BAER Assessment Soils Report – Salt Creek Fire

Shasta-Trinity National Forest (R5-SHF)

August, 2012

Prepared by David Young

R5 North Zone Soil Scientist; BAER Soil Scientist

USFS, R5, Shasta Trinity National Forest, Redding CA

daveyoung@fs.fed.us

530-226-2545

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This is an abbreviated soil assessment report, commensurate with the size and complexity of the fire. It includes little of the usual explanation of methodology and detailed discussion of values at risk. Further information can be furnished by the author if desired.

The Salt Creek fire burned in the Interstate 5 corridor in the Shasta Lake RNA between Salt Creek and Gilman Road to the north and O'Brien to the south. The fire started in a center divide between separated lanes of travel for north and south; it jumped both sides of the freeway and proceeded to burn. The fire was confined to few acres on the west side of the freeway, mostly on private lands, with the great majority burning toward the east on FS lands. Lower facial drainages above I-5 to the east burned hot; upper watersheds generally burned cool due to the intensive suppression effort, including rapid-fire retardant drops as the Redding air-attack base was in close proximity.

Vegetation type is a mix of [brewer] oak-dominated chaparral as a minor component on south and west facing slopes, [ponderosa] pine-oak woodlands as the majority component, and mixed conifer at higher elevations and north facing slopes. Understory shrub components were quite dense everywhere, and the rapid rate of spread was wind-driven to the east on day 2 of the fire, consuming the majority of acres on that day.

Soils are gravelly to very gravelly loams on 20-60% slopes, with metavolcanic rock and shale as parent materials. Soil profiles range from shallow to deep, but are mostly mod-deep (20-40"). There are 3 dominant soil families in 6 map units, which differ by dominant component and slope phase (table 1, appendix map 1). Minor inclusions include rock outcrop and soil families Neuns, Hugo, and Deadwood.

Table 1. Soil Map Units and acreage in the Salt Creek fire area.

SMU	Soil Map Unit Name	Hydrologic Soil Group	Acres	Percent
82	Goulding-Holland families assoc, 40-60% slopes	D-B	84	9%
83	Goulding-Marpa families assoc, 40-60% slopes	D-B	14	1%
105	Holland family-Holland family, deep complex, 40-60% slopes	B	517	53%
119	Holland family, deep-Holland family complex, 20-40% slopes	B	108	11%
178	Marpa-Goulding families assoc, 20-40% slopes	B-D	21	2%
179	Marpa-Goulding families assoc, 40-60% slopes	B-D	238	24%
Total			**981**	**100%**

Soil burn severity was assessed following principles described in Parsons et al., 2010. Burned Area Reflectance Classification (BARC) imagery from the Remote Sensing Applications Center (RSAC) in Salt Lake City, UT was utilized by the soil scientist, and modified to better reflect actual soil burn severity as observed in the field. Subsequent watershed response modeling efforts use the soil burn severity map as a key input. SBS is summarized in table 2 and displayed spatially in appendix map 2.

Erosion hazard rating utilized the CA EHR system for sheet and rill erosion. Soil burn severity was factored in by manipulating values for infiltration and soil cover, as determined appropriate based on field observations within this fire. Post-fire EHR by soil map unit is summarized in table 3 and displayed spatially in appendix map 3. In

total there are 102 acres Moderate (10%), 805 acres High (82%), and 74 acres Very High (8%), whereas pre-fire it was 23% Moderate and 77% High.

Table 2. Soil Burn Severity acreage, summarized by Sub-Watersheds used for assessment.

ACRES	Soil Burn Severity					
Watershed	**Unb**	**Low**	**Mod**	**High**	**Total**	**Mod+High**
McCloud Arm	**3.9**	**54.2**	**12.2**	**1.2**	**71.5**	**19%**
Ycotto@ Shasta Lk	3.9	54.2	12.2	1.2	71.5	19%
Salt Creek Inlet	**104.5**	**354.6**	**197.4**	**70.1**	**726.6**	**37%**
LCoal Cr @ Gilman Rd	10.2	31.0	33.2	16.2	90.7	54%
M Coal Cr Residence	66.4	212.7	68.9	26.4	374.4	25%
U Coal Residence	1.1	9.8	44.3	18.4	73.6	85%
Salt Cr @ Shasta Lk	19.4	52.8	12.1	2.6	86.9	17%
Salt Cr Trib	7.4	48.2	38.8	6.5	100.9	45%
O'Brien Creek Inlet	**18.5**	**103.4**	**43.5**	**17.9**	**183.3**	**33%**
Obrien E @ Shasta Lk	9.7	19.1	5.1	3.5	37.4	23%
Obrien W Blw Salt	0.5	1.4	0.1		1.9	4%
ObrienT1	0.8	10.9	7.2	1.8	20.8	44%
ObrienT2	6.1	60.8	20.7	2.1	89.6	25%
ObrienT3	1.4	11.3	10.4	10.4	33.6	62%
Grand Total	**126.9**	**512.1**	**253.1**	**89.2**	**981.4**	**35%**
	13%	**52%**	**26%**	**9%**		

Table 3. Erosion Hazard Ratings, by Soil Burn Severity class.

SHF Salt Creek Fire, August 2012		Hydrologic Soil	Erosion Hazard Rating by Soil Burn Severity			
Map Unit	**Soil Map Unit Name**	**Group**	**unburned**	**low**	**mod**	**high**
82	Goulding-Holland families assoc, 40-60% slopes	D-B	M	M	H	H
83	Goulding-Marpa families assoc, 40-60% slopes	D-B	M	M	H	H
105	Holland family-Holland family, deep complex, 40-60% slopes	B	H	H	H	VH
119	Holland family, deep-Holland family complex, 20-40% slopes	B	M	H	H	H
178	Marpa-Goulding families assoc, 20-40% slopes	B-D	M	H	H	H
179	Marpa-Goulding families assoc, 40-60% slopes	B-D	H	H	H	VH

Quantitative erosion and sedimentation modeling utilized the FS-WEPP ERMiT model (batch ERMiT module), which is fundamentally based on single hillslopes and single storm runoff events (not annual estimates). Particulars and documentation may be found at http://forest.moscowfsl.wsu.edu/fswepp/. A custom climate was generated for the fire area using the PRISM module integrated in ERMiT, and the model was run for a range of storm-runoff recurrence intervals. Stated model output accuracy is +/- 50%; therefore, the absolute numbers are considered best estimates only. However, this model is particularly useful in that it can be easily tailored to particular areas (sub-watersheds) to assess potential sediment source areas on a relative basis, and help prioritize areas for potential hillslope treatments if that is determined necessary later in the assessment. ERMiT

also models the probable success of potential treatments in terms of reduction in sediment production. 111 representative hillslopes were modeled for this fire, and results extrapolated in Excel for sub-watershed level analysis. ERMiT output is summarized in table 3. Note that estimates are based upon watershed area within the fire perimeter only; unburned watershed area outside the fire perimeter was not modeled. There are unburned (or very low burn severity) acres within the fire perimeter as well. ERMiT does not produce output for the unburned condition, as it was not part of the original empirical research data that went into building the model. Therefore, ERMiT values for the 5th out-year post-burn were applied to unburned acreage; this would assume that erosion returns to pre-fire levels after 5 years, which is likely not the case, and erosion is probably over-estimated to some degree here. For rapid assessment purposes, this is considered adequate, and preferable to using unrelated models or anecdotal data for a small portion of the fire area and combining results. As an interpretive visual, tons/ac is roughly equivalent to that many sheets of paper stacked being removed from the soil surface, and 1000 tons of sediment would fill about 120 standard 10-yard dumptrucks.

Table 3. ERMiT-estimated sediment production, for a range of storm runoff events.

	2-year event		5-year event		10-year event	
Watershed	**tons/ac**	**tons**	**tons/ac**	**tons**	**tons/ac**	**tons**
McCloud Arm	**22.9**	**1,549**	**40.4**	**2,699**	**58.8**	**3,941**
Ycotto@ Shasta Lk	22.9	1,549	40.4	2,699	58.8	3,941
Salt Creek Inlet	**20.8**	**17,911**	**36.6**	**31,138**	**52.6**	**45,596**
LCoal Cr @ Gilman Rd	19.9	2,006	34.6	3,378	49.7	5,020
M Coal Cr Residence	21.8	9,074	38.2	15,987	54.0	23,134
U Coal Residence	19.1	2,402	33.9	4,105	49.3	6,120
Salt Cr @ Shasta Lk	18.5	1,551	32.5	2,724	47.9	4,043
Salt Cr Trib	23.8	2,878	41.8	4,943	59.9	7,279
O'Brien Creek Inlet	**15.4**	**4,069**	**26.9**	**7,097**	**38.9**	**10,527**
Obrien E @ Shasta Lk	13.8	537	24.3	937	34.3	1,319
Obrien W Blw Salt	9.8	20	17.3	36	25.6	53
ObrienT1	16.3	459	28.2	789	41.2	1,169
ObrienT2	19.3	2,092	33.9	3,670	49.2	5,558
ObrienT3	14.5	962	25.6	1,665	37.1	2,428
Fire Total	**18.9**	**23,530**	**33.2**	**40,934**	**47.9**	**60,064**

Values at risk and Emergency Determination (Soils)

Soil productivity was not in itself determined to be a value at risk. Soils here are inherently only moderately productive (Forest Survey Site Class 4-7) due to the geographic and climatic setting. The ecosystems here are also fire-adapted, so periodic post-fire erosion is a natural ecological and geomorphic process. The watersheds all flow downstream to 3 inlets of Lake Shasta, so resident fish will be impacted by sediment, but impacts to T&E habitat should be relatively minor and temporary. Therefore the assessment team did not identify emergency threats to critical values at risk that would drive land treatments. Point protection treatments for two private residences are being recommended in coordination with NRCS to address flow and sediment concerns.

Treatment Recommendations (FS Roads)

A boulder barrier and two hand-dug relief dips are proposed on FS land to maintain the integrity of a decommissioned road (U34N12C). This road had obvious signs of past erosion, drainage, and stability problems (leading to its decommissioning); it was however in stable condition prior to the fire. Increased flows expected as a result of the fire, as well as increased accessibility (due to fire suppression efforts) are both threats to the stability of the road prism. Even though the road is decommissioned, erosion or mass failure of the road prism would contribute to downslope resource degradation, possibly compromise powerline structures on PG&E lands, and possibly overwhelm drainage structures on I-5 and compromise freeway safety and travel.

To address flows, relief dips across the road are recommended at two crossings to keep flows in the channel; the site setting makes the road highly vulnerable to intercept flow and direct it down the road grade, which would create substantial erosion and road stability problems. No evidence of these crossings ever having culverts was found; sediment deposition on the road has to date created small berms just large enough to keep most water directed across. Post-fire flows have a high likelihood of going down the road.

To address access/incursion concerns, a boulder barrier is recommended to prevent 4WD or OHV incursion and allow the area to revegetate naturally. A functioning boulder barrier currently exists at the downslope (north) end of the road adjoining PG&E lands. Prior to the fire, the road was not accessible from the south because it was too overgrown, so an existing closure sign was effective. Suppression repair replaced the standard closure sign, but it is not expected to be effective with rural residences in close proximity down the road. Use of the road tread by 4WD or OHV would cause erosion problems, and likely render proposed relief dips ineffective in the short term.

For reasons stated above, the probability of damage or loss of the road prism is likely, and the magnitude of consequences is moderate (damage resulting in considerable or long-term effects), so the risk level is high. These recommended treatments in combination are the minimum necessary to effectively reduce the risk; feasibility, timeliness, and cost of the treatments are quite favorable.

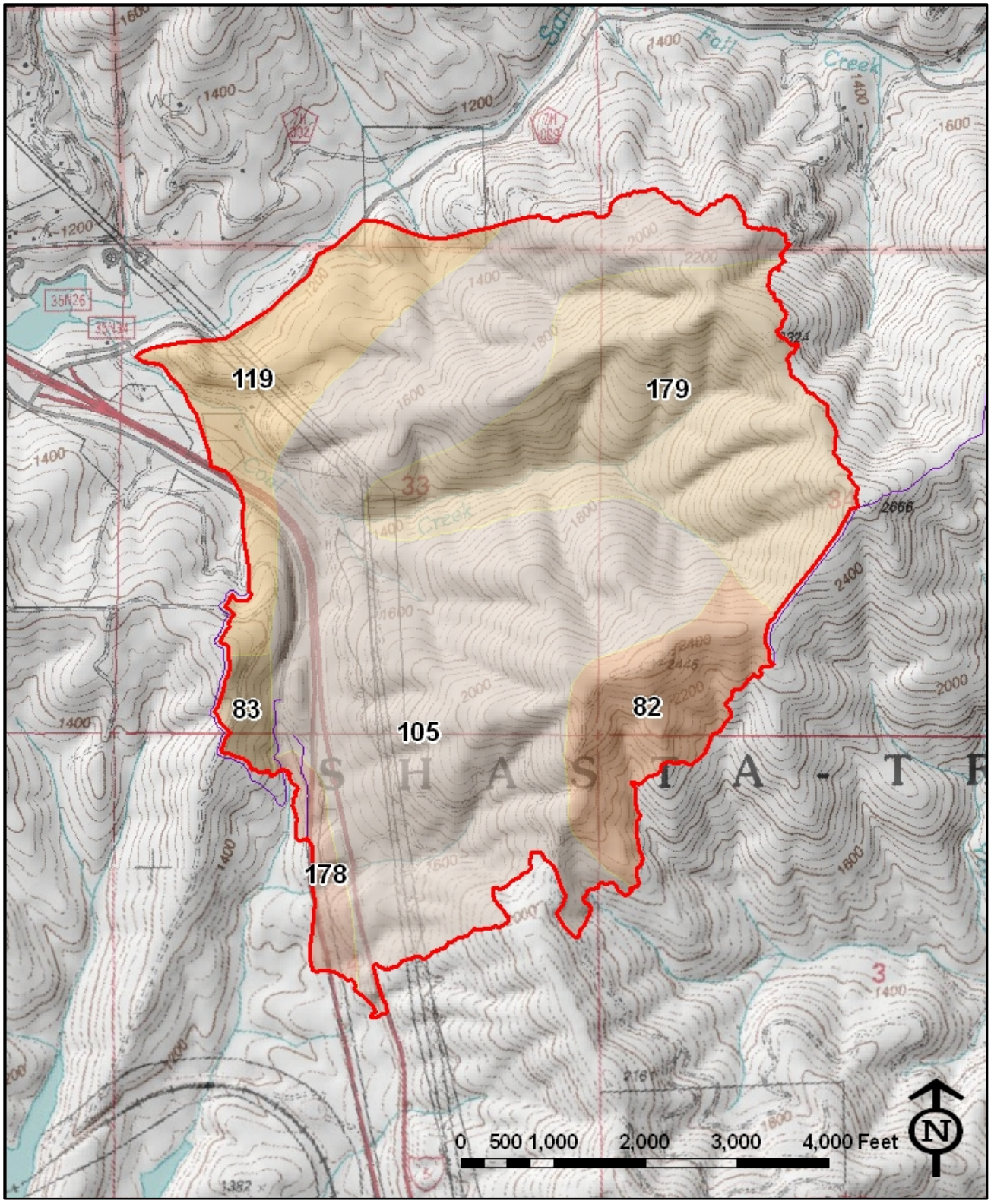
Treatment Recommendations (PG&E lands)

The utility corridor above I-5 consists of high-voltage powerlines with associated structures and a primary access road with many spurs to individual towers. Erosion from this road (collectively with spurs) represents the largest resource concern in the fire area. The road was intensively used during and after the fire for suppression efforts and facility repairs. The road is quite steep in places, and original design and drainage features are poor in several areas. Largely due to the soil types, the road surface is currently covered with 6-12 inches of silty “fluff” or dust which will be readily mobilized with coming rain events, on the order of several hundred tons per acre. Even with improved road drainage, that material will move and create considerable resource problems downstream. It is recommended that the entire length of the road, including spurs and extending south beyond the fire perimeter to the graveled section of road, be mulched with ag straw at a rate of 2 tons/acre to prevent most sediment mobilization in the first place. A truck-mounted straw blower would be well suited for the application.

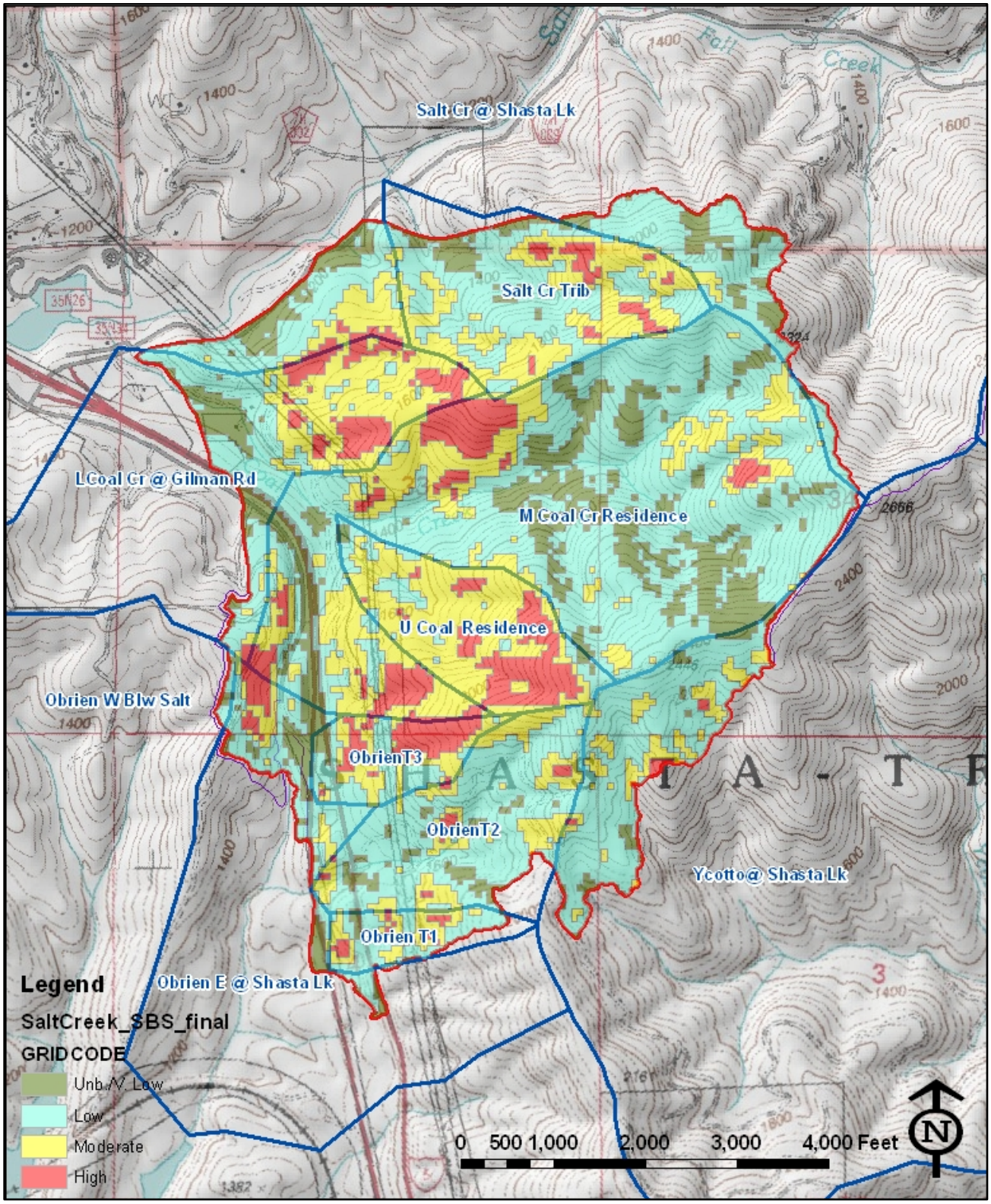
References

Parsons, A, PR Robichaud, SA Lewis, C Napper, JT Clark, 2010. Field Guide for Mapping Post-Fire Soil Burn Severity. USFS Rocky Mountain Research Station, General Technical Report RMRS-GTR-243.

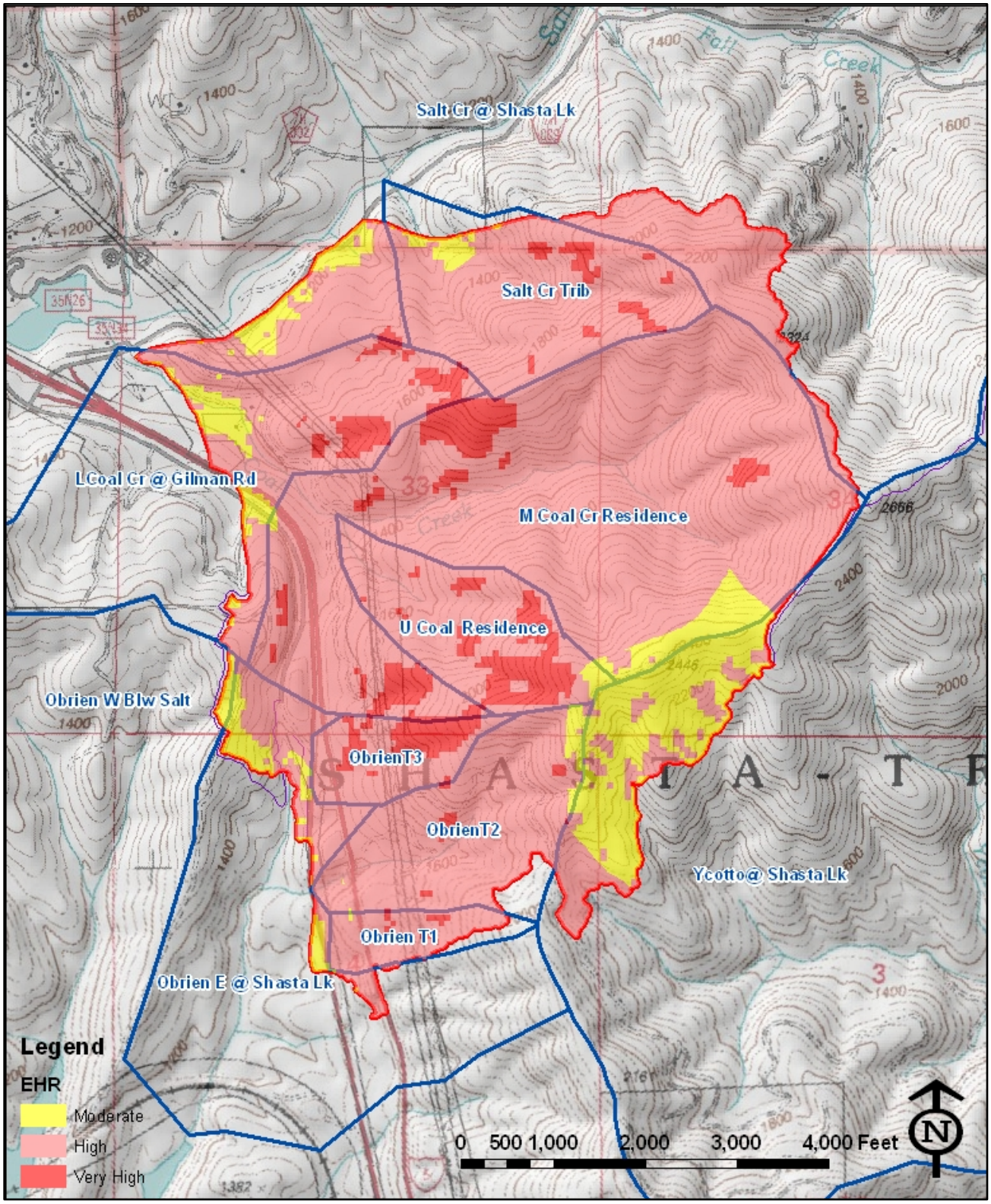
APPENDIX A – MAPS



Map 1 – Soil Map Units. Refer to table 1 for legend.



Map 2 – Soil Burn Severity Map. Refer to table 2 for acreage summary by sub-watershed.



Map 3 – Post-Fire Erosion Hazard Rating Map. All soils are Moderate to High Pre-fire as well (table 3).