0 |
| FRZ7 | 238 | FR | M/UB | 10 | 35.7 | 23.9 | 10.0 |
| | 485 | FR | UB | 1 | 72.8 | 5.0 | 1.0 |
| FRZ9 | 132 | FR | M/UB | 5–10 | 19.8 | 6.6 | 5.0 |
| | 317 | FR | UB | 1 | 47.6 | 3.3 | 1.0 |
| FRZ10 | 179 | FR | M/UB | 5–10 | 26.9 | 9.0 | 5.0 |
| | 205 | FR | UB | 1 | 30.8 | 2.1 | 1.0 |
| FRZ11 | 101 | FR | M/UB | 0 | 15.2 | 0.3 | 0.3 |
| | 233 | FR | UB | 0 | 35.0 | 0.07 | 0.3 |
| FRZ12 | 193 | FR | M/UB | 0 | 27.5 | 0.05 | 0.03 |
| | 254 | FR | UB | 0 | 38.1 | 0.08 | 0.03 |
| FRZ13 | 287 | FR | M/UB | 5 | 43.1 | 14.4 | 5.0 |
| | 407 | FR | UB | 1 | 61.1 | 4.2 | 1.0 |
| FRZ14 | 103 | FR | M/UB | 5–20 | 15.5 | 12.4 | 12.0 |
| | 151 | FR | UB | 5 | 22.7 | 7.6 | 5.0 |
| FRZ15 | 56 | FR | M/UB | 5–20 | 8.4 | 6.7 | 12.0 |
| | 261 | FR | UB | 5 | 39.2 | 13.1 | 5.0 |
| FRZ16 | 102 | FR | M/UB | 10 | 15.3 | 10.2 | 10.0 |
| | 212 | FR | UB | 1 | 31.8 | 2.2 | 1.0 |
| FRZ17 | 145 | FR | M/UB | 5–10 | 21.8 | 10.2 | 7.0 |
| | 138 | FR | UB | 1 | 20.7 | 1.4 | 1.0 |
| FRZ20 | 131 | FR | M/UB | 1 | 19.7 | 1.3 | 1.0 |
| | 869 | FR | UB | 1 | 130.1 | 9.0 | 1.0 |
| RX4 | 4339 | FR | UB | 0–5 | 650.9 | 131.5 | 3.0 |
| RX5 | 1608 | FR | UB | 0–5 | 241.2 | 48.7 | 3.0 |

**Notes:**

a. Rx (Treatment Type):
T = Thin
FR = Fuels Reduction.

b. Treatment Method:
T = Tractor
S = Skyline
UB = Underburn
M = Mastication.