

Johnson Canyon West Watershed Assessment



Prepared for

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Truckee River Watershed Council
Collaborative solutions to protect, enhance and restore the Truckee River Watershed



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EXECUTIVE SUMMARY

Johnson Canyon has been historically impacted by human use, including grazing and logging, which has led to accelerated erosion, water quality impacts, and degradation of riparian and in-stream habitat. The Johnson Canyon watershed is approximately 1,027 acres in size and drains to Donner Lake via Gregory Creek. Recent efforts by the Truckee River Watershed Council (TRWC) have culminated in a comprehensive assessment (IERS 2010) of approximately 800 acres of the watershed and implementation of several restoration projects to improve water quality throughout the eastern portion of the watershed. The initial watershed assessment was spatially limited due to private landownership on the western side of the watershed. The recent acquisition of more than 200 acres of privately held land by Truckee Donner Land Trust (TDLT) has enabled the continuation of the watershed assessment and restoration efforts in the western portion of the watershed.

The assessment described herein was conducted during the fall of 2016 as a continuation of the 2010 Assessment and covered the entire western portion of the watershed. Several locations within the 330 acres that were covered during this effort had received preliminary assessment (based on observation from Billy Mack Road) during the 2010 effort, but could not be fully assessed due to inability to access the privately-owned lands. The preliminary assessment of these areas and associated restoration treatment action recommendations were verified/modified according to current conditions and original assessment and restoration recommendations were provided for previously inaccessible areas. The results of the assessment can be summarized as follows:

A total of 15 sites were identified as areas of accelerated erosion and sediment production, nine of which had previously been assessed. Of the nine sites that had previously been assessed, six of the assessments and recommendations were verified and further elaborated upon and three were significantly modified based on current conditions. Table 1 of this assessment provides descriptions of the sites, summary of the 2010 assessment and recommendations (where applicable) and current condition assessment and recommendations, relative restoration priority, and approximate cost ranges. Of the 15 sites, four were characterized as high priority, two as moderate priority, and nine as low priority. A recommended order of action was provided for the six moderate and high priority sites based on the existing evidence of erosion and risk for continued erosion.

The information and recommendations provided will be utilized by TRWC to plan continued restoration efforts within the watershed, which will play a vital role in minimizing impacts to ecological health and water quality while enabling ongoing recreational use and enjoyment of Johnson Canyon.

Chapter 1. Introduction

Project Background

Johnson Canyon (formerly known as Negro Canyon) has been historically impacted by human use, including grazing and logging, which has led to accelerated erosion and deposition of sediment to Donner Lake via Gregory Creek and degradation of riparian and in-stream habitat. Today, Johnson Canyon is a prominent recreational area offering hiking and biking trails, ideal terrain for summer and winter off-highway-vehicle (OHV) use, and excellent views of the Donner Lake Basin. Additionally, Johnson Canyon is a primary access route to Summit Lake and is used by the 7 C's Ranching Company to access their pasture lands.

Recent efforts by the Truckee River Watershed Council (TRWC) to rectify human impacts in the Johnson Canyon watershed have culminated in a comprehensive watershed assessment of approximately 800 acres of the 1,027-acre watershed and implementation of several restoration projects within the area. The initial assessment of the watershed was spatially limited due to private landownership on the western side of the watershed. The recent acquisition of more than 200 acres of privately held land by Truckee Donner Land Trust (TDLT) has enabled the continuation of the watershed assessment and restoration efforts in the western portion of the watershed. The TRWC contracted with Wildscape Engineering, Inc. (Wildscape) to assess the hydrologic condition of these newly acquired lands within Johnson Canyon as a supplement to the 2010 Negro Canyon Watershed Assessment by Integrated Environmental Restoration Services (IERS 2010).

This report summarizes the assessment and provides recommendations for restoration actions and prioritization. Figure 1 of Appendix A displays the newly acquired TDLT land and the Johnson Canyon West Watershed Assessment study area boundary.

Assessment Goals and Objectives

The goals of the Johnson Canyon West Watershed Assessment are to verify and update the assessment of the western portion of the watershed conducted in 2010 (IERS, 2010) and to assess the portion of the watershed that could not be accessed during that effort. This assessment is a continuation of the 2010 work, supplementing and updating the findings thereof. Accordingly, the findings are organized and conveyed in a fashion consistent with the 2010 Assessment. Specific objectives include:

- Assess the newly acquired TDLT lands:
 - Develop narrative descriptions, listings, and map figures that identify erosion hot spots and areas in need of restoration;

- Confirm or revise the preliminary assessments of areas within the study area that were accessed in the 2010 Assessment;
- Assess the contributions of existing roadways, OHV trails, and staging areas on erosion and sediment transport and the feasibility of decommissioning, repairing, or relocating as needed.
- Develop recommendations for restoration:
 - Prescribe actions and treatments for identified erosion hot spots and areas in need of restoration taking into account limitations and stakeholder interests;
 - Prioritize identified hot spots to move forward to design and construction, taking into account budgetary considerations.

Chapter 2. Watershed Assessment

Description of Study Area

A detailed site map of the study area is shown in Figure 2 of Appendix A. The study area comprises approximately 330 acres, including more than 200 acres of newly acquired TDLT land and USFS land, and ranges in elevation from approximately 7,630 feet at the top of the unnamed peak that marks the northwest corner of the watershed to approximately 6,400 feet where Gregory Creek crosses under Interstate 80 (I-80). The west fork of Gregory Creek is located entirely within the study area along with numerous small ephemeral and intermittent tributaries. The east fork of Gregory Creek enters the study area toward the bottom of the watershed from the northeast just before the confluence with the west fork. The study area is bounded to the west by the western watershed boundary, to the south by the I-80 Right-of-Way, to the east by the approximate boundary separating the Gregory Creek west fork sub-watershed from the east fork sub-watershed, and to the north by the northern watershed boundary.

An old Caltrans Staging Area [Former Staging Area] exists across from the Wendin Way Trailhead Parking Area [Parking Area]. Drainage from the I-80 West off ramp (Exit 180) drains along the southern boundary of the Staging Area into Gregory Creek. Runoff from the Staging Area joins the drainage ditch before its outlets to Gregory Creek immediately upstream of the I-80 underpass.

Billy Mack Road, also known as US Forest Service (USFS) Road 0676-088 [USFS Rd 0676-088] and Summit Lake Road, runs along the west fork of Gregory Creek from the bottom of the Parking Area northwest for approximately 0.6 miles then forks. The west route from the fork [Billy Mack Road (USFS Rd West)] bisects the study area until gaining the ridge at the western watershed boundary, approximately 1.3 miles from the Parking Area, then follows the ridge up in the northwest direction for approximately 0.1 miles and continues out of the watershed toward Summit Lake. The west route has one fork [USFS Rd Southwest Fork], which splits to the south approximately 1.1 miles from

the Parking Area and traverses approximately 0.3 miles in the southwest direction to a lower point on the western ridge then into heavily forested USFS land where it turns south, forks twice, and terminates at all ends (Figure 3 of Appendix A). The east route from the fork [USFS Rd East] wraps to the northeast out of the study area toward the northern boundary of the watershed forking at numerous locations along the way. One of the western forks of the east route provides access to several abandoned spur roads within the northwestern portion of the watershed, however the route is gated where it passes through private property.

Powerlines run northeast through the upper portion watershed. Wendin Way Trail parallels the east fork of Gregory Creek outside of the study area as it climbs to the Donner Lake Rim Trail (DLRT). From the intersection, the DLRT traverses through the northern portion of the study area approximately 300 feet above and parallel to Billy Mack Road, as shown in Figure 1 of Appendix A.

Erosion Hot Spots

The following descriptions of erosion hotspots are based on observations made during field reconnaissance in Fall 2016 and are listed beginning from the top of the watershed working down. Where applicable the associated photograph numbers and ID numbers from the 2010 Assessment are referenced in parentheses.

1. Four Corners; Project Area L (2010 Assessment Site 35)

At the location where Billy Mack Road (USFS Rd West) gains the ridge that defines the western watershed boundary, the slope is steep, vegetation is sparse, and numerous OHV trails have been developed. Figure 4 of Appendix A shows an aerial view of the site. Photos B1-B12 of Appendix B display field photos of the location. Signs of erosion vary among OHV routes and along Billy Mack Road, ranging from mild to severe. This site is broken into several sub-sites for more detailed description and assessment, which is included in Appendix C – Field Log.

2. USFS Rd Southwest Fork

The southwest fork of USFS Rd 0676-088 has mild slope and minimal erosion. No rolling dips or waterbars exist on the road. A small (approximately 6-inch diameter) iron culvert exists approximately 0.1 miles from the fork where an intermittent stream crosses the road (Crossing #1; Photo 13). The culvert is exposed, partially collapsed, and poorly aligned and flow regularly overtops the road. Some rock lining exists along the culvert within the developed flow path. The upstream and downstream reaches of the intermittent stream are well vegetated and erosion is mild. Photo 14 displays the road beyond the culvert crossing and Photo 15 shows the road as it enters the densely forested USFS land.

3. Quarry (2010 Assessment Site 34)

An abandoned quarry approximately 1.1 acres in size exists on the west side of Billy Mack Road approximately one mile from the Parking Area. Runoff from the steep quarry slopes flows into a contained basin with dense riparian and upland vegetation. A 16-inch diameter culvert exists to convey overflows from the basin to the down-gradient east side of the road. The culvert is approximately 50% full of sediment and some minimal sediment accumulation exists at the outlet, which discharges flows into a densely vegetated, mildly sloped drainage with no visible erosion. Photo 16 shows the north side of the Quarry site as viewed from the road and Photo 17 shows the south side as viewed from the top of the Quarry. Photo 18 shows the culvert crossing, Photo 19 shows the inlet, and Photo 20 shows the outlet area.

4. OHV Climb

A steep OHV trail forks west from Billy Mack Rod (USFS Rd West) approximately 0.95 miles from the parking area (250 northwest of the Quarry described above). The trail climbs straight up the slope for approximately 115 feet then terminates. Erosion along the trail is minor. Photo 21 shows the trail from the top down toward the road.

5. Crossing #2

An intermittent stream crossing under Billy Mack Road exists approximately 0.91 miles from the Parking Area (130 feet north of the OHV trail described above). The crossing comprises two culverts (Photo 22): the primary culvert is approximately 20-inches in diameter and free of sediment and the overflow culvert is approximately 10-inches in diameter and is approximately 50% full of sediment. No sign of overtopping is evident. The upstream channel (Photo 23) is wide and well-vegetated, but has minor incision. The downstream channel (Photo 24) is slightly more narrow and steep. A large pool has formed at the outfall from the primary culvert and minor erosion is evident continuing downstream.

6. Billy Mack Road/DLRT Connector

A steep spur road/OHV trail exists approximately 0.88 miles from the Parking Area (160 feet east of Crossing #2). The road forks northwest from Billy Mack Road (Photo 25) and continues up the moderate slope for approximately 0.1 miles before terminating at the intersection with the Donner Lake Rim Trail (Photo 26). Minor erosion is evident from roadway runoff (Photo 27).

7. Project Area C (2010 Assessment Sites 27-31, 40-41 & Photos 72-73)

Several spur roads exist within the newly acquired TDLT land north of the Donner Lake Rim Trail (Photos 28-29). The spur roads can only be accessed from the north via a private gated road which forks west from the east fork of USFS Rd 0676-088 and

follows the northern watershed boundary along the northern boundary of the study area. The spur roads, apparently abandoned logging spur roads, lead to two separate abandoned logging landings. Figure 5 of Appendix A shows an aerial overview of the spur roads and logging landings.

Vegetation has encroached and covered a large portion of the spur roads and both of the logging landings (Photo 30). A number of remnant trails which appear to be mountain biking trails were identified along and in the vicinity of the spur roads. The spur roads and logging landings altered drainage patterns in several small drainages in the headwaters of the watershed. Several areas of mild erosion were identified, but appeared to be relatively stable. Moderate to severe erosion was identified (Photo 31) at the larger of the two logging landings (the western landing; #40 from the 2010 Assessment), but signs of active erosion were generally minimal.

8. Crossing #3 (2010 Assessment Site 32)

The same intermittent stream referenced in the description of Crossing #2 again crosses under Billy Mack Road approximately 0.05 miles downstream of Crossing #2. The crossing consists of one CMP culvert, approximately 18-inches in diameter and approximately 80% full of sediment (Photo 36). No sign of overtopping is evident. Both the upstream (Photo 34) and downstream (Photo 35) reaches of the stream are densely vegetated and mildly sloped. Signs of erosion are minimal.

9. Logging Landing #1 (2010 Assessment Site 39)

An abandoned logging landing (Photo 37), approximately 0.4 acres in size, exists on the west side of Billy Mack Road approximately 0.67 miles from the Parking Area (approximately 0.2 miles southwest of the spur road described above). The landing is flat, well vegetated, and blocked to vehicle traffic by large rocks placed at the entrance (Photo 38). OHV traffic, however, can bypass the rocks to enter the landing. An ephemeral drainage runs southwest onto (Photo 39) and through the landing. The drainage channel is mildly incised. Signs of sediment mobilization are minimal.

10. Crossing #4

A large intermittent drainage (west fork Gregory Creek) crossing under Billy Mack Road exists approximately 0.63 miles from the parking area (240 feet southeast of Logging Landing #1 described above). The crossing consists of one 60-inch culvert (Photo 40) with a headwall at the inlet (with "1966" engraved across the top) in good condition with no sediment or debris accumulation. The upstream reach has moderately steep banks, but minimal erosion. The downstream reach (Photos 41-43), however, is severely incised and eroded from the culvert outlet to approximately 150 feet downstream. The banks are steep and the reach has high sinuosity, with tight, narrow turns.

11. The "T"; Project Area K (9a. 2010 Assessment Sites 21-22 & Photos 60-61; 9b. 2010 Assessment Site 33 and Photo 74)

The "T" area, aptly named, is the location where Billy Mack Road approaches from the south, forks to the west and to the east, and Logging Landing #2 primary access road forks to the north. The site is approximately 0.6 miles from the Parking Area (130 feet southeast of Crossing #3). Figure 6 of Appendix A shows an aerial view of the site. Photos 44-56 display field photos of the location. The site is a significant erosion hot spot and source of flows and sediment to the degraded reach of the intermittent stream described above. This site is broken into several sub-sites for more detailed description and assessment, which is included in Appendix C – Field Log.

12. Billy Mack Road (2010 Assessment Sites 37-38 & Photo 75)

This stretch of roadway, approximately 1.2 miles in length, maintains a moderate to steep slope of approximately 7-13% throughout its length, with the upper portion generally running steeper than the lower portion. The road runs parallel to the west fork of Gregory Creek, crosses the creek, and then runs above the creek up and out of the watershed. Numerous existing waterbars (Photo 57-68) divert road runoff toward the creek and in many cases, directly into the creek. The waterbars appear to be functional and had received minor maintenance shortly before the field reconnaissance. Erosion at the waterbar outfall ranges from minor at the lower waterbars to severe at the upper waterbars where the road is directly adjacent to the deep Gregory Creek West Fork channel. Photo 69 shows an example of moderate erosive rilling and gullying at the outfall of an upper waterbar (above The "T") where waterbar spacing is insufficient for preventing erosion.

13. Gregory Creek Spur Road

A short spur road forks to the south off of Billy Mack Road approximately 0.12 miles from the Parking Area. The road terminates as it approaches the Gregory Creek overflow channel west of the main channel. The road and surrounding area is flat and erosion is minimal (Photos 70-71).

14. Crossing #5

Gregory Creek East Fork crosses under Billy Mack Road approximately 0.1 miles from the Parking Area. The crossing consists of two 16-inch diameter culverts with headwalls constructed at both the inlets (Photo 72) and outlets. Mild erosion is evident within the upstream and downstream reaches, which are relatively low slope and well vegetated through the reach (Photos 73-74). An overflow channel exists along the west side of the main channel (Photos 75-76). The overflow channel displays signs of moderate erosion upstream from the road and severe erosion downstream of the road where the overflow channel turns slightly south to reconnect with the main channel. It is apparent that the

overflow channel is activated periodically during normal water years and the large rocked low water crossing that was recently installed for the overflow channel road crossing suggests that overflow has partially washed out the road in the past. Photos 88 and 89 show Billy Mack Road being overtopped at the location in fall 2016.

15. Former Staging Area; Project Area J (2010 Assessment Site 36)

An abandoned Caltrans Staging Area exists across Billy Mack Road from the Parking Area. The Former Staging Area was constructed during the construction of I-80 in the 1960's with relatively impermeable compacted subbase and a concrete pad, approximately 0.07 acres in size, occupying the northwest corner. The total area of the site is approximately 0.8 acres. The site generally lacks vegetation and is sloped from north to south at approximately 6% (elevation ranging from 6,409 feet at the north boundary to 6,382 at the south boundary/primary drainage outlet). Run-on to the site occurs in two locations from two small ephemeral drainages, one of which contributes to flows down the center of the Staging Area and the other is conveyed through a small drainage ditch along the east side of the Staging Area. The site is a significant erosion hotspot, with several locations of moderate to severe rilling and gulying. Figure 7 of Appendix A shows an aerial view of the site. Photos 77-85 and 91-94 display field photos of the area. This site is broken into several sub-sites for more detailed description and assessment, which is included in Appendix C – Field Log.

2010 Assessment Verification and Revisions

The majority of the preliminary assessments and recommendations from the 2010 effort that were investigated during this effort were verified and further elaborated upon. The most significant modifications that were made to the 2010 assessment and recommendations are as follows:

1. The 2010 assessment referred to the Four Corners (Site #1) area as an abandoned quarry. It is the opinion of the Wildscape team that the area is not an abandoned quarry. However, the 2010 assessment of the site – "OHV use is causing erosion; regrade and fully restore" is consistent with the assessment and recommendations provided herein.
2. The 2010 assessment recommended that the abandoned Quarry (Site #3) be regraded and fully restored. It is the opinion of the Wildscape team that the regrading and restoring of the quarry site is not necessary, as the quarry is currently functioning as a detention basin and isn't posing a direct threat to water quality. Given its remoteness and minimal impact to water quality, we recommend the site largely be left "as is", with the exception of replacing the clogged culvert with a rocked spillway and possibly enhancing the road/berm feature to protect the road from erosion during large precipitation events and extend the longevity of the "detention feature".

3. The 2010 assessment called for water bars or rolling dips along several of the spur roads in Project Area C (Site #7) and only recommended decommissioning one of the steep spur roads. Because the spur roads don't appear to serve any purpose (i.e. fire protection or powerline access) and can only be accessed from a gated road which passes through private property, we recommend that all of the spur roads be decommissioned, regraded as necessary to restore historic drainage patterns, and revegetated as necessary to stabilize bare soils.

Roadways and OHV Trails

Removing roads and OHV trails that are no longer needed will contribute to restoring historic natural drainage patterns and improving the hydraulics and water quality of the watershed. Several cannot be decommissioned, however, due to fire access needs, OHV stakeholders' interests, and legalities (easements). Billy Mack Road along the west fork of Gregory Creek has been identified as a significant contributor to accelerated erosional and incisional processes within the watershed, and relocation of the road has been considered. Realigning the road such that it is less steep and further from Gregory Creek would substantially reduce future sediment transport and enable more intensive restoration efforts along the west fork of Gregory Creek. The high cost and short term impacts, however, present challenges to such an option. Improvement and addition of erosion mitigating measures, such as waterbars, rolling dips, rock-lined swales, and rock energy dissipaters, is an effective intermediate solution for minimizing the impacts of Billy Mack Road and other roads and trails that cannot be decommissioned or relocated at this time. Installation of gravel along sensitive portions of the roadway (i.e. where runoff discharges directly to Gregory Creek) is another potential intermediate solution that should be considered to assuage the water quality issues.

Chapter 3. Restoration Actions, Prioritization, and Costs

Table 1 lists the sites identified as erosion hotspots and areas in need of restoration, provides a brief description of the sites, restoration recommendations, prioritization, and cost scale on a \$, \$\$, \$\$\$ basis where \$ is less than \$50,000, \$\$ is \$50,000 - \$100,000, and \$\$\$ is greater than \$100,000. The high priority sites are shown in bold.

Based on the existing evidence of erosion and risk for continued erosion of the erosion hotspots identified and described, the Wildscape Team recommends that the following moderate and high priority sites be restored, via the recommended restoration actions provided in Table 1, in the following order:

1. Site #15: Project Area J (Staging Area)
2. Site #12: Billy Mack Road
3. Site #10: Crossing #4
4. Site #11: Project Area K (The "T")
5. Site #1: Project Area L (4 Corners)
6. Site #7: Project Area C

Table 1: Assessment Summary Table.

Site ID	Photo #s	Name	Description	2010 Assessment ID	2010 Assessment Photo #s	2010 Assessment/ Recommendation	Restoration Priority	Recommended Restoration Action	Cost
#1	1-12	Four Corners: Project Area L	Area along eastern slope of western ridge with numerous OHV trails.	#35	N/A	Quarry: OHV use causing erosion; Regrade and fully restore.	High	See recommended actions for sub-sites shown below.	\$\$
#1a	2-3	Billy Mack Road Ascent to Ridge	Ascent to ridgetop approximately 165 feet in length from OHV forks.	N/A	N/A	N/A	High	Install rock-lined drainage swale and check dams along inside edge.	\$
#1b	4	Billy Mack Road Main Ridge Route	Approximately 0.1 miles along ridgetop before leaving watershed.	N/A	N/A	N/A	High	Install rolling dips and rock-lined drainage swale outlets.	\$
#1c	5	Billy Mack Road Alternative Ridge Route	Approximately 175-foot long alternative route along east side of main route.	N/A	N/A	N/A	High	Decommission, scarify, and revegetate.	\$
#1d	6-7	OHV North Route	OHV route north over rock outcrop, approximately 460 feet in length.	#35	N/A	Quarry: OHV use causing erosion; Regrade and fully restore.	Moderate	Consider decommissioning.	\$
#1e	8-9	OHV Center Route	OHV route straight ascent to ridgetop, approximately 215 feet in length.	#35	N/A	Quarry: OHV use causing erosion; Regrade and fully restore.	High	Decommission, scarify, and revegetate.	\$
#1f	10-11	OHV South Loop	OHV route to scenic lookout atop ridge.	#35	N/A	Quarry: OHV use causing erosion; Regrade and fully restore.	Moderate	Decommission, scarify, and revegetate east portion of loop; leave portion along ridge with turn-around for access to scenic overlook.	\$
#1g	12	Existing Rolling Dip	Failed rolling dip at bottom of Four Corners drainage area.	N/A	N/A	N/A	High	Reconstruct rolling dip; construct new rolling dip up road and rock-lined outlets.	\$
#2	13-15	USFS Rd Southwest Fork	One crossing with 6" culvert; 2 forks; terminates at all ends within USFS land.	#35	N/A	N/A	Low	Remove culvert and install rock-lined crossing.	\$
#3	16-20	Quarry	Abandoned quarry, approximately 1.1 acres, 16" culvert at basin outlet.	#34	N/A	Quarry: some signs of sediment leaving area; Regrade and fully restore.	Low	Replace culvert with rock-lined spillway.	\$
#4	21	OHV Climb	Steep climb from Billy Mack Road, approximately 115 feet up to terminus.	N/A	N/A	N/A	Low	Decommission and revegetate.	\$

Table 1: Assessment Summary Table.

Site ID	Photo #s	Name	Description	2010 Assessment ID	2010 Assessment Photo #s	2010 Assessment/ Recommendation	Restoration Priority	Recommended Restoration Action	Cost
#5	22-24	Crossing #2	Intermittent stream crossing with two culverts (primary 20" and secondary 10" diameter approximately 50% full of sediment); minimal erosion.	N/A	N/A	N/A	Low	Monitor and consider replacing culverts with single suitably-sized culvert, or realign.	\$
#6	25-27	Billy Mack Road /DLRT Connector	Steep spur road approximately 0.1 miles; terminates at DLRT.	N/A	N/A	N/A	Low	Consider decommissioning (consult with stakeholders). Install gate if decommissioning is not an option.	\$
#7	28-33	Project Area C	Several spur roads accessed from private road to the north, leading to two logging landings - significantly altered drainage patterns, several areas of minor erosion; severe erosion through West Logging Landing.	#27-31, 40-41	#72-73	27, 28, 29, 31: Road capturing drainage and actively eroding; Need to place water bars or rolling dips. 29: This is a steep spur road that is no longer needed. The road is actively eroding; Completely remove road and replant with grasses, shrubs, and trees. 40, 41: Old logging landing is eroding and modify water flows; Remove landing fill and recontour landscape, and replant native vegetation.	Moderate	Decommission all spur roads, regrade spur roads and logging landings as needed to restore historic drainage patterns, and revegetate as needed to stabilize bare soils; equipment access to this area may present challenges (only road access is through private property).	\$\$
#8	34-36	Crossing #3	Intermittent stream crossing with one culvert, approximately 18" diameter and 80% full of sediment; minimal erosion.	#32	N/A	Culvert mostly blocked; Replace culvert and add rolling dip.	Low	Monitor and consider flushing or replacing culvert if overtopping occurs.	\$
#9	37-39	Logging Landing #1	Approximately 0.4 acres; float and well-vegetated; run-on from ephemeral drainage.	#39	N/A	Eroding and modifying flows; Remove fill, re-contour, revegetate.	Low	Consider minor regrading, revegetation, and rocking drainage swales.	\$

Table 1: Assessment Summary Table.

Site ID	Photo #s	Name	Description	2010 Assessment ID	2010 Assessment Photo #s	2010 Assessment/ Recommendation	Restoration Priority	Recommended Restoration Action	Cost
#10	40-43	Crossing #4	Large intermittent drainage (West fork Gregory Creek); 60" culvert with headwall; severe downstream erosion.	N/A	N/A	N/A	High	Install bank stabilization throughout eroded downstream reach (biotechnical measures and rock slope protection) and regrade banks as needed.	\$\$\$
#11	44-56	The "T": Project Area K	Intersection of USFS Rd east & west forks and logging landing #2 access roads.	#21-22, 33	#60-61, 74	N/A	High	See recommended actions for sub-sites shown below.	\$\$
#11a	45	USFS Road East Fork	Approximately 0.15 miles, three failed waterbars, large drainage area.	#21-22	#60-61	Road capturing drainage and actively eroding; install waterbars or rolling dips.	High	Reconstruct existing waterbars, construct new waterbars up-gradient, install rock-lined outlets.	\$
#11b	46-49	Logging Landing #2	Approximately 0.3 acres with two camp areas and run-on channel.	N/A	N/A	N/A	Moderate	Decommission, regrade, and revegetate as needed.	\$
#11c	50-51	Logging Landing #2 East Access Road	Primary access road to Logging Landing #2.	#33	#74	Steep spur road no longer needed; Remove and revegetate.	High	Decommission, regrade, and revegetate as needed.	\$
#11d	52-53	Logging Landing #2 Center Access Road	Secondary access road to Logging Landing #2.	N/A	N/A	N/A	High	Decommission, regrade, and revegetate as needed.	\$
#11e	54-55	Logging Landing #2 West Access Road	Steep short access road to Logging Landing #2.	N/A	N/A	N/A	Moderate	Decommission, regrade, and revegetate as needed.	\$
#11f	56	Rolling Dip and Diversion Channel	Immediately south of fork, routes runoff into adjacent stream.	N/A	N/A	N/A	High	Improve existing rolling dip and install rock energy dissipaters within existing diversion channel.	\$
#12	57-69	Billy Mack Road	Approximately 1.5 miles of steep roadways in vicinity of the west for of Gregory Creek, consisting of numerous rolling dips with varying spacing.	#37-38	#75	Roadway capturing water, waterbars not sufficient; Create new waterbars/modify existing.	High	Improve existing rolling dips and install rock outlet protection; construct new rolling dips where spacing is inadequate to prevent roadway erosion.	\$\$

Table 1: Assessment Summary Table.

Site ID	Photo #s	Name	Description	2010 Assessment ID	2010 Assessment Photo #s	2010 Assessment/ Recommendation	Restoration Priority	Recommended Restoration Action	Cost
#13	57-58	Gregory Creek Spur Road	Short spur road west of Gregory Creek East Fork south of Billy Mack Road.	N/A	N/A	N/A	Low	Decommission and revegetate.	\$
#14	59-63 89-90	Crossing #5	Gregory Creek East Fork and overflow channel crossing at Billy Mack Road.	N/A	N/A	N/A	Low	Stabilize overflow channel banks.	\$
#15	64-72 91-94	Former Staging Area: Project Area J	Approximately 0.8 acres, generally impervious and lacking vegetation.	#36	N/A	Creek has been pushed to side for construction pad; fully remove, relocate riparian area, and revegetate. cbec et al. 2016 recommendation: convert the area into a floodplain meadow and wetland complex.	High	Restore to historic condition – will require additional analyses to determine approximate historic state. See additional recommended actions for sub-sites shown below.	\$\$\$
<i>#15a</i>	64	Ephemeral Drainage	Drains from Billy Mack Road south to Former Staging Area	N/A	N/A	N/A	Moderate	Construct new rock lined channel or vegetated swale to re-route drainage away from Staging Area.	\$
<i>#15b</i>	65-66	Partially Decommissioned Road	Connects Staging Area to Billy Mack Road, approximately 300 feet long.	N/A	N/A	N/A	Low	Revegetate.	\$
#15c	67-68	Concrete Pad	Northwest corner of Former Staging Area, approximately 63' x 46'.	N/A	N/A	N/A	High	Demolish concrete pad, scarify, and revegetate.	\$
#15d	69 93-94	Compacted Subbase	The majority of the Former Staging Area.	N/A	N/A	N/A	High	Scarify and revegetate.	\$
<i>#15e</i>	70-71 92	East Drainage Ditch	Drainage ditch along east boundary of Former Staging Area.	N/A	N/A	N/A	Moderate	Install rock-lining and rock check dams.	\$
#15f	72	Runoff Outlet	Primary Former Staging Area runoff outlet.	N/A	N/A	N/A	High	Regrade and revegetate.	\$

Literature Cited

IERS (Integrated Environmental Restoration Services). 2010. Negro Canyon Watershed Assessment. May 28, 2010. Prepared for Truckee River Watershed Council.

cbec Engineering, H.t. Harvey & Associates, Susan Lindstom. 2016. Donner Basin Watershed Assessment. Prepared for Truckee River Watershed Council. January 2016.

APPENDIX A – Project Photos

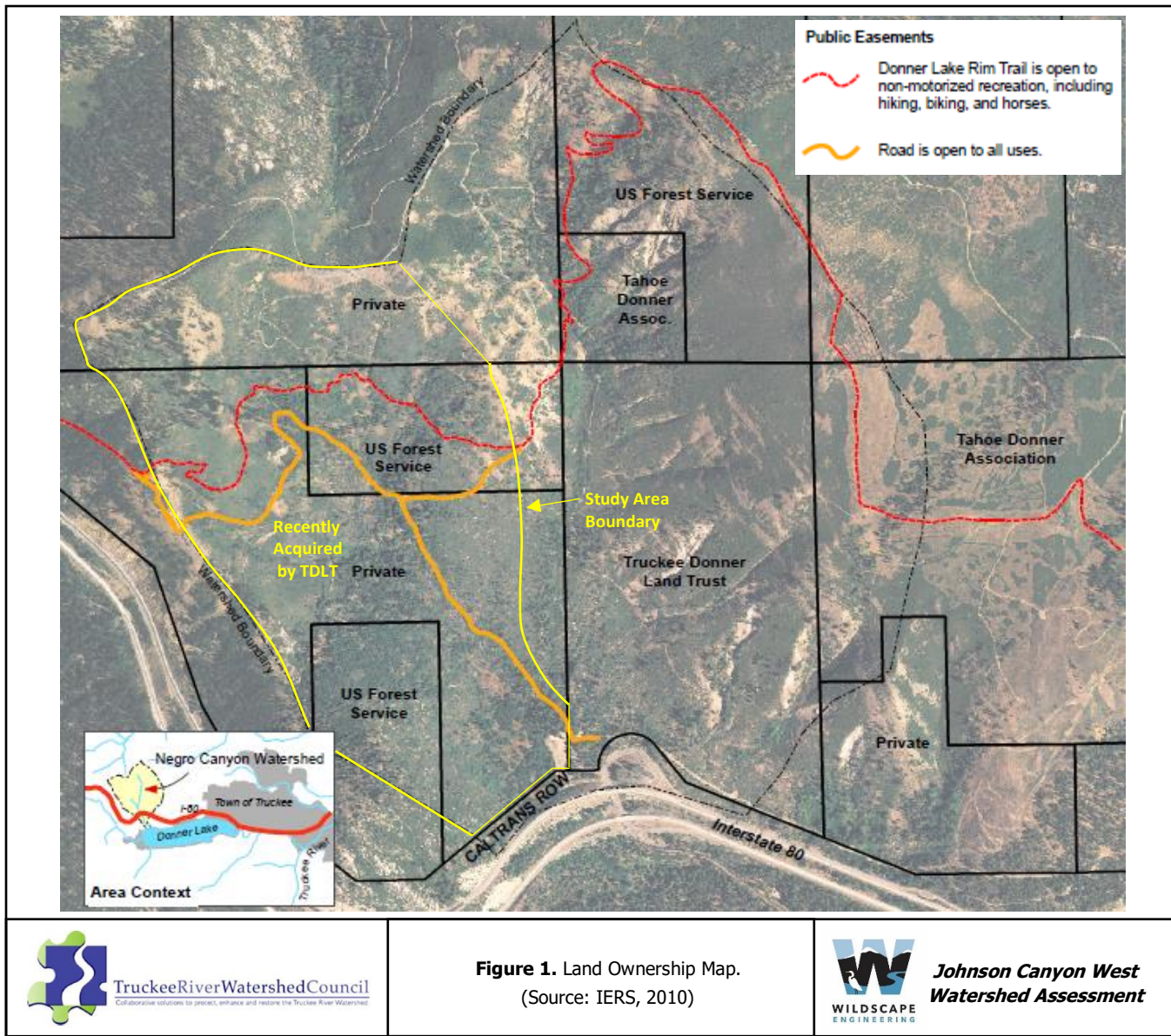


Figure 1. Land Ownership Map.
(Source: IERS, 2010)





Figure 2. Study Area Site Map.
(Source: Google Earth, 2016)



Johnson Canyon West
Watershed Assessment



Figure 3. USFS Roads within Study Area.
(Source: <http://www.fs.fed.us/ivm/index.html>)



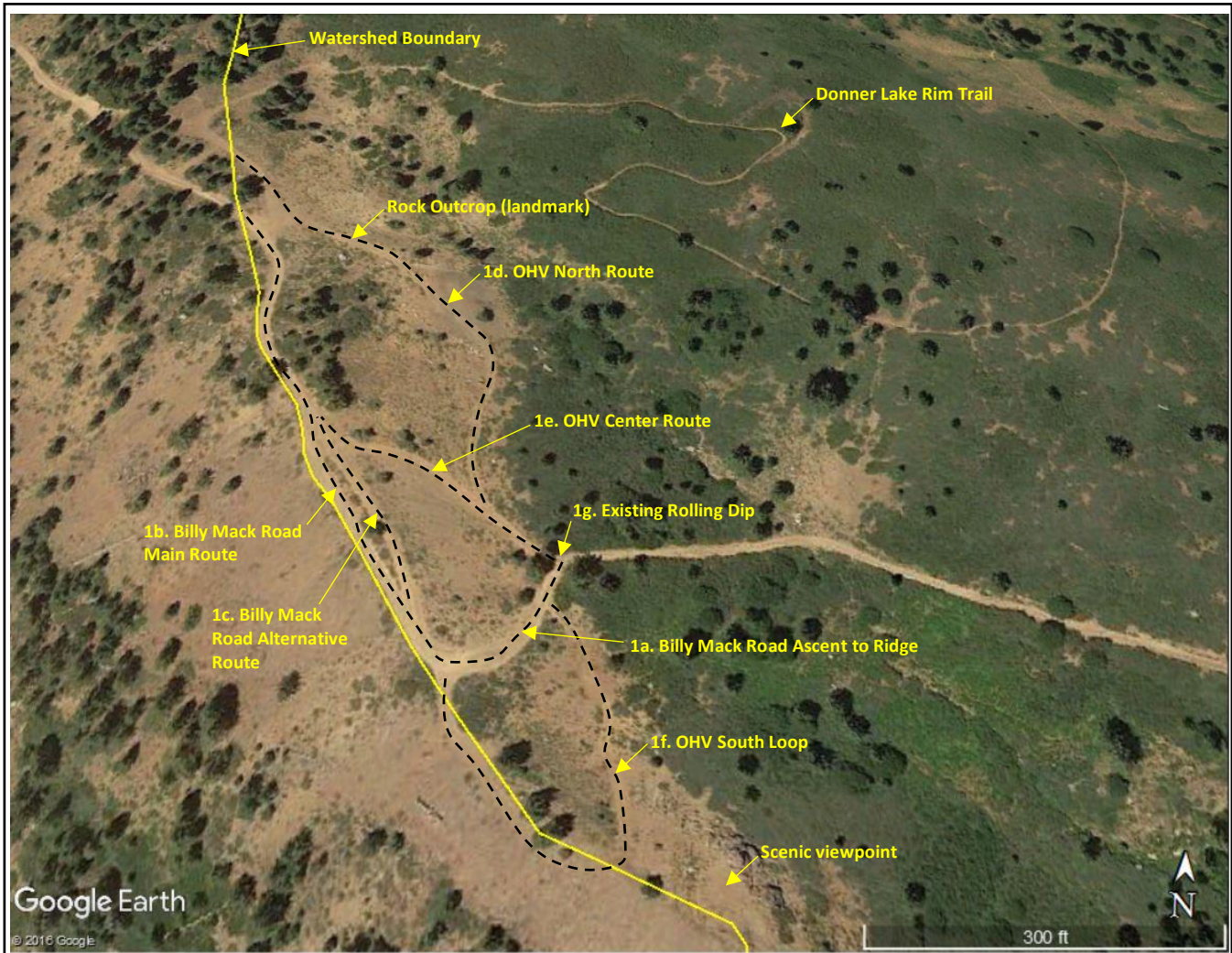


Figure 4. Aerial View of Project Area L: "Four Corners" (#1).
 (Source: Google Earth, 2016)



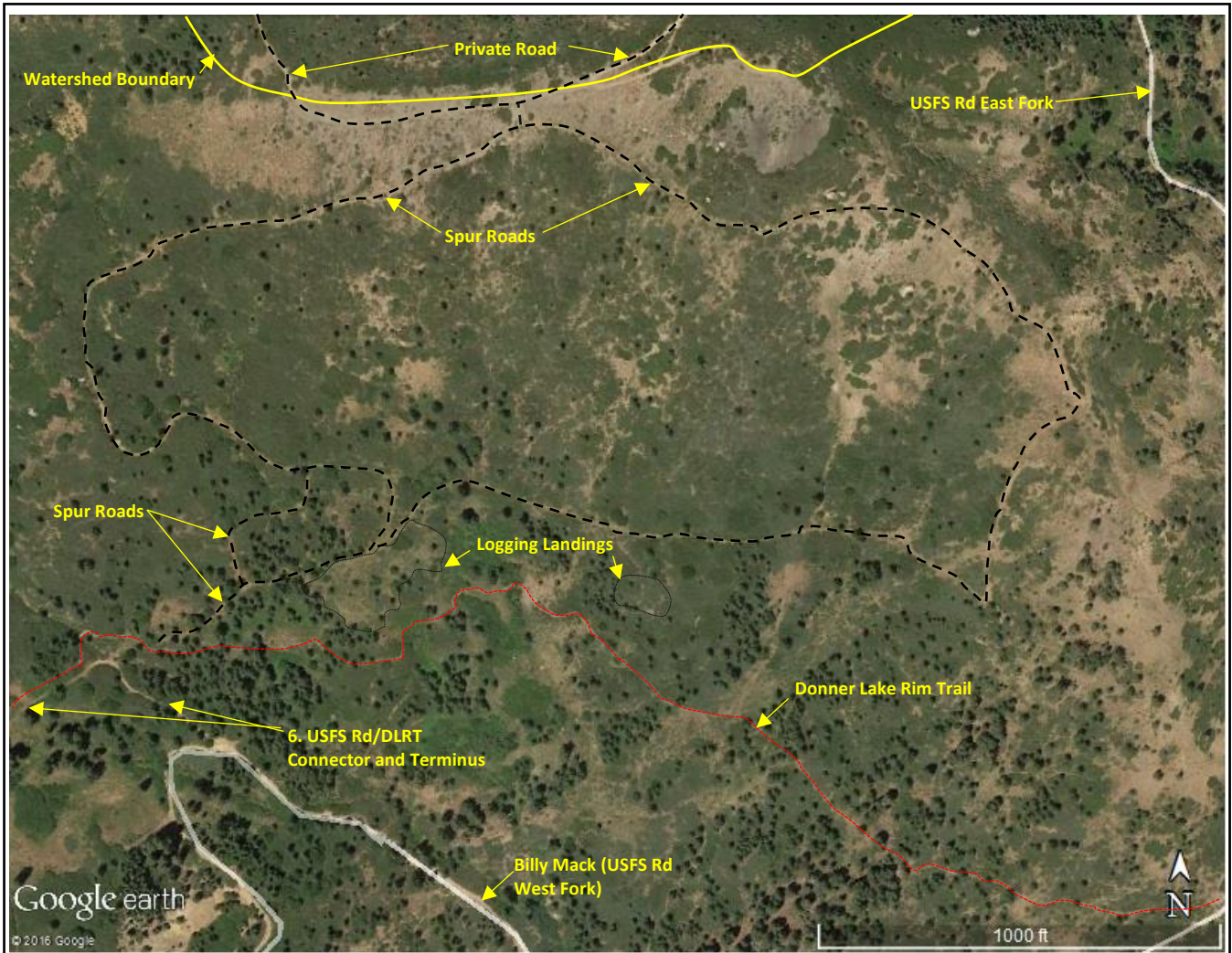
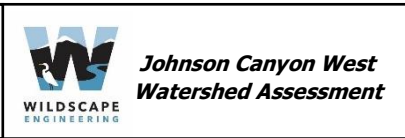


Figure 5. Aerial View of Project Area C (#7):
 (Source: Google Earth, 2016)





Figure 6. Aerial View of Project Area K: "The T" (#11).
 (Source: Google Earth, 2016)





Google earth

300 ft



Figure 7. Aerial View of Project Area J: "Former Staging Area" (#15).
(Source: Google Earth, 2016).



APPENDIX B – Photo Log



Photo 1. #1 – Four Corners Site (looking northwest from #1f – OHV South Loop).



Photo 2. Inside bend of #1a – Billy Mack Road Ascent to Ridge (looking southeast).



Photo 3. Gullying along northern edge of #1a – Billy Mack Road Ascent to Ridge (looking northeast down road from start of #1f – OHV South Loop).



Photo 4. #1b – Main Route of Billy Mack Road along ridge (looking south down road from intersection of Main Route, Alternative Route, OHV Center Route; #1f – OHV South Route visible in background).



Photo 5. #1c – Alternative Route of Billy Mack Road along ridge (looking south down road from intersection of Main Route, Alternative Route, and OHV Center Route).



Photo 6. #1d – OHV North Route ascent to Billy Mack Road (looking northwest from rock outcrop).



Photo 7. #1d – OHV North Route descent to Billy Mack Road (looking south from rock outcrop).



Photo 8. #1e – OHV Center Route ascent to Billy Mack Road and runoff flowline (looking northwest from location where OHV North Route forks from Center Route).



Photo 9. #1e – OHV Center Route (looking northwest from Billy Mack Road, #1d – OHV North Route forks to the right at center of frame).



Photo 10. #1f – OHV South Loop to scenic viewpoint (looking south from Billy Mack Road).



Photo 11. #1f – OHV South Loop possible turn-around location (looking north).



Photo 12. #1g – Rolling Dip at bottom of Four Corners drainage area (looking east from location where OHV Center/North Route fork from Billy Mack Road).



Photo 13. #2 – Southwest Fork USFS Rd 6-inch iron culvert at Crossing #1 (looking southeast in downstream direction).



Photo 14. #2 – Southwest Fork of USFS Rd beyond culvert crossing (looking southwest).



Photo 15. #2 – Southwest Fork of USFS Rd entering forested USFS land (looking south).



Photo 16. #3 – Quarry north side (looking west from Billy Mack Road).



Photo 17. #3 – Quarry south side (above looking east from top of Quarry).



Photo 18. #3 – Quarry culvert outlet from basin (looking south).



Photo 19. #3 – Quarry culvert inlet (looking southwest).



Photo 20. #3 – Quarry culvert outlet area (looking southeast).



Photo 21. #4 – OHV Climb
(looking east from top looking down to Billy Mack Road).



Photo 22. #5 – Crossing #2 culvert outlets (looking west).



Photo 23. #5 – Crossing #2 upstream channel (looking northwest).



Photo 24. #5 – Crossing #2 downstream channel (looking southeast).



Photo 25. #6 – Billy Mack Road/DLRT Connector (looking northwest from Billy Mack Road West Fork, waterbars present in foreground).



Photo 26. #6 – Billy Mack Road/DLRT Connector terminus just beyond intersection with DLRT (looking north, DLRT crosses through center of frame).



Photo 27. Looking southeast from #6 – Billy Mack Road/DLRT Connector toward Billy Mack Road, waterbar diverts runoff to the left where minor erosion is evident.



Photo 28. #7 – Project Area C Spur Road capturing drainage causing minor erosion (looking northwest).



Photo 29. #7 – Project Area C Spur Road capturing drainage causing minor erosion (looking northeast).



Photo 30. #7 – Project Area C Spur Road partially grown over near East Logging Landing (looking northeast).



Photo 31. #7 – Project Area C West Logging Landing, alters drainage patterns and has caused significant erosion (looking southwest from above).



Photo 32. #7 – Project Area C incised drainage channel along east side of West Logging Landing (looking south).



Photo 33. Looking east from the top of #7 – Project Area C where private road traverses along the ridge/northern watershed boundary.



Photo 34. #8 – Crossing #3 (looking upstream, northwest from Billy Mack Road).



Photo 35. #8 – Crossing #3
(looking downstream, southeast from Billy Mack Road).



Photo 36. #8 – Crossing #3 culvert outlet approximately 80% full of sediment.



Photo 37. #9 – Logging Landing #1 (looking southeast from blocked entrance).



Photo 38. #9 – Logging Landing #1 blocked entrance (looking northeast).



Photo 39. #9 – Logging Landing #1 intermittent drainage running onto landing (looking northwest).



Photo 40. #10 – Crossing #4 culvert inlet (looking south).



Photo 41. #10 – Crossing #4 culvert outlet (looking northwest).



Photo 42. #10 – Crossing #4 immediately downstream of culvert (looking south).



Photo 43. #10 – Crossing #4 approximately 75 feet downstream of culvert outlet (looking south).



Photo 44. #11 – The “T” (looking southwest from #11c – Logging Landing #2 East Access Road)



Photo 45. #11a – USFS Rd East Fork (looking east) 



Photo 46. #11b – Logging Landing #2
(looking northwest from #11c – Logging Landing #2 East Access Road).



Photo 47. Ephemeral drainage channel running onto #11b – Logging Landing #2 (looking northeast from #11b – Logging Landing #2).



Photo 48. Camp area #1 located in northwest portion of #11b – Logging Landing #2 (looking northwest from #11b – Logging Landing #2).



Photo 49. Camp area #2 located in north portion of #11b – Logging Landing #2 (looking north from #11b – Logging Landing #2).



Photo 50. #11c – Logging Landing #2 East Access Road (looking south from #11b – Logging Landing #2).



Photo 51. #11c – Logging Landing #2 East Access Road (looking northwest from Billy Mack Road fork).



Photo 52. #11d – Logging Landing #2 Center Access Road (looking south from #11b – Logging Landing #2).



Photo 53. #11d – Logging Landing #2 Center Access Road (looking north from Billy Mack Road fork).



Photo 54. #11e – Logging Landing #2 West Access Rd (looking southwest from #11b – Logging Landing #2).



Photo 55. #11e – Logging Landing #2 West Access Road (looking northeast from Billy Mack Road).



Photo 56. #11f – Billy Mack Road Fork Rolling Dip and Diversion Channel (looking southwest from USFS Road 0676-088 fork).



Photo 57. #12 – Billy Mack Road waterbar #1 (from The “T” working down).



Photo 58. #12 – Billy Mack Road waterbar #2.



Photo 59. #12 – Waterbar #2 outfall.



Photo 60. #12 – Gregory Creek West Fork downstream of waterbar #2 outfall.



Photo 61. #12 – Billy Mack Road waterbar #3.



Photo 62. #12 – Billy Mack Road waterbar #4.



Photo 63. #12 – Billy Mack Road waterbar #5.



Photo 64. #12 – Billy Mack Road waterbar #6.



Photo 65. #12 – Billy Mack Road waterbar #7.



Photo 66. #12 – Billy Mack Road waterbar #8.



Photo 67. #12 – Billy Mack Road waterbar #9.



Photo 68. #12 – Billy Mack Road waterbar #10.



Photo 69. Example of erosive rilling and gullying from inadequate waterbar spacing on Billy Mack Road (taken in November 2016 after large October 2016 storms).



Photo 70. #13 – Gregory Creek Spur Road (looking south from Billy Mack Road).



Photo 71. #13 Gregory Creek Spur Road terminus at Gregory Creek overflow channel (looking southeast).



Photo 72. #14 – Crossing #5 Gregory Creek east fork culvert inlet (looking southwest).



Photo 73. #14 – Crossing #5 Gregory Creek east fork (looking north upstream from Billy Mack Road; lose dirt in channel, possibly from road maintenance crew).



Photo 74. #14 – Crossing #5 Gregory Creek east fork (looking south downstream from Billy Mack Road).



Photo 75. #14 – Crossing #5 Gregory Creek overflow channel (looking southwest downstream toward Billy Mack Road from west bank of Gregory Creek main channel).



Photo 76. #14 – Crossing #5 Gregory Creek overflow channel (looking south downstream from rockied crossing on Billy Mack Road toward confluence of overflow channel and main channel).



Photo 77. #15a – Ephemeral Drainage that runs onto #15 – Former Staging Area (looking southwest from Billy Mack Road; staging area visible through trees center-left of frame).



Photo 78. #15b – Partially decommissioned road from #15 Former Staging Area to Billy Mack Road; #15a Ephemeral Drainage is along west side of road (looking northeast approximately 150 feet from the northern edge of the Staging Area).



Photo 79. #15b – Partially decommissioned road from #15 Former Staging Area to Billy Mack Road (looking southwest approximately 100 feet from the Staging Area).



Photo 80. #15c – Concrete Pad covering northwest portion of #15 Former Staging Area (looking southeast).



Photo 81. Eroded flowline from northeast corner of #15c – Concrete Pad (looking northwest).



Photo 82. #15d – Compacted Subbase portion of #15 Former Staging Area (looking southeast from southeast corner of #14c – Concrete Pad).



Photo 83. #15e – East Drainage along #15 Former Staging Area (looking south downstream from Staging Area access road).



Photo 84. #15e East Drainage along #15 Former Staging Area (looking north upstream from Staging Area access road).



Photo 85. #15f Outlet from #15 Former Staging Area to Caltrans drainage ditch along I-80 (looking southwest).



Photo 86. Central portion of eastern slope within study area (looking west from USFS Rd 0676-088 East Fork near the Gregory Creek West Fork sub-watershed east boundary; the previously referenced scenic viewpoint is visible at top-right of frame; the powerlines are visible passing beneath the scenic viewpoint; USFS Road Southwest Fork gains the ridge and leaves the study area behind the rock knoll at top-left of frame).



Photo 87. South portion of eastern slope within study area (looking southwest from USFS Rd 0676-088 East Fork near the Gregory Creek West Fork sub-watershed east boundary).



Photo 88. View of the lower portion of the Gregory Creek West Fork sub-watershed (looking southwest from USFS Rd 0676-088 East Fork at the sub-watershed east boundary).



Photo 89. #14 – Crossing #5 Gregory Creek east fork flowing over Billy Mack Road due to high flows during storm in fall 2016 (looking northwest, up Billy Mack Road).

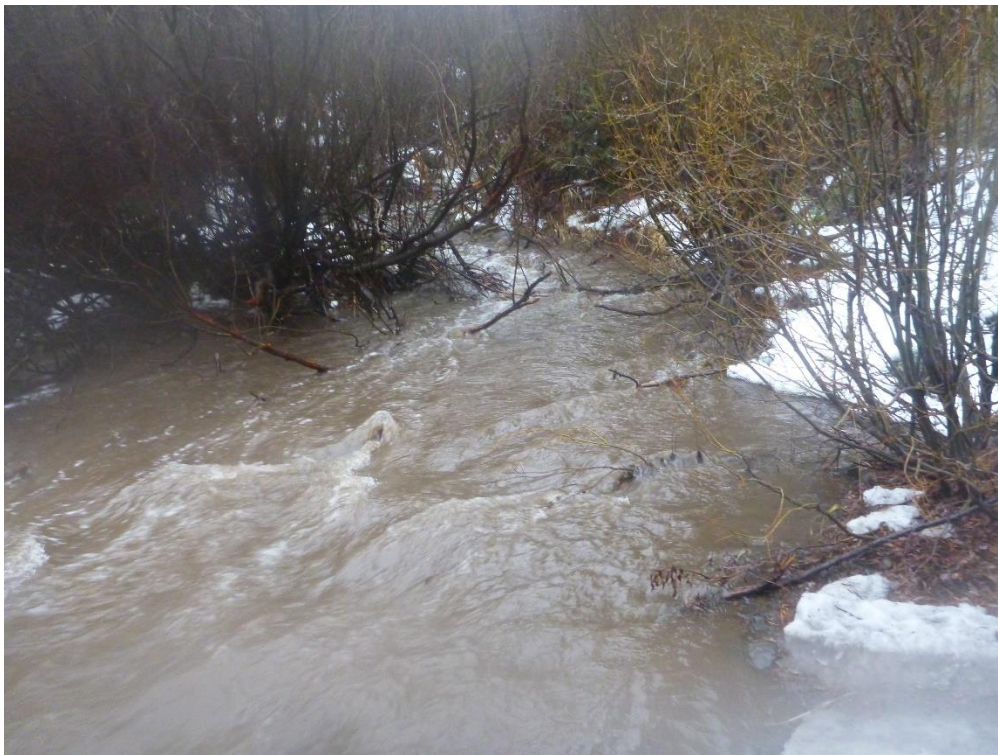


Photo 90. #14 – Crossing #5 Gregory Creek east fork during storm in fall 2016 (looking northeast, upstream).



Photo 91. #15d – Compacted Subbase during storm in fall 2016 (looking southwest).



Photo 92. #15d – Compacted Subbase during storm in fall 2016 (looking southwest).



Photo 93. #15e – East ephemeral drainage along Former Staging Area east boundary during storm in fall 2016 (looking southwest).



Photo 94. #15 – Confluence of runoff from I-80 West Exit 180 off-ramp and ephemeral drainage from the lower eastern portion of Johnson Canyon (looking north); these flows drain through the Caltrans drainage ditch and join runoff flows from the Former Staging Area before entering Gregory Creek.

APPENDIX C – Field Log

1. Four Corners; Project Area L (2010 Assessment Site 35)

At the location where Billy Mack Road gains the ridge that defines the western watershed boundary, the slope is steep, vegetation is sparse, and numerous OHV trails have been developed. Figure 5 of Appendix A shows an aerial view of the site. Photos 1-12 of Appendix B display field photos of the location. Signs of erosion vary among OHV routes and along Billy Mack Road, ranging from mild to severe. This site is broken into the following sub-sites for more detailed description and assessment:

1a. Billy Mack Road Ascent to Ridge (Photos 2-3)

This steep stretch of Billy Mack Road, approximately 165 feet in length, currently drains runoff from the Main and Alternative Routes along the ridge (see descriptions below) and lacks erosion control (i.e. rocked ditch, rolling dips, waterbars). Accordingly, gullying has developed along the northern border of the road. The gullying is most severe along the inside bend of the road (Photo B2) where it gains the ridge (approximately 1.5 feet in depth and 3 feet wide across the top) and continues along the inside edge of the road (Photo B3) to the location where the Center/North OHV routes (see descriptions below) fork north from Billy Mack Road.

1b. Billy Mack Road Main Ridge Route (Photo 4)

This moderately sloped stretch of Billy Mack Road sits atop the ridge that defines the western watershed boundary for approximately 0.1 miles. Moderate gullying has developed along its eastern boundary and no erosion control currently exists. A small portion of runoff from the western side of the road drains west out of the watershed, where the flow path is steep and moderately eroded.

1c. Billy Mack Road Alternative Ridge Route (Photo 5)

This alternative route, approximately 175 feet in length, exists adjacent to the main route along the east side within the watershed. Moderate gullying has developed along its eastern boundary and no erosion control currently exists. A portion of runoff from the top of the stretch near the intersection with the main route and the OHV center route drains east toward the OHV Center Route where minor gullying has formed.

1d. OHV North Route (Photos 6-7)

This OHV route, approximately 460 feet in length, forks from the Center Route to the north, passes over a rock outcrop, turns northwest, then ascends to the ridgetop where it reconnects with Billy Mack Road. Erosion along this stretch is minor, with no significant gullying present.

1e. OHV Center Route (Photos 8-9).

This OHV route, approximately 215 feet in length, ascends the steep sparsely vegetated slope to the ridgetop where it reconnects with Billy Mack Road (at the intersection of the main and alternative Billy Mack Road ridge routes). Moderate gullying has developed along the southern boundary of this OHV trail where runoff from the route itself and from the bowl to the south of the route concentrates. This drainage flow path converges with the gullied drainage flow path from Billy Mack Road at the location where the OHV Center/North routes fork from Billy Mack Road.

1f. OHV South Loop (Photos 10- 11)

This OHV route forks from the Billy Mack Road approximately 35 feet after the OHV Center/North route fork and traverses south across two small ephemeral drainages for a distance of approximately 260 feet to the ridgetop where it turns sharply to follow the ridge to the northwest back to Billy Mack Road (where the road gains the ridge) providing access to a scenic viewpoint (knob atop ridge to the southeast). The steep portion of the loop that traverses and climbs to the ridgetop has mild gullying along the north side and runoff from this portion has contributed to mild erosion within the ephemeral drainages. The portion of the loop atop the ridge is wide and flat, has no signs of erosion, and could potentially be used as a turn-around (Photo B11).

1g. Existing Rolling Dip (Photo 12)

The existing rolling dip at the bottom of the Four Corners drainage area is appropriately placed to divert runoff, but has been compacted and eroded through the center and is no longer functional. Runoff currently bypasses the rolling dip and flows along the north edge of Billy Mack Road for approximately 100 feet until reaching the next rolling dip, which effectively diverts the flow to the south off of the roadway. Moderate gullying has developed along this stretch of road as a result of the rolling dip failure.

11. The "T"; Project Area K (11a. 2010 Assessment Sites 21-22 & Photos 60-61; 11b. 2010 Assessment Site 33 and Photo 74)

The "T" area, aptly named, is the location where Billy Mack Road approaches from the south, forks to the west and to the east, and Logging Landing #2 primary access road forks to the north. The site is approximately 0.6 miles from the Parking Area (130 feet southeast) Figure 6 of Appendix A shows an aerial view of the site. Photos 44-56 display field photos of the location. The site is a significant erosion hot spot and source of flows and sediment to the degraded reach of the intermittent stream described above. This site is broken into the following sub-sites for more detailed description and assessment:

11a. USFS Road East Fork (Photo 45)

The portion of the east fork of the USFS Road that is within the study area is approximately 0.15 miles in length, spanning from the fork to the approximate divide between the Gregory Creek east and west sub-watersheds. This east-west stretch of roadway is moderately sloped at approximately 10% throughout the stretch (drops from elevation 6,835 feet at the east study area boundary to 6,755 feet at the roadway fork over approximately 800 feet) and captures runoff from the hillside to the north. The runoff currently runs the length of the road and discharges to the previously described degraded intermittent stream reach via the diversion channel at the fork.

Three waterbars exist along the stretch (Figure 6 of Appendix A), spaced at approximately 75 feet apart, with the first located approximately 500 feet from the eastern boundary of the Gregory Creek west fork sub-watershed and the last approximately 150 feet from the roadway fork. Minor erosion is evident along the slope south of the road at the outfall of the waterbars, although it is clear that runoff no longer discharges via the waterbar outfalls as intended, due to the failure of the waterbars along the northern edge of the road. The lack of waterbars to divert roadway runoff along the first 500 feet is the likely cause of failure of the existing waterbars (first waterbar overloaded, leading to failure followed by subsequent failure of downstream waterbars). The failed waterbars have resulted in severe gulying along the north edge of the road (Photo 45), substantial sediment transport and added drainage area and runoff entering the degraded reach, which in turn has contributed to the observed downstream erosion.

11b. Logging Landing #2 (Photos 46-49)

An abandoned logging landing, approximately 0.3 acres in size, exists north of the USFS Rd fork, approximately 0.6 miles from the Parking Area. The logging landing is relatively flat and well vegetated (Photo 46). A small ephemeral drainage channel runs onto the landing (Photo 47) and continues along the east side of the landing onto the road at the fork. Two areas within the northwest and north portions of the landing have rock campfire rings and some trash (Photos 48 and 49), indicating that the site has been used as a camp in the past. Signs of erosion in the area of the landing are minimal. However, it was noted that invasive Cheat Grass is present in the area.

11c. Logging Landing #2 East Access Road (Photos 50-51)

The east access road to the logging landing appears to be the primary access road. The above described ephemeral drainage runs along the east side of the road and has caused minor gulying. Runoff from the channel joins runoff from the east fork of the road (described above), crosses the road in the west direction, and discharges to the above described degraded intermittent stream reach via the existing diversion channel.

Large rocks and earth mounds exist in the area of the access road, likely from the displacement of material in the construction of the access road and logging landing.

11d. Logging Landing #2 Center Access Road (Photo 52-53)

The center access road to the logging landing also appears to be a primary access route. The center access route is slightly steeper than the east route. Runoff from the majority of the landing discharges along the west edge of the access road and minor erosion is evident. Runoff from this route runs along Billy Mack Road (west fork beyond The "T") for approximately 100 feet until reaching the rolling dip and being diverted to the above described degraded intermittent stream reach via the existing diversion channel. An earthen berm exists along the east edge of the access road, likely from the displacement of material in the construction of the access road and logging landing.

11e. Logging Landing #2 West Access Road (Photos 54-55)

The west access road to the logging landing is the steepest, narrowest, and least used of the three routes. Some erosion is evident, with tree roots exposed along the west edge of the route. Runoff from this route crosses Billy Mack Road.

11f. Rolling Dip and Diversion Channel (Photo 56)

A rolling dip exists on Billy Mack Road just before the road forks. The rolling dip is in moderate condition (slightly compressed) and appears functional in diverting runoff from the roadway to the adjacent diversion channel, which discharges into the above described degraded intermittent stream reach. The diversion channel is wide and shallow and is unlined with thin vegetation growth. Erosion along the southern bank of the channel is evident, but minimal.

15. Former Staging Area; Project Area J (2010 Assessment Site 36)

An abandoned Former Staging Area exists across Billy Mack Road from the Parking Area. The Staging Area was constructed during the construction of I-80 in the 1960's with relatively impermeable compacted subbase and a concrete pad, approximately 0.07 acres in size, occupying the northwest corner. The total area of the site is approximately 0.8 acres. The site generally lacks vegetation and is sloped from north to south at approximately 6% (elevation ranging from 6,409 feet at the north boundary to 6,382 at the south boundary/primary drainage outlet). Run-on to the site occurs in two locations from two small ephemeral drainages, one of which contributes to flows down the center of the Staging Area and the other is conveyed through a small drainage ditch along the east side of the Staging Area. The site is a significant erosion hotspot, with several locations of moderate to severe rilling and gullying. Figure 7 of Appendix A shows an aerial view of the site. Photos 77-85 display field photos of the area. This site is broken into the following sub-sites for more detailed description and assessment:

15a. Ephemeral Drainage (Photo 77)

A small ephemeral drainage crosses Billy Mack Road approximately 300 feet north of the Staging Area and runs down along the west side of a partially decommissioned road (described below), where the drainage channel is well defined and well vegetated. The drainage channel diverges to the west from the partially decommissioned road and fans out. The flowline(s) of the drainage beyond this point are no longer visible and the terrain is relatively flat, but the majority of runoff from the channel likely continues south to the Staging Area. The entrenched flow path that forms at the northeast corner of the concrete pad (Photo 81) is likely the ultimate discharge location of the majority of the flow from the ephemeral drainage onto the Staging Area.

15b. Partially Decommissioned Road (Photos 78-79).

A partially decommissioned road exists between the Staging Area and Billy Mack Road. The road, approximately 300 feet in length, is mildly sloped and erosion is minimal. The road has unblocked access from the Staging Area, but is blocked by a series of several large rocks where it meets Billy Mack Road. Accordingly, the road appears to have seen little to no use in recent years.

15c. Concrete Pad (Photos 80-81)

A concrete pad, approximately 0.07 acres in size (63 feet by 46 feet), exists in the northwest corner of the Staging Area. A curb, approximately 6-inches in height, exists along the northern boundary of the pad. The pad slopes slightly to the northeast and runoff from the pad joins run-on from the above described ephemeral drainage, where an entrenched flow path has developed. Flows that run onto the Staging Area from this location continue south through the center of the Staging Area where several flow paths have formed, each demonstrating various degrees of rilling and gulying.

15d. Compacted Subbase (Photos 82, 91, 92)

The majority of the Staging Area is compacted subbase, relatively impermeable and lacking vegetation. As mentioned above, several flow paths have formed through this portion of the Staging Area, with varying degrees of rilling and gulying. These flow paths eventually merge toward the southern half of the staging, where a primary flow path has developed through which runoff from the Staging Area discharges to the previously described Caltrans drainage ditch (running along the north side of I-80 before discharging to Gregory Creek immediately upstream of the I-80 underpass).

15e. East Drainage Ditch (Photos 83-84, 93)

A small ephemeral drainage crosses the access road to the Staging Area and continues south through a small drainage ditch along the east boundary of the Staging Area. The ditch is well vegetated, but moderate gulying is evident in various locations along the

channel. Flow from the ditch discharges to the same Caltrans drainage ditch described above (upstream approximately 150 feet east).

15f. Runoff Outlet (Photo 85)

The majority of flows from the Staging Area concentrate to one flow path toward the south boundary of the Staging Area, where they discharge through an entrenched outlet into the Caltrans drainage ditch approximately 50 feet upstream of the location where the Caltrans drainage ditch discharges to Gregory Creek. Erosion along the entrenched outlet channel is severe.