Final

Burke Creek-Rabe Meadow Complex Master Plan

Existing Conditions

Existing Conditions Report

June 2014

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This publication made possible through a grant from the USDA Forest Service.

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ACRONYMS AND ABBREVIATIONS

The acronyms and abbreviations identified below are used throughout this document. This list is intended for reference use.

ac	Acre
APN	Assessor's Parcel Number
BMP	Best Management Practice
CICU	Commercial/Industrial/ Communications/Utilities
cfs	cubic feet per second
CN	Curve Number
DCIA	Directly Connected Impervious Area
DI	drop inlet
EIP	Environmental Improvement Program
ft	feet
FSP	Fine Sediment Particles
FEA	Formulation and Evaluation of Alternatives
HEC	Hydrologic Engineering Center
HMS	Hydrologic Modeling System
H:V	Horizontal to Vertical
GIS	Geographic Information System
ICIA	Indirectly Connected Impervious Area
Inc.	Incorporated
KGID	Kingsbury General Improvement District
Ksat	Saturated Hydrologic Conductivity
LTBMU	Lake Tahoe Basin Management Unit
mi	mile
min	minute
Mt.	Mountain
MFR	Multi-Family Residential
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NV	Nevada
NDEP	Nevada Division of Environmental Protection
NDOT	Nevada Department of Transportation
NDSL	Nevada Division of State Lands
NTCD	Nevada Tahoe Conservation District
PLRM	Pollutant Load Reduction Model
RWQCB	Regional Water Quality Control Board
ROW	right of way
SFR	Single Family Residential
sq	Square
SR	State Route
SEZ	Stream Environment Zone
SRP	Soluble Reactive Phosphorus
SW	South West
SWQIC	Stormwater Quality Improvement Committee
TAC	Technical Advisory Committee
TES	Threatened and Endangered Species
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TRPA	Tahoe Regional Planning Agency
US	United States
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geologic Survey
WQIP	Water Quality Improvement Project

EXECUTIVE SUMMARY

An Existing Conditions Analysis has been conducted for the Burke Creek-Rabe Meadow Complex Project Area to provide existing information to the Technical Advisory Committee in order to proceed with the alternative selection process for the project area water quality improvements.

The project is located in Stateline, Nevada, on the south shore of Lake Tahoe, between Kahle Drive to the south, Shady Lane to the east, Lake Tahoe to the west, and Elks Point Road to the north. The land use in the project area is largely open space owned by the U.S. Forest Service. Adjacent land use to the south is mostly residential, with some commercial properties on the southeast corner. The majority of the project area slopes towards Lake Tahoe, with steeper slopes located to the east of US 50. Burke Creek runs westerly through the project area, and discharges runoff from the project area to Lake Tahoe. Stormdrains along Kahle Drive and a portion of US 50 discharge to Burke Creek.

Future project opportunities include: the restoration of Burke Creek from upstream of US 50 to Jennings Pond located just downstream of US 50, the modification of the Kahle Drive basin in the lower meadow to provide additional treatment, stormwater treatment improvements along US 50, bike path and trail connectivity, invasive weed eradication and the stabilization of bare earthen shoulders and slopes.

1.0 INTRODUCTION

This report summarizes the Existing Conditions Analysis for the Burke Creek-Rabe Meadow Complex Master Plan prepared by Wood Rodgers, Inc. (Wood Rodgers) and Nevada Tahoe Conservation District (NTCD). This area has been identified by Tahoe Regional Planning Agency (TRPA) as Environmental Improvement Program (EIP) # 01.02.03.01.

The project is located in Stateline, Douglas County, Nevada, on the south shore of Lake Tahoe, within the Burke Creek Watershed (TRPA Priority 3 Watershed 39). The project is bordered by Kahle Drive to the south, Shady Lane to the east, Lake Tahoe to the west, and Elks Point Road to the north (see Figure 1-Vicinity Map). The project covers approximately 232 acres within Stateline, Nevada. The project area appears on the (1999) United States Geologic Survey (USGS) South Lake Tahoe 7.5-minute quadrangle. It is located in Sections 22 and 23 of Township 13 North, Range 18 East, of the Mt. Diablo Meridian.

The majority of the project area is comprised of open space owned by the United States Forest Service (USFS). East of US 50 is privately owned commercial development and the Kahle Drive Community Center owned by Douglas County. Single family residential and multi-family residential land use is found immediately to the south of the project area, on the south side of Kahle Drive. US 50, which runs through the project area, is owned and controlled by the Nevada Department of Transportation (NDOT). The entire project area drains to Lake Tahoe via surface drainage, mainly through Burke Creek. Stormdrain systems collect runoff from Kahle Drive, a portion of US 50 and the adjacent neighborhoods and route it to Burke Creek.

The Technical Advisory Committee (TAC) for this project consists of personnel representing the following entities:

- United State Forest Service – Lake Tahoe Basin Management Unit (USFS-LTBMU)
- NDOT
- Nevada Division of State Lands (NDSL)
- Nevada Department of Environmental Protection (NDEP)
- Douglas County
- TRPA

Wood Rodgers has teamed with Zeier & Associates (Cultural Resources Analysis) to produce this report with NTCD.

1.1 Project Objective

The main objective of this project is to improve the health, functionality, and water quality of the rain and snowmelt runoff from the Burke Creek-Rabe Meadow Complex Master Plan project area.

The ancillary existing conditions data collection and analyses, including biological and cultural resource identification, and hydrologic/hydraulic analyses, have been completed in order to better characterize those opportunities and constraints.

The original EIP formulation was completed after the 1997 Presidential Summit at Lake Tahoe, where President Clinton and other national, regional and local leaders convened to focus efforts on protecting the Lake for future generations. The EIP identified more than 700 projects critical to restoration of Lake Tahoe's clarity and environment.

In order to properly address the main goal of improving the health, functionality, and water quality of the rain and snowmelt runoff, the project will seek to enhance or at minimum have no adverse impact on TRPA's nine environmental thresholds including water quality, soil conservation, wildlife, scenic, air quality, vegetation, fisheries, noise and recreation as outlined below:

- Water Quality: the Lake Tahoe TMDL was developed by NDEP and the Lahontan Regional Water Quality Control Board (RWQCB), along with TRPA and project funding and implementing entities, to address Section 303(d) of the Clean Water Act as it applies to the impairment of Lake Tahoe's clarity. The clarity of Lake Tahoe has been declining steadily since record keeping began in the 1960s due to loading of sediment, nitrogen and phosphorus from the Lake Tahoe Basin. The ultimate goal of the TMDL is to restore Lake Tahoe's deep water transparency to 29.7 meters, which was the average annual Secchi depth measured between 1967 and 1971. The analyses completed for the TMDL includes an estimation to reach the target clarity; the loads of Fine Sediment Particles (FSP), phosphorus, and nitrogen should be reduced by 65%, 35% and 10% respectively. Because this reduction will take an estimated 65 years, the shorter term goal of the TMDL is to reduce the pollutant loads by 32%, 14% and 4% respectively in 20-years. FSP is defined as sediment with less than 16 micrometers in diameter and contributes the most to the decline of Lake Tahoe clarity, the TMDL has been set up to initially solely address reduction of FSP.
- Soil conservation: through stabilization of erosive areas that are directly connected to Lake Tahoe, such as bare shoulders and slopes, soil conservation will be an integral part of the project.
- Wildlife: project elements should improve the wildlife habitat throughout the project area. Any sensitive species in the area or habitat of sensitive species will be identified and construction will be planned so as to minimize impact.
- Scenic resources: the project improvements will be designed to have either a beneficial or neutral impact to scenic resources in the project area. The aesthetics of all proposed improvements will be considered in the design.
- Air quality: the project improvements should have a slight beneficial impact on the local air quality as they will stabilize existing sources of sediment that can become ablated and airborne.
- Vegetation: the vegetation will not be negatively impacted and may be slightly enhanced through project implementation. The occurrence of any sensitive biologic species will be protected during the design and

construction of the project. Impacts to existing healthy, native vegetation will be minimized. All new vegetation incorporated into the improvements will be native with high likelihood of success without regular irrigation as identified by project vegetation specialists. Noxious weeds identified in the project area will be abated where possible.

- Fisheries: any improvements to Burke Creek will evaluate the effect on fisheries and how fish passage will be impacted or improved upon.
- Noise: there will be no impact to noise in the project area once construction is complete.
- Recreation: the project should have no impact to recreational resources. No improvements will permanently impact any sidewalks, paths, or other recreational features.

Objectives:

- Implementation of the project will reduce active erosion, reduce weed infestations, enhance wildlife habitat, and improve fish passage.
- Project design will feature selection of Best Management Practices (BMPs) that are thought to effectively remove FSP from Stormwater while focusing on those features that can be maintained relatively easily by NDOT or County personnel and will not increase the risk of flooding.
- Subsequent to passage through a BMP, every attempt will be made to eliminate commingling treated water with untreated water and/or causing additional erosive forces in areas that do not currently need treatment.

1.2 Methods

The goals and other objectives are to be accomplished utilizing the Lake Tahoe TMDL tools, NDOT and Douglas County Design Standards.

Methods of the design will adhere to the following tenets:

- Emphasis will be placed on stream restoration components to enhance wildlife habitat, improve water quality, and improve fish passage.
- Emphasis will be placed on source control methods such as shoulder stabilization to prevent sediment and nutrients from entering stormwater runoff, or, at a minimum, reduce the amount of sediment and nutrient loading in runoff.
- Emphasis will be placed on utilization and maintenance of natural drainage pathways for flow reduction, and separation of clean and polluted flows.
- Emphasis will also be placed on the infiltration of stormwater runoff through natural means, such as sheet flow across dense vegetation and construction of vegetated or stabilized infiltration basins.
- Mechanical (such as settling/infiltration facilities) and/or filtration treatment of flows at the end-of-pipe will be considered in design alternatives as part of a water quality treatment train rather than the sole treatment method.

1.3 Implementation

As funding becomes available for projects identified through the master planning effort NTCD will work closely with the TAC to ensure that all project features meet long-term programmatic goals and objectives with full consideration of cost effectiveness.

- Project design will consider integration with current and planned future infrastructure to the greatest extent practicable.
- The project will be designed to NDOT or County standards and will meet TRPA EIP and threshold requirements.
- Project features will minimize the necessity of changes to NDOT or County maintenance equipment and practices.

1.4 Existing Conditions Analysis Process

Assessment of existing conditions within the project area follows the basic guidelines of the Stormwater Quality Improvement Committee (SWQIC) Formulation and Evaluation of Alternatives (FEA).

Specific objectives of this existing conditions analysis are as follows:

- Complete the 2013 existing condition characterization of the FSP and nutrient loading from the project area to Lake Tahoe using the most up-to-date models, parameter estimation, and methodology. The main tool for the existing condition characterization is the Lake Tahoe Basin Pollutant Load Reduction Model (PLRM).
- Describe the hydrology of the project watershed, including delineation of the contributing watershed areas and quantification of rainfall distribution at statistical frequencies relevant to design standards.
- Identify and preliminarily evaluate existing drainage facilities that affect project area hydrology and water quality.
- Characterize project area water quality problems, identify sources, and quantify pollutant loads.
- Identify and characterize project area environmental resources, both biological and cultural, so as to more accurately ascertain project constraints and opportunities.
- Identify and map land uses, capabilities and ownership within and immediately adjacent to the project area and delineate existing utilities.
- Identify opportunities and constraints for project improvements based on project area characteristics and design priorities and approach.

Information to prepare the existing conditions analyses was obtained from the sources listed in the References Section.

1.5 Project Area Mapping

Topographic base mapping for the project area was developed for project planning and design. A five-foot contour interval base map with background aerial photo was prepared utilizing information provided by Open Topography (see Figure 2: Topographic Base Map).

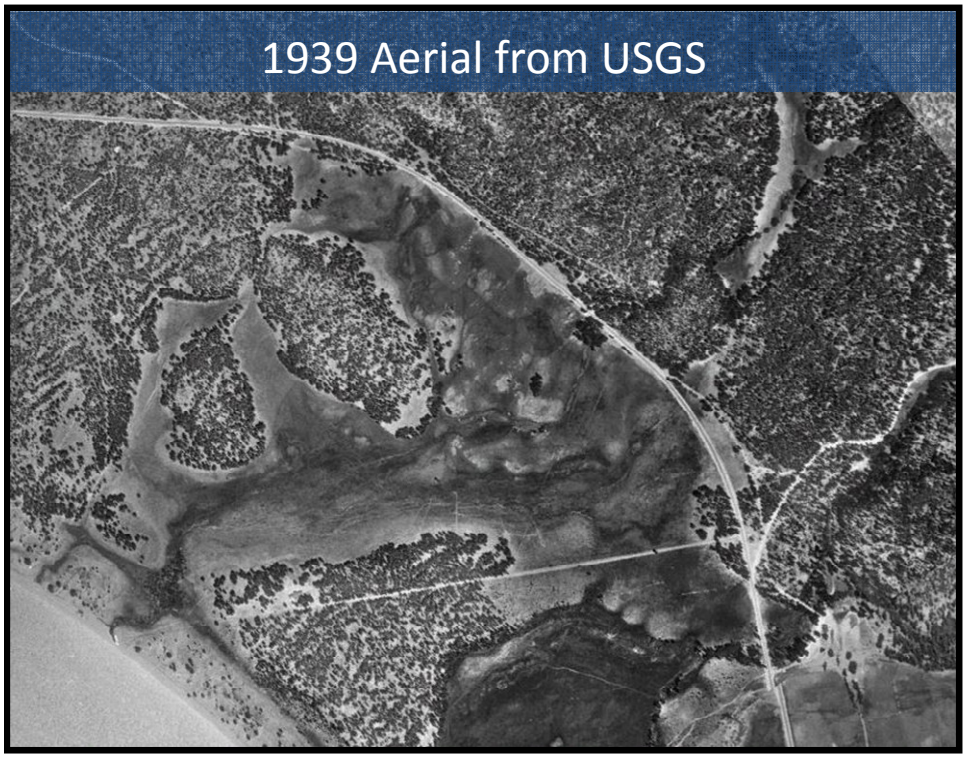
Both the aerial photography and topographic data cover public and private property. The figures were prepared using ESRI ArcGIS for ease of preparation and analysis and because much of the background environmental and spatial data available for the Tahoe Basin is GIS-based. These background data are based on a grid projection.

2.0 PROJECT AREA CHARACTERISTICS

2.1 Historical Disturbances

Rabe Meadow and Burke Creek have been dramatically impacted over the last 100 years. The first major disturbance to the project area came from logging during the Comstock mining boom in the late 1800s. The area between Kingsbury Grade and Dagget Pass was heavily logged. During this time, roads were established throughout the area to support the logging, and other industries needed to service workers. Rabe Meadow was home to the Hobart Logging camp until a majority of the timber was depleted and mining in the area came to a close.

After the end to the Comstock mining, the area became home to seasonal ranches and farms to support the resorts and estates around the Lake. During this time the Rabe family owned a majority of the project area and it remained in the family for many generations. The family mainly used the meadow for cattle ranching and grazing until the 1980s.



Some of the most significant impacts to the meadow and creek occurred in the 1940s and 1950s. In the late 1940's Burke Creek was relocated to the western part of the meadow for the development of an airport which later was closed and urbanized as a residential neighborhood. Later, in 1978 the property at the corner of US 50 and Kahle Drive was sold to a casino developer. Construction of the Ted Jenning Tahoe Palace Resort and Casino was started however never finished. Remnants of the casino resort foundation can still be found. The property was sold to the USFS in the 1980s and the USFS quickly began restoration efforts, working to reverse some of the development impacts to the meadow and stream.

In the northwestern portion of the meadow, on USFS property, there appears to be a few small vagrant camps set up underneath the large boulders. These camps have left debris and some minor graffiti in the area as shown in the photos below.

2.2 Past Projects (Stormwater Assets)

Over the past 30 years a number of water quality and stream restoration projects have been implemented in or near the project area. The table below provides a list of a few of the projects that have influenced water quality.

Water Quality Project affecting Burke Creek & Rabe Meadow	
Approx. Date	**Project**
1981	USFS Jenning Casino Site Restoration Project
1992	Burke Creek/Kahle Ditch Restoration Project, Douglas County/USFS
1995	Kahle Community Park Improvement Plan
2003	Kingsbury Village Erosion Control Project (Kingsbury North EIP #240)
2004	Lower Kingsbury Erosion Control Project Phases I & II (EIP #239)
2004	NDOT Contract 3216 (US 50 Erosion Control)
2007	Lake Village HOA Water Quality Improvement Projects 1A/1B
2012	Lake Village HOA Water Quality Improvement Projects II/IIA

Stormwater assets can be described as part of five basic systems or asset groups over the project area.

- Lake Village Homeowners Association (HOA)
- US 50 Roadway and Crossings
- Ball Fields/Burke Creek and Commercial Stormdrain System
- Upper Kahle Drive Stormdrain System
- Oliver Park General Improvement District (GID) Stormdrain System

Lake Village Homeowners Association

Although the Lake Village Homeowners Association is not in the project boundary, the entire area drains to Rabe Meadow and directly affects the project area. The residential area has stormwater improvements, including curb and gutter which tie to a number of drop inlets, culverts and channels. All stormwater runoff is captured and directed to four discharge points along US 50. Sediment traps, vaults, and basins exist as current stormwater treatment BMPs for the subdivision. All stormwater facilities appear to be maintained and in working order.

Armored conveyance Ditch at the Southwest corner of Lake Village Drive, East of US 50

US 50 Roadway and Crossings

US 50 stormwater improvements mainly consist of culverts that pass offsite flow across the highway to Rabe Meadow. Seven culverts and two stormdrain systems cross the highway at low points. Drop inlets and sediment traps have been installed along a portion of the highway to capture and convey roadway runoff to culverts. Most outfalls and discharge points have outlet protection in the form of riprap dissipaters. Two drop inlets are directly connected to Burke Creek and Folsom Spring respectively, which subsequently drain to Lake Tahoe. Sediment deposition can be seen at many of the outlets and some are in need of maintenance.

Culvert Outlet at US 50

US 50 culvert outlet to small water body

Ball Fields/Burke Creek and Commercial Stormdrain System

The existing Burke Creek has had extensive channel relocation and modification over the last 50 to 60 years. Currently the creek conveys flows from the largest watershed in the project boundary. As the creek enters the project area, the creek captures runoff from the Kahle Community Center ball fields. It is then conveyed along a hillside past the parking area of a commercial property. Burke Creek enters an undersized 24" CMP culvert well over 250 feet long to cross US 50. Stormwater runoff from the NDOT ROW and bypass flow from the commercial property's BMPs combine with the creek at this crossing. The commercial property has many BMPs in place but has not received a BMP Certificate of Completion. Burke Creek then continues on to Jennings Pond which was created as part of a United States Forest Service restoration project in the 1980s.

Inlet @ UD 50 and Commercial Property

Burke Creek & Jennings Pond West of US 50

Upper Kahle Drive Stormdrain System

A stormdrain system collects runoff from the Kahle Community Center impervious area. The system continues down Kahle Drive collecting runoff through a number of drop inlets and conveys it to a treatment vault and wet basin on the northeast corner of US 50 and Kahle Drive, which was installed in 1995. The stormdrain system then crosses US 50, capturing runoff from the north and south along US 50 via drop inlets and conveyance pipes. The stormdrain system then runs about 1,800 feet along the north side of Kahle Drive to a dry basin in Rabe Meadow. The dry basin was installed in 1994. Since its construction the basin has collected a large amount of sediment and no longer functions. Overflow from this basin enters Burke Creek via a vegetad swale. There is a number of drainage inlets, sediment traps, vaults, channels and basins above and below US 50 also associated with this system.

Dry Basin in Rabe Meadow North of KahleDrive

Kahle Community Center Drop Inlet

Oliver Park GID Stormdrain System

Similar to the Lake Village residential area, the Oliver Park General Improvement District (GID) stormdrain system is not in the project area however it has water quality impacts to Rabe Meadow and Burke Creek. This stormdrain system collects runoff from commercial, casino and residential property in the Oliver Park GID south of Kahle Drive. The system runs parallel to the stormdrain system on the north side of Kahle Drive; however it conveys runoff to a wet basin on the south side of Kahle Drive. Overflow from the wet basin is directed north to Rabe Meadow, across Kahle Drive. It enters Burke Creek after bubbling up a standpipe in the meadow. This system captures flows from Oliver Park GID, commercial properties adjacent to US 50 and portions of US 50 near the US 50 and SR 207 intersection.

Wet Basin South of Kahle Drive

Appendix B provides project photos for many of the stormdrain assets discussed above.

2.3 Land Use/Ownership

Figure 3 shows the project area land use, according to the Douglas County Assessor's data. The land use is predominantly open space with some commercial, recreational, and vacant land use to the east and west ends of the project area.

There are private vacant parcels interspersed throughout the project site, but the area is predominantly public vacant. The south east corner of the project area is owned by Douglas County, and includes the Kahle Community Center. Property ownership was provided by NTCD and is shown on Figure 4. Publically owned parcels include four owned by Douglas County and five by USFS.

Land use will assist in identifying project opportunities and constraints. Typically publicly owned vacant land provides the best opportunities for water quality improvements.

2.4 Utilities

Local utility companies were contacted to request "as-built plans" and any available GIS information was obtained from the various entities. Information about the known existing utilities has been identified and the approximate locations mapped, including type, location, and owners. Utility locations will be finalized during the design process and are shown in Figure 5: Existing Utilities. Existing drainage systems and other stormdrain assets can be seen in Figure 6: Existing Drainage Facilities.

In order to locate the utilities at the US50/Burke Creek Crossing, potholing was performed in 2012. During this investigation eight potholes were dug to identify the depth of the gas, telephone, cable, and sewer lines. The water line was unable to be located during this investigation and Kingsbury General Improvement District was unsure of its exact location. These locations can be seen in Figure 7: Pothole Locations.

2.5 Land Capability

The delineation of land capability coverage (the level of use an area can tolerate without sustaining permanent damage through erosion and other causes) was provided by TRPA. Many parcels within the project area have been delineated and verified by TRPA for previous projects. NTCD updated the existing Bailey land capability GIS layer according to TRPA's records to complete the Land Capability Map as shown in Figure 8. The majority of the project site has been mapped as District 1B – stream environment zone (SEZ) where only 1% coverage is allowed. Areas of Districts 1A, 2, 3, 4, 5 and 7 also occur within the project area.

Land Capability District	Tolerance for Use	Slope Divisions (%)	Relative Erosion Potential	Runoff Potential	Disturbance Hazard
1A	Least	30+	High	Moderately High to High	High
1B	Poor Natural Drainage				
1C	Fragile Flora and Fauna				
2		30-50	High	Low to Moderately Low	High
3		9-30	Moderate	Moderately High to High	Moderate

Land Capability District	Tolerance for Use	Slope Divisions (%)	Relative Erosion Potential	Runoff Potential	Disturbance Hazard
4		9-30	Moderate	Low to Moderately Low	Moderate
5		0-16	Slight	Moderately High to High	Low
6		0-16	Slight	Low to Moderately Low	Low
7	Most	0-5	Slight	Low to Moderately Low	Low

2.6 Soils

There are nine NRCS soil types within the project area (Figure 9). The soils represent a full range of hydrologic soil groups, from well drained to poorly drained. The soil types are briefly discussed below based on their description in *USDA Soil Survey for the Tahoe Basin Area, California and Nevada (NRCS 2006)*. No further soils investigation is planned at this time but it is anticipated that geotechnical work will occur as necessary when the design of different components moves forward in the design process.

7011 – Beaches

This map unit is located on the shores of Lake Tahoe at the western edge of the project area and comprises approximately 4% of the project area. Slopes range between 0 and 5 percent for this soil unit. The soil is very well drained and has a very high saturated conductivity of 21.3 in/hr through its profile.

7041 - Tahoe complex, 0 to 2 percent slopes

This map unit is located in the wet meadow area of Rabe Meadow in the center of the project area and comprises the majority of the project area at approximately 55%. Slopes range between 0 and 2 percent for this soil unit. The soil is very poorly drained and has a saturated conductivity of .3 in/hr at 3 to 15 inch depth.

7411 - Cagwin-Rock outcrop complex, 5 to 15 percent slopes, extremely stony

This map unit is located along the banks of Burke Creek along the eastern edge of the project area and comprises approximately 2% of the project area. Slopes range between 5 and 15 percent for this soil unit. The soil is somewhat excessively drained and has a saturated conductivity of 7.1 in/hr at 1 to 9 inch depth.

7421 - Cassenai gravelly loamy coarse sand, 5 to 15 percent slopes, very stony

This map unit is located in the forested pockets within Rabe Meadow in the center of the project area and comprises approximately 23% of the project area. Slopes range between 5 and 15 percent for this soil unit. The soil is somewhat excessively drained and has a saturated conductivity of 4.0 in/hr through its profile.

7444 - Christopher-Gefo complex, 0 to 5 percent slopes

This map unit is located just upslope of the beach complex along the northwestern edge of the project area and comprises approximately 3% of the project area. Slopes range between 0 and 5 percent for this soil unit. The soil is somewhat excessively drained and has a saturated conductivity of 12.8 in/hr through its profile.

7461 - Jabu coarse sandy loam, 0 to 9 percent slopes
This map unit is located in pockets of upland along the north and south edges of the project area and comprises approximately 4% of the project area. Slopes range between 0 and 9 percent for this soil unit. The soil is well drained and has a saturated conductivity of 4.0 in/hr through the majority of its profile.

7471 - Marla loamy coarse sand, 0 to 5 percent slopes
This map unit is located near the intersection of US 50 and Kahle Drive along the southern edge of the project area and comprises the smallest portion of the project area at approximately 1%. Slopes range between 0 and 5 percent for this soil unit. The soil is poorly drained and has a saturated conductivity of 4.0 in/hr at 3 to 47 inch depth.

7492 - Oneidas coarse sandy loam, 5 to 15 percent slopes
This map unit is located near the Kahle Community Center complex along the eastern edge of the project area and comprises approximately 7% of the project area. Slopes range between 5 and 15 percent for this soil unit. The soil is poorly drained and has a saturated conductivity of 12.8 in/hr at 1 to 9 inch depth.

9011 - Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0 to 15 percent slopes
This map unit is located along the banks of Burke Creek in the eastern part of the project area and comprises approximately 1% of the project area. Slopes range between 0 and 15 percent for this soil unit. The soil is somewhat poorly drained and has a saturated conductivity of 7.1 in/hr in the upper 32 inches of the soil profile.

2.7 Private Property BMP Status

The TRPA BMP Retrofit Program requires developed private properties to implement stormwater BMPs to infiltrate the 20-year, 1-hour storm event by October 15, 2008. The Retrofit Program's objective is to have all developed properties with the Lake Tahoe Basin install water quality BMPs to control and improve the water quality of runoff from the private property. It represents the primary private sector portion of the EIP and TMDL implementation. BMP Certificates of Completion are issued to properties complying with the TRPA ordinance. Properties unable to infiltrate the design storm on-site, but have implemented source control BMPs are issued a Source Control Certificate. The status of private property BMP implementation within the Burke Creek-Rabe Meadow Complex Master Plan project site was obtained from NTCD. The BMP status of properties within the project area is shown on Figure 10. Within the project area, there are no developed parcels that have received their BMP Certificate of Completion or Source Control Certificate.

3.0 EXISTING HYDROLOGIC AND HYDRAULIC CONDITIONS

The Burke Creek–Rabe Meadow Complex Master Plan project area slopes toward the Lake, with the largest contributing watershed forming the Burke Creek drainage, see Figure 11A and 11B for overall watershed delineation.

Annual rainfall is approximately 22.5 inches, much of which falls as snow. Much of the stormwater runoff within and from the site is from spring snowmelt and rain-on-snow precipitation events; summer precipitation

events are infrequent and localized in nature. The site has an approximate average elevation of 6,280 above mean sea level.

Hydrology of the project area is largely characterized by runoff from forested areas which concentrates in defined channels prior to crossing US 50 and entering the project area. A portion of the runoff is urbanized storm runoff which is conveyed through road shoulders, earthen roadside ditches and stormdrain systems which drain to Burke Creek at intervals throughout the project area. The existing stormdrain system locations were provided by NTCD, see Figure 6.

3.1 Approach and Methods

Hydrologic analysis to compute peak flow rates using the methods outlined in the NDOT Drainage Manual, December 2006 are discussed below. Precipitation data were obtained from National Oceanic and Atmospheric Administration (NOAA) Atlas 14.

3.1.1 Subwatershed Delineation

The project area is within TRPA Priority 3 Burke Creek Watershed. The subwatersheds were delineated by reviewing two-foot contour topography based on the 2010 LiDAR data obtained from the USGS (Figures 11A and 11B). The existing drainage facilities and outlet points were incorporated into the LiDAR data.

3.1.2 SCS Unit Hydrograph Method

The SCS Unit Hydrograph method was utilized to compute onsite peak flow rates for the 2-, 25- 50- and 100-year storm events. Existing soil types and conditions for the stormwater runoff analysis were determined from the NRCS *Soil Survey for the Tahoe Basin Area, California and Nevada* (USDA, 2008). The hydrologic soil groups contained within the project area vary between hydrologic soil group A and hydrologic soil group D. A map of the hydrologic soil groups for the watersheds has been provided in Appendix A. The impervious area was determined utilizing the 2006 TMDL GIS Land use layer. Methods outlined in the NDOT Drainage Manual were used to calculate runoff curve numbers (CN) based on the soil and land use cover. Lag times were determined by calculating the time of concentration according to the NDOT Drainage Manual shallow initial sheet flow, and channel flow equations and converting the time of concentration to lag time. Appendix A includes the curve number (CN) parameters, lag time parameters, and flow routing parameters for each subwatershed.

3.2 Computed Peak Discharge

Peak runoff was computed using Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) for each of the design storms for each of the subwatersheds. Table 1 presents the summary of the peak flow estimates for each subwatershed in the project area for the 2-year, 25-year, 50-year and 100-year storm events. The 2-year peak flows are presented for reference for future design of water quality treatment alternatives.

3.3 Hydraulic Analysis/ Drainage issues

The existing drainage facilities (Figure 12) were analyzed hydraulically for capacity and compared to the peak 25-year, 50-year and 100-year peak flow results. The analysis of the drop inlets, culverts and channels

has been presented in Tables 2a through 2c. Based on the NDOT Drainage Manual the following design requirements were utilized to determine if the analyzed drainage facilities are adequately sized:

- For all drop inlets the maximum spread of shoulder plus ½ of travel ways for the 25-year event.
- All channels and culverts shall convey the 25-year event.

This analysis was followed for all crossings with the exception of the Burke Creek crossing, per the TRPA Code, 60.4.6.D, drainage conveyances through a SEZ shall be designed for a minimum of a 50-year storm.

All of the analyzed drop inlets meet the spread requirements outlined above. Although not shown by the analysis, it is known that ponding occurs in the eastern travel lane in the north bound direction of US 50 near Lake Village. All but one of the existing channels have the capacity to convey the 25-year flows and approximately two thirds of the culverts have the capacity to convey the 25-year peak flows.

3.4 Burke Creek Functionality

The existing natural stream channel functionality within the project area has been compromised in part by the channelization of Burke Creek just upstream of US 50 into a steep man-made ditch to the north of the existing parking lot. At US 50 the stream is currently routed through a 24" CMP culvert that collects stormwater runoff from the NDOT US 50 ROW and adjacent privately owned BMP overflow and is approximately half full of sediment at the outlet. This culvert currently acts as a barrier for any fish passage upstream of the culvert. Downstream of US 50, the stream channel has been realigned multiple times in order to shift the creek to the north in order to accommodate development that occurred to the south of the project area.

In June 2009, Winzler & Kelly completed the Burke Creek Restoration Project, Alternatives Analysis Report. This report assessed the existing conditions of the geomorphology from Lake Tahoe to upstream of US 50. For the reach between Lake Tahoe and Jennings Pond incision and headcuts are occurring approximately 1,500 feet downstream of the pond. This report suggested that additional monitoring be done on this section in order to evaluate what was causing the issues, what the risk of it migrating upstream was, and the risk to the upstream reach. For the reach between Jennings Pond and US 50 (restored in the 1980's), the geomorphic assessment determined that this reach is very stable. For the reach from US 50 to upstream of the upper meadow, the assessment determined that the low flow channel was very stable but it appears some portions do have incision and head cutting. A low berm was constructed in this reach to keep flows from flooding the adjacent commercial parking lot. In addition, the slope adjacent to the creek below the Kahle Community Center ball fields failed in the large rain-on-snow event of January 1997.

Reconstruction of the stream channel and associated floodplain through the area currently occupied by the northern commercial parking area will restore stream functionality and promote the frequent interaction between channel and floodplain. Restoring a more natural, or wetter, moisture regime with a greater vitality of plant community will provide sediment and nutrient removal and promote a SEZ habitat.

4.0 WATER QUALITY

4.1 Existing Water Quality Data

Some water quality data has been collected for the project area. According to the Burke Creek Stream Channel Restoration Monitoring Report by the USFS-LTBMU water quality monitoring was conducted from 1990 to 1998 in conjunction with the reconstruction of the lower portion of the Burke Creek from Lake Tahoe upstream 2,000 meters and the Burke Creek/Kahle Drive Restoration Project. The purpose of this monitoring was to determine if water quality standards were being met downstream of the Kahle Drive dry basin and in Burke Creek, to determine if the reconstructed channel improved water quality, and to evaluate the stability and fish habitat characteristics of the reconstructed channel. This study monitored three locations downstream of the Kahle Drive dry basin. The report concluded that there was no statistical difference in water quality for this reach of channel from before construction (1990-1992), during construction (1993-1994), and after construction (1996-1998). The report concluded there was no water quality improvement in the stream channel because of the high gradient of this reach before and after construction. It should be noted that the mean discharge before and during construction (1990 to 1994) ranged from 0.3 to 0.7 cfs and for the two years after construction (1996 to 1998) the mean discharge more than doubled and ranged from 1.7 and 2.2 cfs at the downstream most monitoring location. This flow increase was not discussed in this report and it is felt that data collected in subsequent years with similar discharge rates to the years prior and during construction may have been beneficial.

Another water quality study in the area was completed by NTCD and Northwest Hydraulic Consultants for Sierra Colina in April 2008, in order to establish baseline water quality data for Burke Creek upstream of US 50. This study monitored six sites collecting grab samples and flow monitoring data from February 2006 through December 2007. Three sites were upstream of the Sierra Colina property and three sites along the Sierra Colina property. This baseline report concluded that the water quality of Burke Creek has low concentrations of sediment, phosphorous, and nitrogen and stated that while Burke Creek is not a large pollutant source, the restoration of Burke Creek would provide incremental benefits in reducing pollutant loads to Lake Tahoe.

4.2 Sources of Degraded Surface Water Quality

Fine sediment and nutrients are the critical pollutants of concern generated within the project area. Other pollutants include coarse sediment, oil and grease (hydrocarbons), iron, chlorides, turbidity, and an elevated water temperature in the creek and pond.

The fundamental sources of sediment contributing to the project area include bare shoulders, bare slopes and applied parking area traction abrasives in residential neighborhoods and along Kahle Drive and US 50. These sediment sources often are tracked onto the roadways, where they are ultimately collected into the existing stormdrain systems, draining to Burke Creek and ultimately Lake Tahoe. The main stormdrain system parallels Kahle Drive on the north below US 50. At its outlet, sediment is collected in the basin prior to exiting to Burke Creek. Currently the basin is full and not functioning.

The project area has minimal number of earthen channels and none have been found to be a major sediment source however there are isolated locations that show signs of past mudslides and headcutting above US 50 just below the ball fields. Figure 13 represents the public sources of erosion and sediment within the project area.

Additional pollutant sources may include runoff from excess fertilizer and pesticide application to the ball fields. This can be seen in the Burke Creek Monitoring location below the ball fields where nutrients were found to be at least a magnitude greater than other sites observed and at times exceeding the TRPA Surface Water Discharge Limits.

4.3 Existing Conditions Pollutant Load Reduction Model Analysis

In order to characterize the loading of FSP and other pollutants of concern from the project area, baseline and existing conditions PLRM model were developed. NTCD created the existing conditions PLRM model using parameters and field data collected by NTCD, and followed the guidelines of the Lake Clarity Crediting Program.

Following the catchments delineated toward the County's Stormwater Load Reduction Plans Baseline Conditions Report (August 5, 2013), catchments considered as inputs to the BRC project include Lake Village (LV01, LV02), part of the Douglas County administration complex (DCA_BRC), and NDOT catchments 5006, 5007, 5008, 5009 and 20701. All modeling followed the assumptions found in the Baseline Report (Technical Memorandum #1, NTCD), and the Existing Conditions Report, Draft Technical Memorandum #2 (NTCD, Draft Nov. 22, 2013). TMDL Land Use Road Risk, and Shoulder Conditions are shown on Figures 14 through 16, respectively. The PLRM Roadway DCIA/ICIA and Met Grid are shown on Figures 17 and 18, respectively.

The results of the PLRM for each catchment are included in Table 3. According to the existing conditions modeling, there are approximately 15,107 lbs of FSP contributed from the project area (equivalent to $7.54e^{+17}$ particles of FSP). Douglas County's contribution is 31% of the total, NDOT's 69%.

5.0 BIOLOGICAL/CULTURAL EXISTING CONDITIONS ANALYSIS

5.1 Vegetation/Noxious Weed Survey

Vegetation types were mapped for the project area in the spring of 2012. This survey also identified an area near Lake Tahoe on the west side of the project area that has been fenced for Tahoe Yellow Cress habitat preservation. A map of the vegetation types supported in the project area and location of fenced area can be found on Figure 19.

A Nevada Natural Heritage Program (NNHP) Database Query was completed for the project area. There was only one "at risk" plant was identified by the query and this was the Tahoe yellowcress. Tahoe yellowcress is a USFS Region 5 sensitive species. The results of the database query can be found on Figure 22 and in Appendix D

A complete species inventory was previously completed for the Sierra Colina EIS in June and July of 2007. This survey included TRPA "special status" species that had potential to occur on the property based on potential habitat observed in the area. These species included Washoe tall rockcress, Galena rockcress, and Mariposa sedge. According to this report none of these species were encountered on the property during the spring 2012 survey.

Several noxious weed risk assessments were conducted by NTCD, Douglas County Weed Abatement and USFS personnel between 2010 and 2013 for the portion of Burke Creek upstream of US 50 to just past the ball fields, and also downstream of US 50 to the pond. The results of these assessments have been provided in Appendix C. Noxious weeds that were found in the project area include:

- *Potentilla recta* (Sulfur cinquefoil)
- *Cirsium vulgare* (Bull thistle)
- *Bromus tectorum* (Cheatgrass)

Due to existing noxious weed establishment, existing disturbance conditions such as established road, foot and animal traffic, and a short-term increase in traffic to the area during construction, a risk of additional noxious weed establishment exists. NTCD will adopt a mitigation plan as part of the project and decrease established habitat to at or below pre-construction levels.

5.2 Wetlands Delineation

A Routine Onsite Wetlands Delineation was completed in the spring of 2012 for a portion of the Master Plan project area. The delineation was conducted in accordance with the US Army Corps of Engineers Mountain West Supplement requirements. The delineation area consists of approximately 12 acres located from the pond to just upstream of the ball fields. This delineation was submitted to the USACE in June 2013. Figure 20 shows potential jurisdictional resources surveyed and delineated for the project and a list of species encountered during this delineation has been provided in Appendix D.

5.3 Cultural Resource Investigation

A Class I cultural resource inventory was conducted for the project area by Zeier and Associates in January 2012. The objective of the records and literature review was to determine what portions if any of the project area have been previously surveyed under a Class III Inventory and the location of any known cultural resources in the project area. It was determined that a large portion of the project area has previously been surveyed and the locations of these areas addressed by these inventories can be found on Figure 21. There is one potential site that will need to be evaluated as the Burke Creek Restoration design progresses.

5.4 Amphibian and Fish Survey

The Winzler & Kelly Report finalized in June 2009 assessed the existing fish passage from the pond to the upper meadow. Based on TAC discussions it was decided that for this section of Burke Creek the target species and life stages utilized for the assessment should be juvenile salmonids and adult resident rainbow and Lahontan cutthroat trout. This assessment utilized the following criteria for fish passage for juvenile salmonids and adult resident rainbow and Lahontan cutthroat trout:

Criteria	Juvenile Salmonids	Adult Resident Rainbow Trout (also applied to resident LCT)
Fish Passage Flows	0.2 cfs to 2.2 cfs	0.2 cfs to 2.2 cfs
Minimum Water Depth	0.3 ft[1]	0.5 ft[2]
Maximum Water Velocity		
Length between Resting Areas	1 ft/s[3]	
Less than 100 ft		4 ft/s[2,4]
100 to 300 ft		3 ft/s[2,4]
Greater than 300 ft		2 ft/s[2,4]
Maximum Water Surface Drop	0.5 ft[1]	0.67 ft[1,2]

[1] California Dept. of Fish and Game Assessment Criteria (CDFG, 2002)

[2] California Dept. of Fish and Game Design Criteria (CDFG, 2002)

[3] Barber and Downs (1996)

[4] Washington Dept. of Fish and Wildlife (Bates, 2003)

*Table 6 from Winzler-Kelly Report, June 2006

From the pond upstream to the US 50 crossing, the assessment determined that at low flows through this section the flows spread out due to the dense willow population which caused "channel aggradation and channel widening". This spreading of the low flows causes the flow depth to be inadequate for both juveniles and adults. During high flows the assessment determined that flows depths, while not ideal, would still potentially allow for passage for both juveniles and adults through this reach.

For the portion of the reach that crosses US 50, the assessment determined that the existing US 50 culvert presents a barrier to the target fish species at both the low and high flows. At low flows the flow depth is too shallow for adult passage and the velocities are too high to allow for the passage of juvenile salmonids. At high flows the flow depth is still too shallow and the velocities are too high to allow for any fish passage for the target species and life stages.

The portion of Burke Creek upstream of US 50 was analyzed using different criteria than the two reaches downstream discussed above. Criteria more appropriate to the steep slopes of this reach and the multiple drops throughout the reach were applied. The Winzler & Kelly report applied the flowing criteria to this reach to determine fish passage potential:

- Individual drops in the water surface profile of 0.5 feet or greater over a maximum channel length of 6 feet or less.
- Channel slopes over a minimum channel length of 35 feet.

Using these criteria, it was determined that there were fifteen drops identified that exceeded the criteria listed above; of these, eight were greater than one foot in height. These drops would potentially make it difficult for fish to pass through this section.

The slope through this reach ranged from 6% to 11.8% for 230 feet immediately upstream of US 50. After this initial steep section the slopes decrease and range from 2 to 4%. It was not determined if either juveniles or adults could pass through the steep slopes of this reach.

5.5 Wildlife Survey

A Nevada Natural Heritage Program (NNHP) Database Query was completed for the project area. The "at risk" mammals identified in the vicinity of the project area include Douglas's squirrel and fringed myotis. Douglas's squirrel is ranked by the Nevada Natural Heritage Program as critically imperiled and the fringed myotis is a Nevada special status species. The results of the database query can be found on Figure 22 and in Appendix D.

A goshawk survey and a Sierra Nevada mountain beaver survey were completed for the Sierra Colina Property for the Sierra Colina EIS. The goshawk survey was completed in August 2007. This survey found no evidence of goshawk, or goshawk nests on the property. In addition, this report stated that it would be highly unlikely that goshawks would nest on the property because suitable habitat was not found within the project area. These locations can be found on Figure 22.

Based on discussions between NTCD and TRPA in October 2013, it has been decided that as design progresses it may be necessary to do further goshawk surveys. Necessity for additional surveys would be dependent on timing of construction of improvement projects.

The Sierra Nevada mountain beaver survey was also completed in August 2007. This survey determined that mountain beavers did not occupy the survey area at that time and it is unlikely that they have occurred in the project area prior to when the survey was completed.

6.0 OPPORTUNITIES AND CONSTRAINTS FOR WATER QUALITY IMPROVEMENT

The purpose of identifying opportunities and constraints early in the project planning process is to assist in focusing and highlighting specific areas during the development of effective and meaningful water quality improvements through a range of design alternatives. The characteristics of the majority of the project area can be viewed as both opportunities and constraints and are as follows:

- Large areas of vacant land owned by the U.S. Forest Service. Nearly all of the project area west of US 50 is owned by the USFS.
- Douglas County owns a large portion of the project area on the east side of US 50.
- Minimal areas of commercial land use are east of US 50.

- Low gradient slopes on the west side of US 50, with steeper slopes (approx. 8%) around the Kahle Community Center on the east side of the project area.
- Two distinct outlets to Lake Tahoe that drain from the project area. Both of these discharge locations are downstream of low gradient, existing meadow areas.
- Bare road shoulders occur intermittently along US 50.
- Eroding and bare slopes within the Kahle Community Center parking lot and along US 50.
- Significant portions of the project area are within land capability classifications 1a and 1b.
- Along US 50 and along the southeast side of the project area there are significant number of utilities including underground water, gas, and sewer with above ground power and communication lines.
- Burke Creek represents a perennial stream within the project area that has been degraded by human activity.
- Based on the USGS soils survey classification the underlying soils vary between well drained with high permeability to poorly drained with low permeability.

In order to decrease the pollutant loads from the project area reaching the Lake, strategies that will maximize source control and increase infiltration capability at locations that produce significant FSP and nutrient loading should be employed. Source control improvements will include stabilizing the unprotected bare shoulders and slopes (along roadways, and within the Kahle Community Center parking lot) as well as stabilizing exiting channels, both on Douglas County and U.S. Forest Service property.

Currently, Burke Creek shows signs of erosion due to headcutting, channel incising, slope failures on adjacent slopes, and associated sediment transport. The creek carries both onsite and offsite runoff, including several sediment sources with the potential to degrade the creek's water quality before entering Rabe Meadow and ultimately Lake Tahoe. The onsite runoff is mainly generated from NDOT right-of-way along US 50 and the commercial/Douglas County area east of US 50. A majority of this runoff combines with the creek flows into a deteriorating stormdrain system that conveys flows across US 50.

The project area has been broken into six different focus areas (see Figure 23) with similar water quality issues. The opportunities and constraints within each area in respect to decreasing FSP loading are outlined below.

Focus Area	Constraint	Opportunity	Discussion
Area 1 - US 50 ROW including bare shoulders and slopes	- Limited area for treatment within ROW - Difficult to capture all runoff for treatment - Significant underground and above ground utilities	- Install curb and gutter or shoulder stabilization in areas that currently sheet flows to bare shoulders. - Direct collected flow to existing vegetated channels in the meadow where natural treatment can occur. - Implement measures to reduce ponding/flooding on US 50 - Mechanical treatment options - Shoulder stabilization	- Ponding and flooding within roadway - Untreated flow currently sheet flows into the meadow.

Focus Area	Constraint	Opportunity	Discussion
Area 2 - Outfalls of culverts crossing US 50	- Significant underground and above ground utilities	- Downstream land is vacant and owned by USFS so expanding treatment is feasible. - Removing road sand before it reaches the meadow will reduce clogging of functioning meadow channels. - Maintain existing outfalls. - Separate spring flows from roadway runoff.	- Outfalls are already protected to some extent. - Potential for erosion due to concentrated flows
Area 3 - Douglas County owned parcels including the Kahle Community Center and ball fields.	- Very little vacant space - Significant underground and above ground utilities	- Sediment production from existing bare shoulders and slopes in Kahle Community Center parking lot could be easily reduced by removing the opportunity for runoff across bare soil. - Failing slope at NE corner of Kahle Drive/US 50 could be repaired - Wet basin northeast of the Kahle Drive/US 50 intersection could be improved/maintained - Improve North/South channel above ball fields.	- Two existing basins and connecting channels are functioning properly.
Area 4 - North meadow drainage, including head cuts - Includes part of Nevada Beach campground	- Well vegetated meadow above and below head cuts should remain in its current condition. - Low gradient, well vegetated drainage means treatment is already taking place.	- Repair of head cuts will be easy to fix with a minimum of disturbance. - Existing non-functioning culverts could be replaced to keep existing trails passable during runoff periods. - Provide defined trails and paths for public in order to keep people out of sensitive areas. - Remove non-functioning culvert	- Meadow functions as treatment
Area 5 - Burke Creek crossing US 50	- Significant underground and above ground utilities along US 50 - Combined creek/stormdrain system - Private property	- Repair and restore creek with channel and floodway to minimize sediment, provide fish passage and improve habitat. - Separate highway and commercial runoff from the creek flows. - Provide treatment for commercial and highway runoff prior to discharge into meadow or creek.	- Trailhead parking has current BMPs. - Headcuts and incised channel east of US 50 - Parking lot flooding during storm events

Focus Area	Constraint	Opportunity	Discussion
Area 6 - Kahle Drive basin and downstream reach of Burke Creek	- Area already includes treatment basin - Area is designated SEZ so construction of treatment facilities need to be site appropriate	- Existing basin at this outfall is nearly full of sediment, so increasing basin capacity could increase sediment capture. - Provide a basin with access and easily maintained elements. - Mechanical treatment upstream of basin to alleviate sediment deposition issues. - Divert portion of stormdrain flows to meadow prior to basin. - Potential to create treatment wetlands.	- Reported high ground water through this area and the neighborhood south of the project area. - Includes the outfalls of two stormdrain systems to the south.

7.0 REFERENCES

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FIGURES

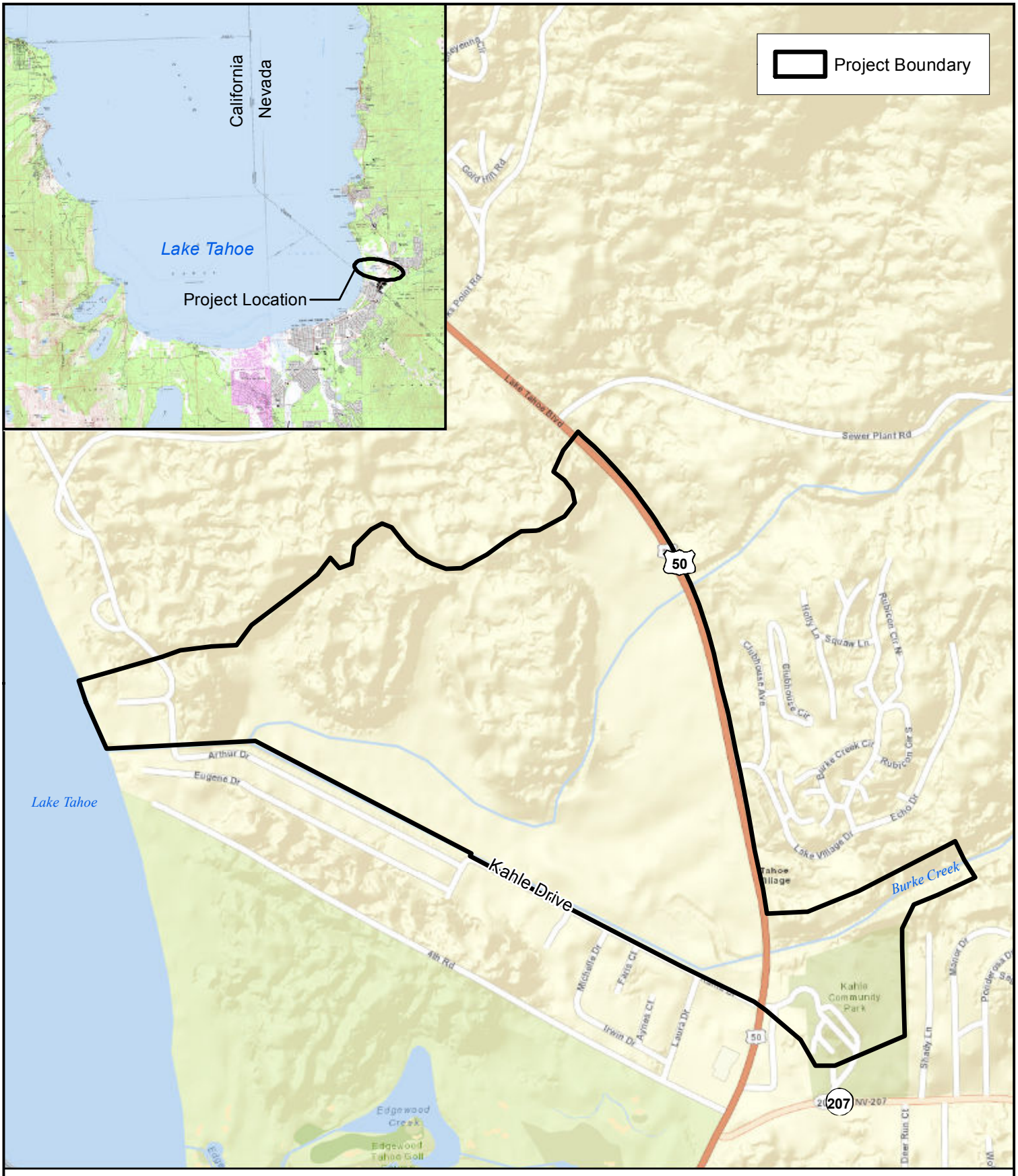

FIGURE 1: VICINITY MAP

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NOTES:

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri

NORTH

0 300 600
FEET

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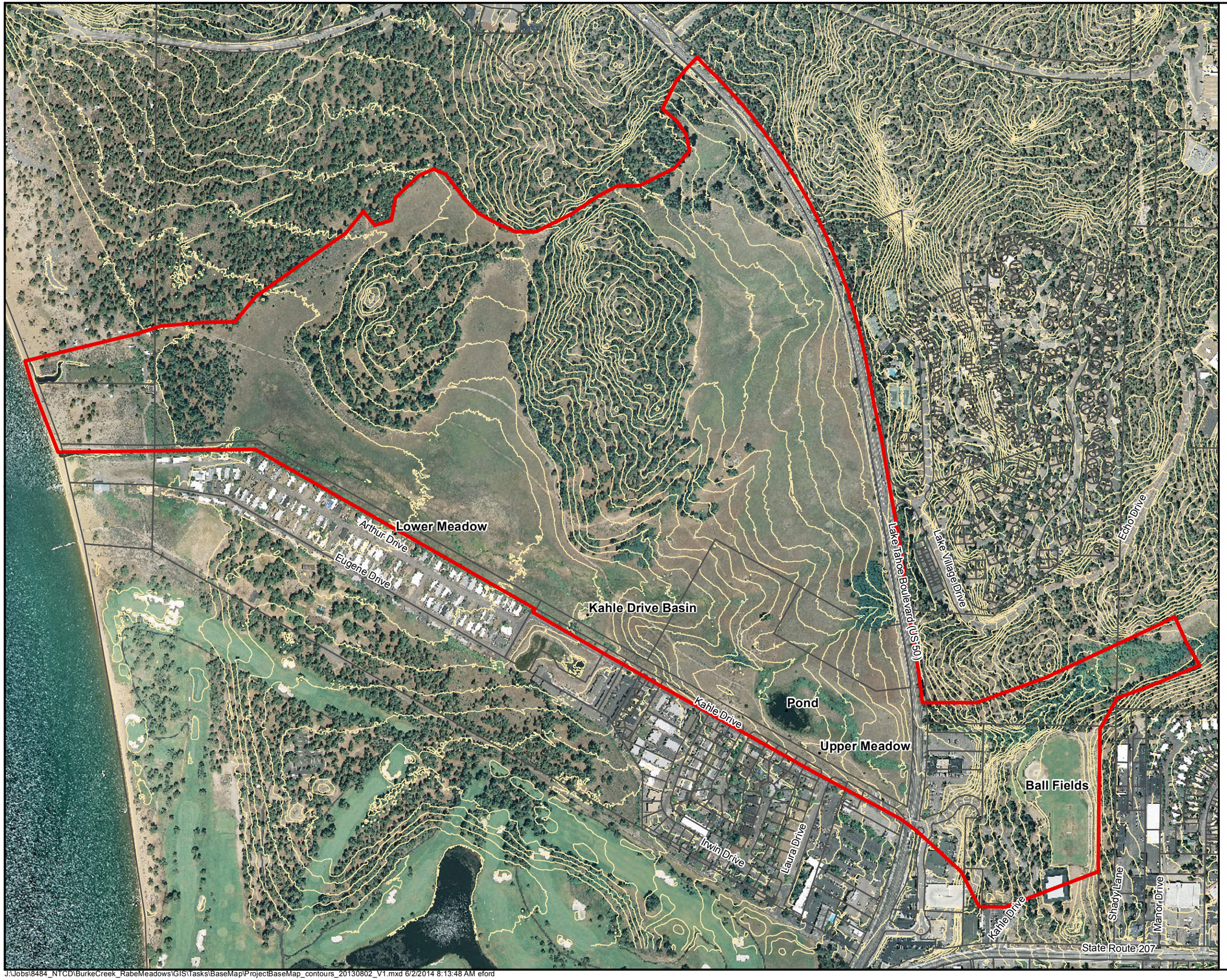
FIGURE 2: TOPOGRAPHIC BASE MAP
BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NORTH

0 250 500

FEET

5-foot Contours
Project Boundary
Parcel Boundary

NOTES:
IMAGERY: DOUGLAS COUNTY
CONTOURS: OPEN TOPOGRAPHY

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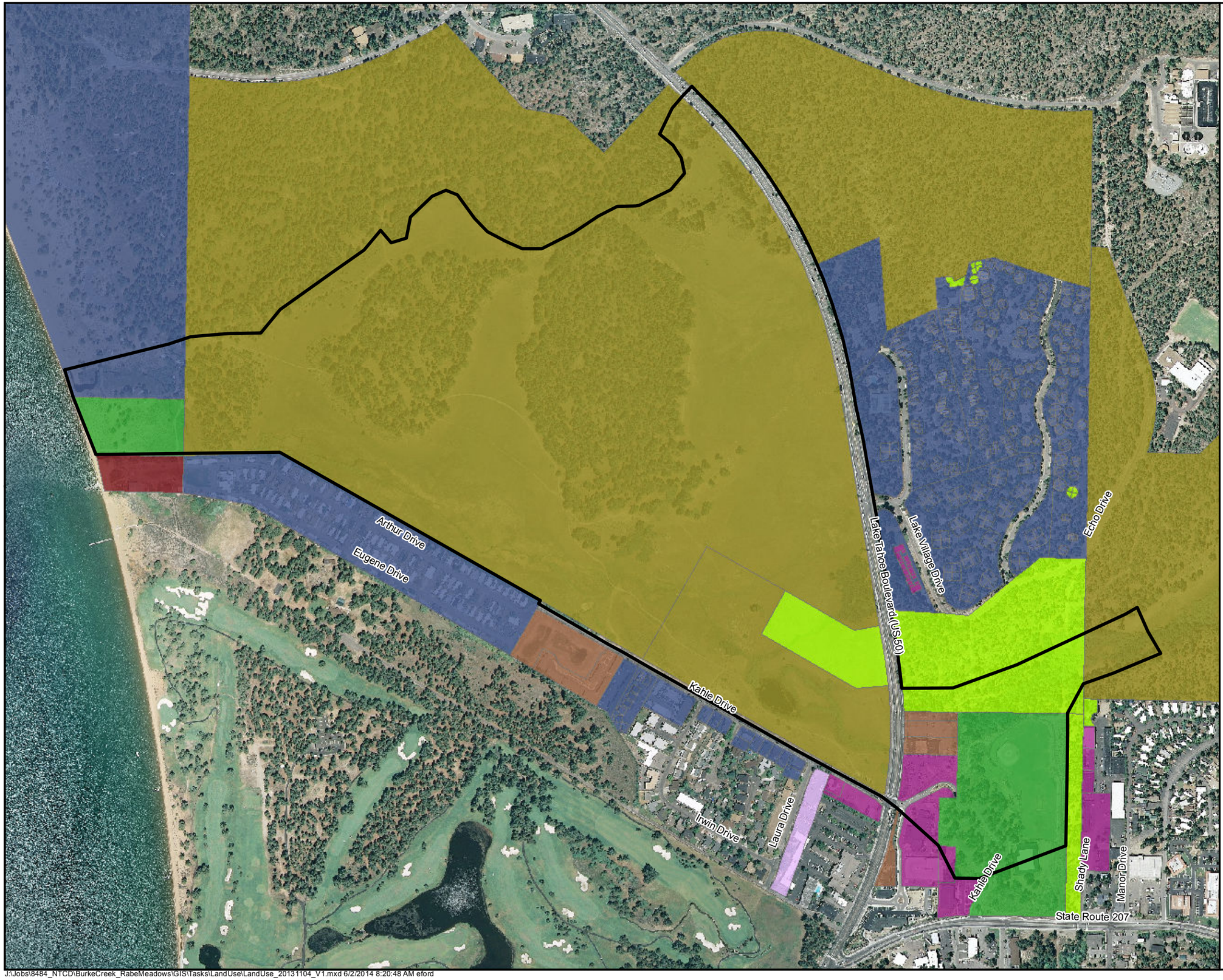
FIGURE 3: LAND USE

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NOTES:
IMAGERY: DOUGLAS COUNTY
LAND USE: DOUGLAS COUNTY

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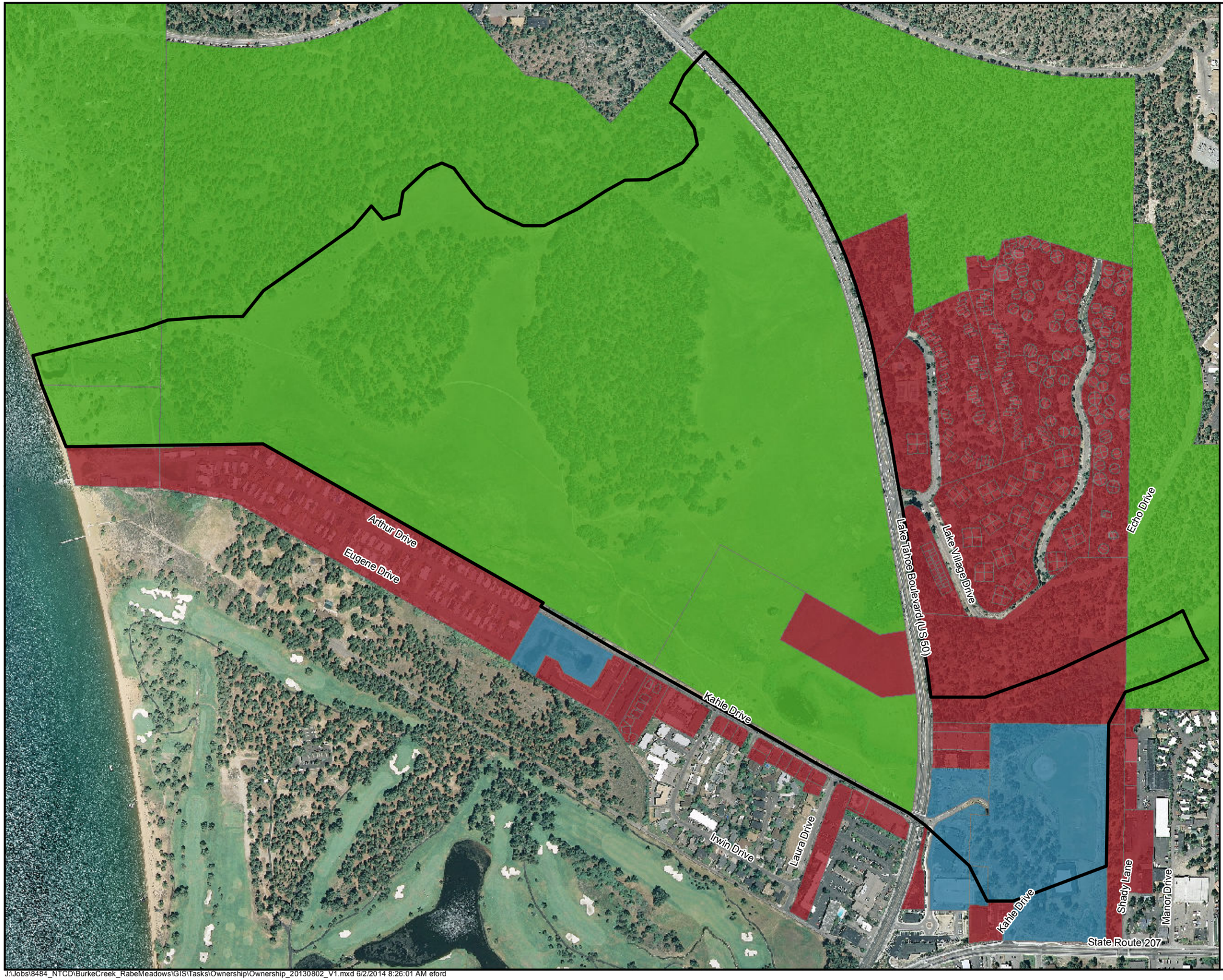
FIGURE 4: LAND OWNERSHIP

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NORTH

0 250 500

FEET

- Project Boundary

Ownership

- Douglas County
- Private
- USFS

NOTES:
IMAGERY: DOUGLAS COUNTY
OWNERSHIP: DOUGLAS COUNTY

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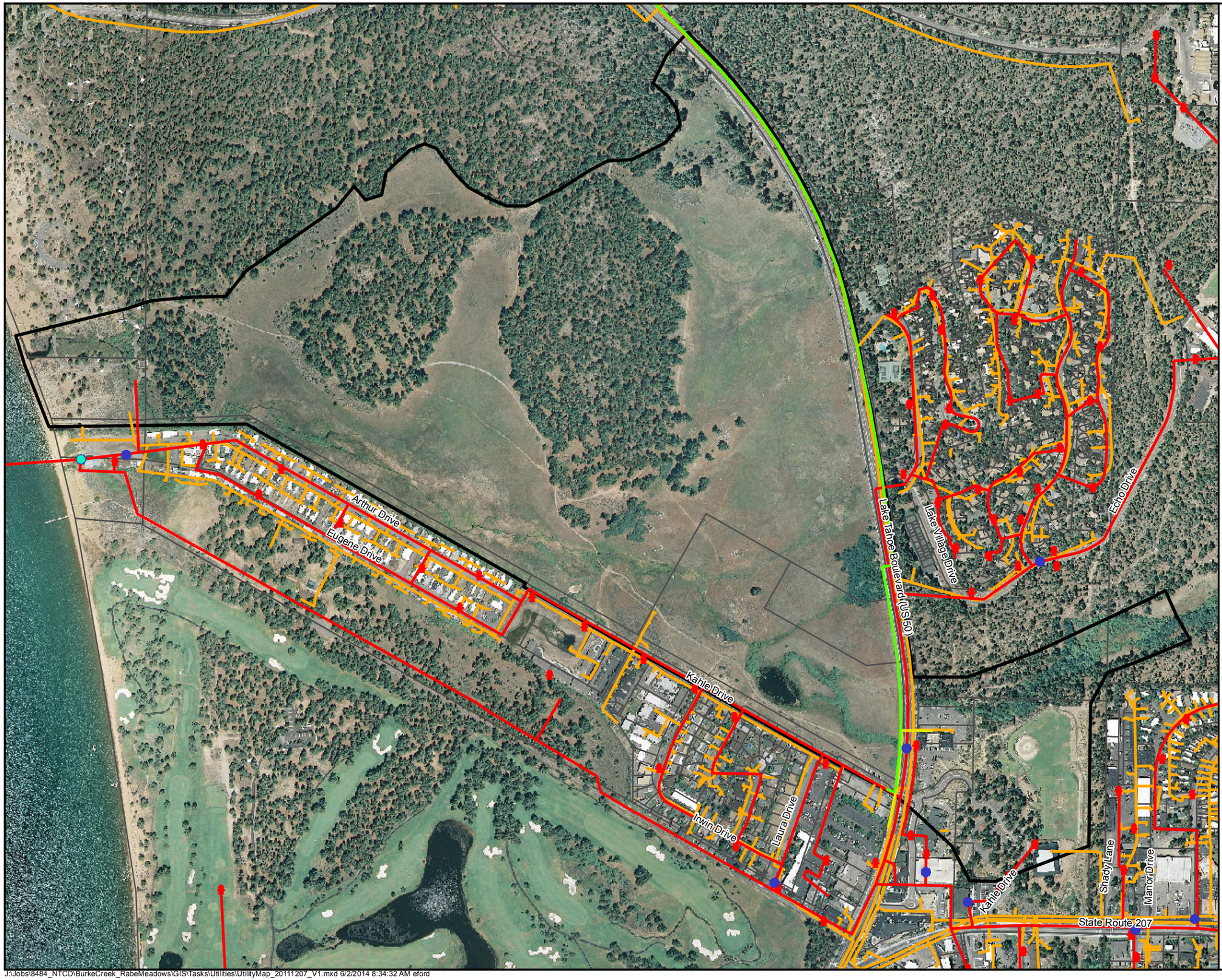
FIGURE 5: EXISTING UTILITIES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NORTH

0 250 500

FEET

- Water Pump Station
- Water Valve
- Water Pressure Reducing Vault
- Fire Hydrant
- Telephone
- Electric
- Water
- Gas
- Project Boundary
- Parcel Boundary

NOTES:
IMAGERY: DOUGLAS COUNTY
PARCELS: DOUGLAS COUNTY
UTILITIES: NTCD

Nevada Tahoe Conservation District

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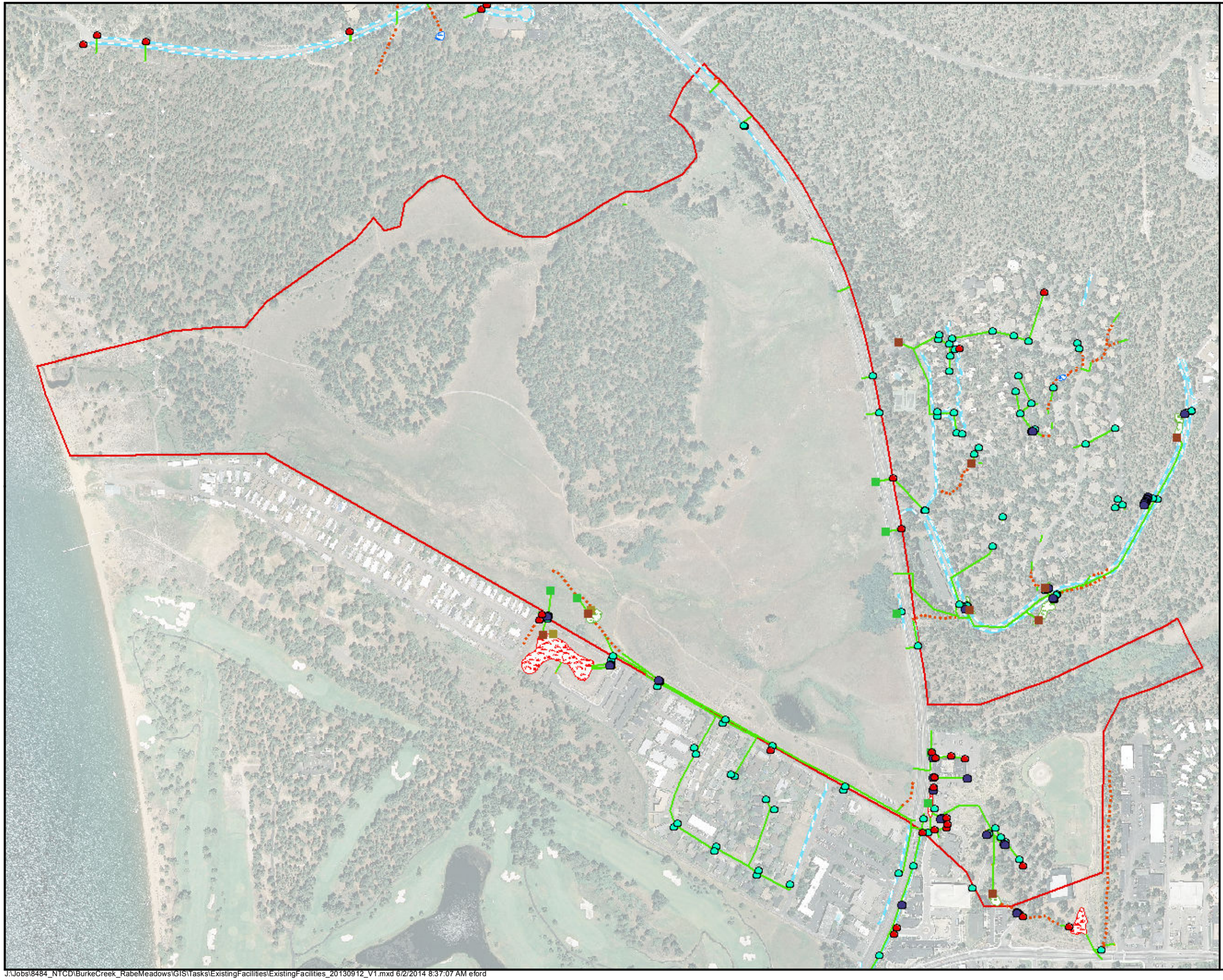
FIGURE 6: EXISTING DRAINAGE FACILITIES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NORTH

0 250 500

FEET

Existing Features

- Standpipe
- Weir
- Drop Inlet
- Vault
- Outfall
- Sediment Trap
- Conveyance Ditch
- Conveyance Pipe
- Curb Gutter
- Cartridge Filter
- Dry Basin
- Wet Basin
- Infiltration Basin
- Infiltration Feature
- Treatment Vault
- Master Plan Project Area

NOTES:
IMAGERY: DOUGLAS COUNTY

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FIGURE 7:
POTHOLE LOCATIONS
BURKE CREEK / RABE MEADOWS MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014
NOTES

NORTH

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FEET

WOOD RODGERS

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FIGURE 8: LAND CAPABILITY

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

- Project Boundary
- Parcel Boundary

Land Capability

- 1A
- 1B
- 2
- 3
- 4
- 5
- 7

NOTES:
IMAGERY: DOUGLAS COUNTY
PARCELS: DOUGLAS COUNTY
TOPOGRAPHY: OPEN TOPOOGRAPHY

Arthur Drive
Eugene Drive
Kahle Drive
Irwin Drive
Laura Drive
Lake Tahoe Boulevard (US 50)
Lake Village Drive
Echo Drive
Kahle Drive
Shady Lane
Manor Drive
State Route 207

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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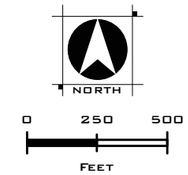
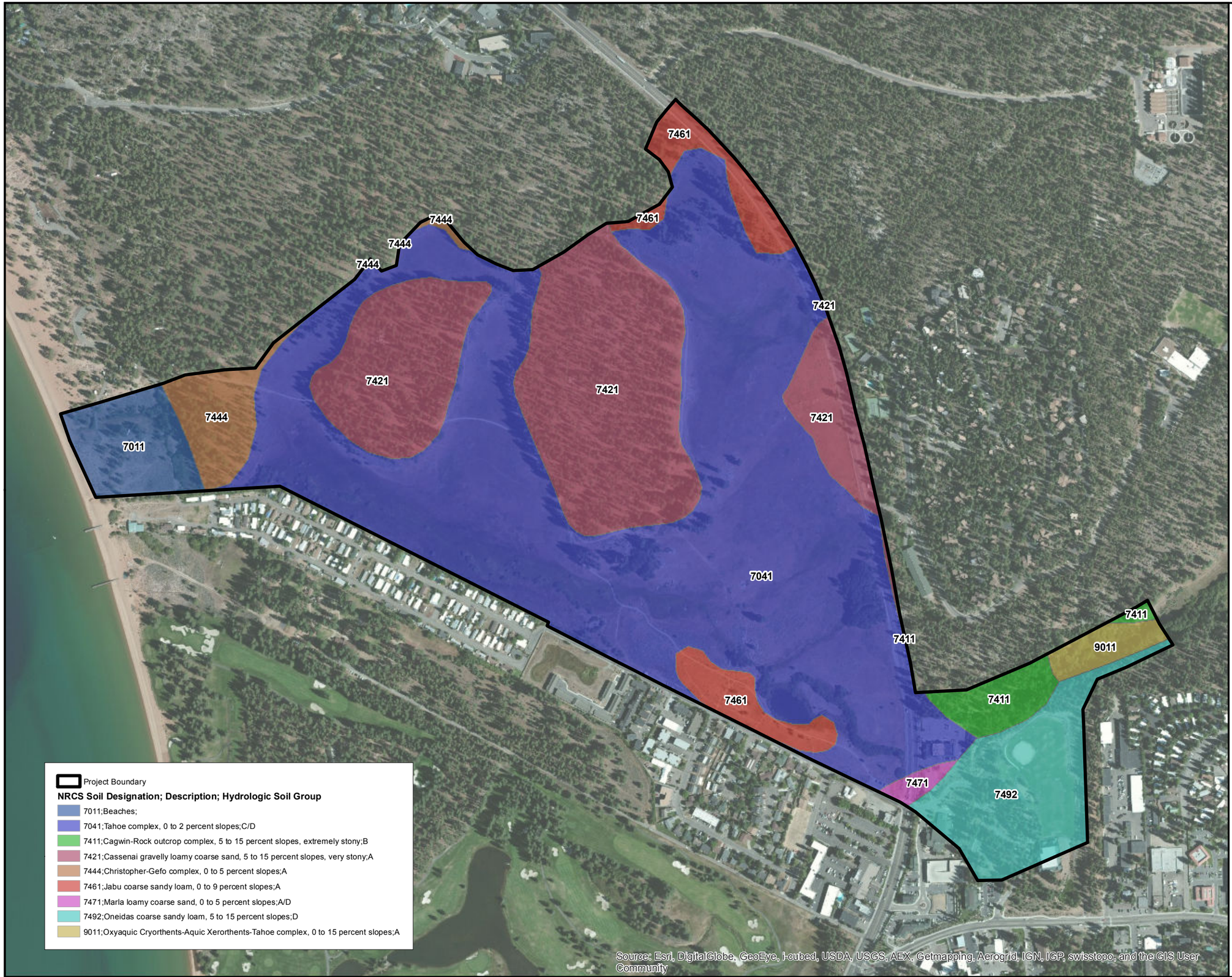
FIGURE 9: NRCS SOILS

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014





NOTES:
SOIL TYPES: NRCS

Nevada Tahoe Conservation District

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FIGURE 10: BMP / SOURCE CONTROL CERTIFICATION

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

Project Boundary

BMP / Source Control Certification

- BMP
- BMP-50% (BMPs Installed before 2008)
- Has Source Control Certificaiton
- No Source Control Certification

NOTES:
PARCELS: DOUGLAS COUNTY

Arthur Drive
Eugene Drive
Kahle Drive
Irwin Drive
Laura Drive
Lake Tahoe Boulevard (US 50)
Lake Village Drive
Echo Drive
Kahle Drive
Shady Lane
Manor Drive
State Route 207

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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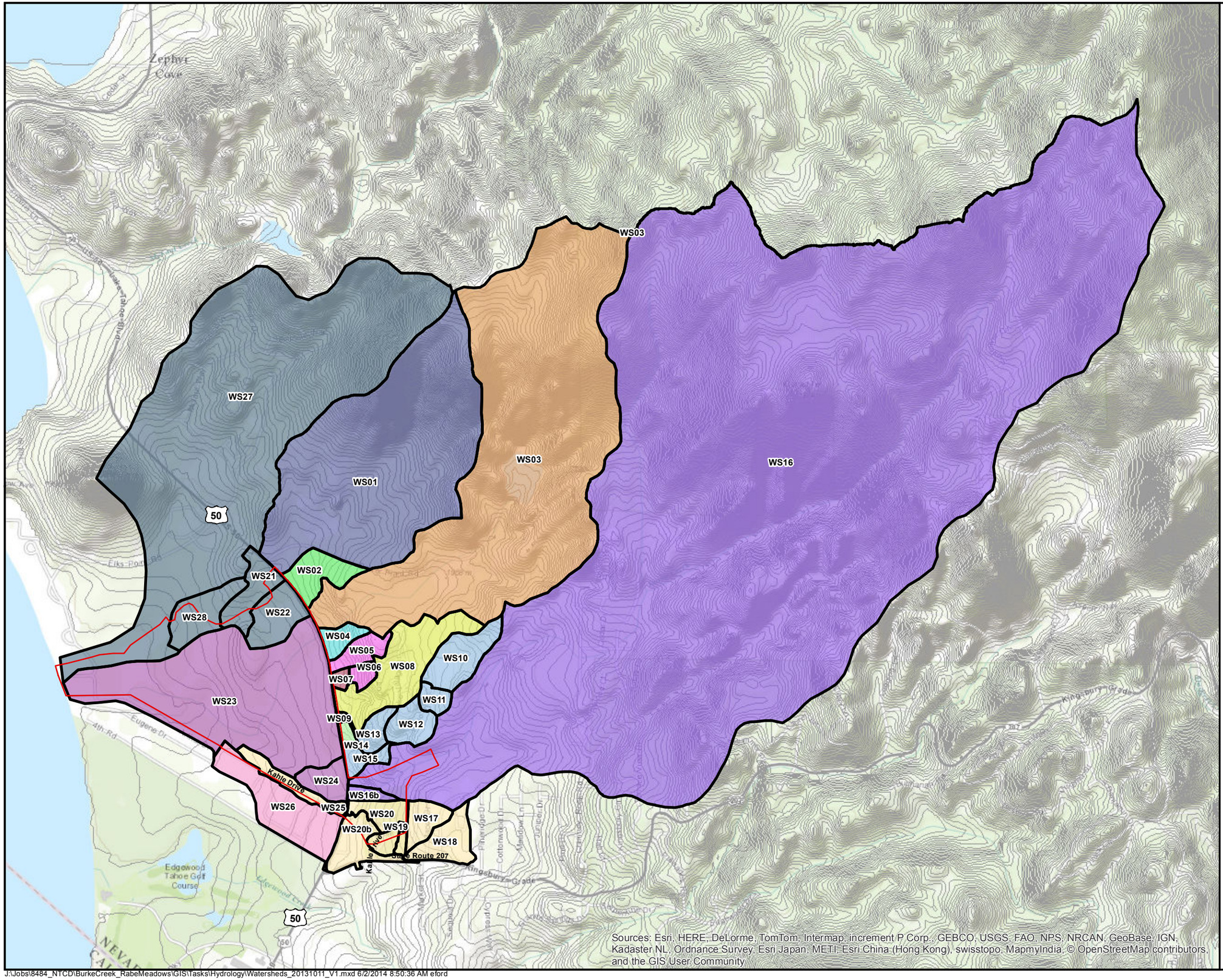
FIGURE 11A: SUBWATERSHED BOUNDARIES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



0 750 1,500
FEET

- 10' Contour
- Project Boundary
- Existing Subwatershed Boundary

Outfall

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15

NOTES:
Topo: USGS

Nevada Tahoe Conservation District

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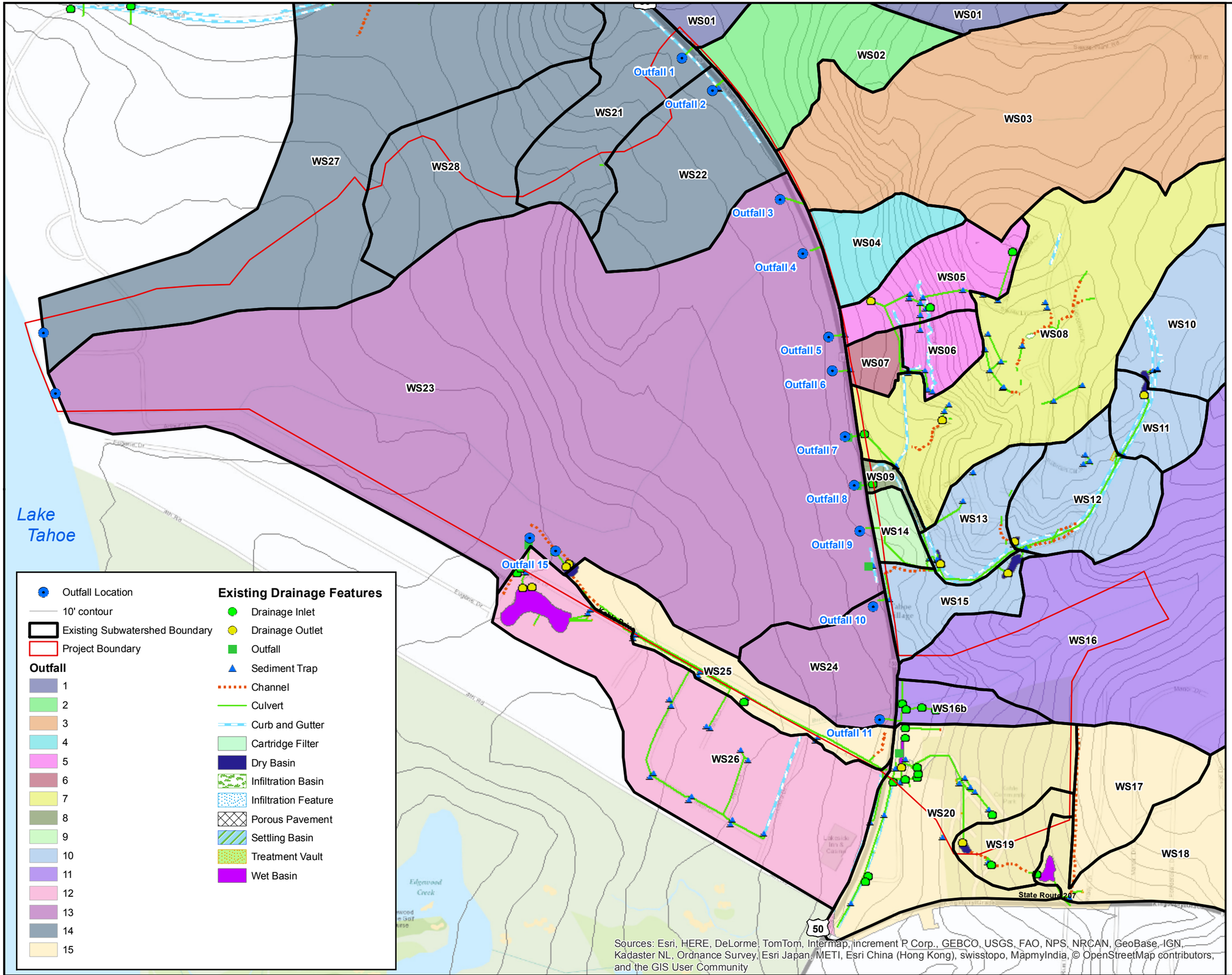
FIGURE 11B: SUBWATERSHED BOUNDARIES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NORTH

0 250 500
FEET

NOTES:
Topo: USGS

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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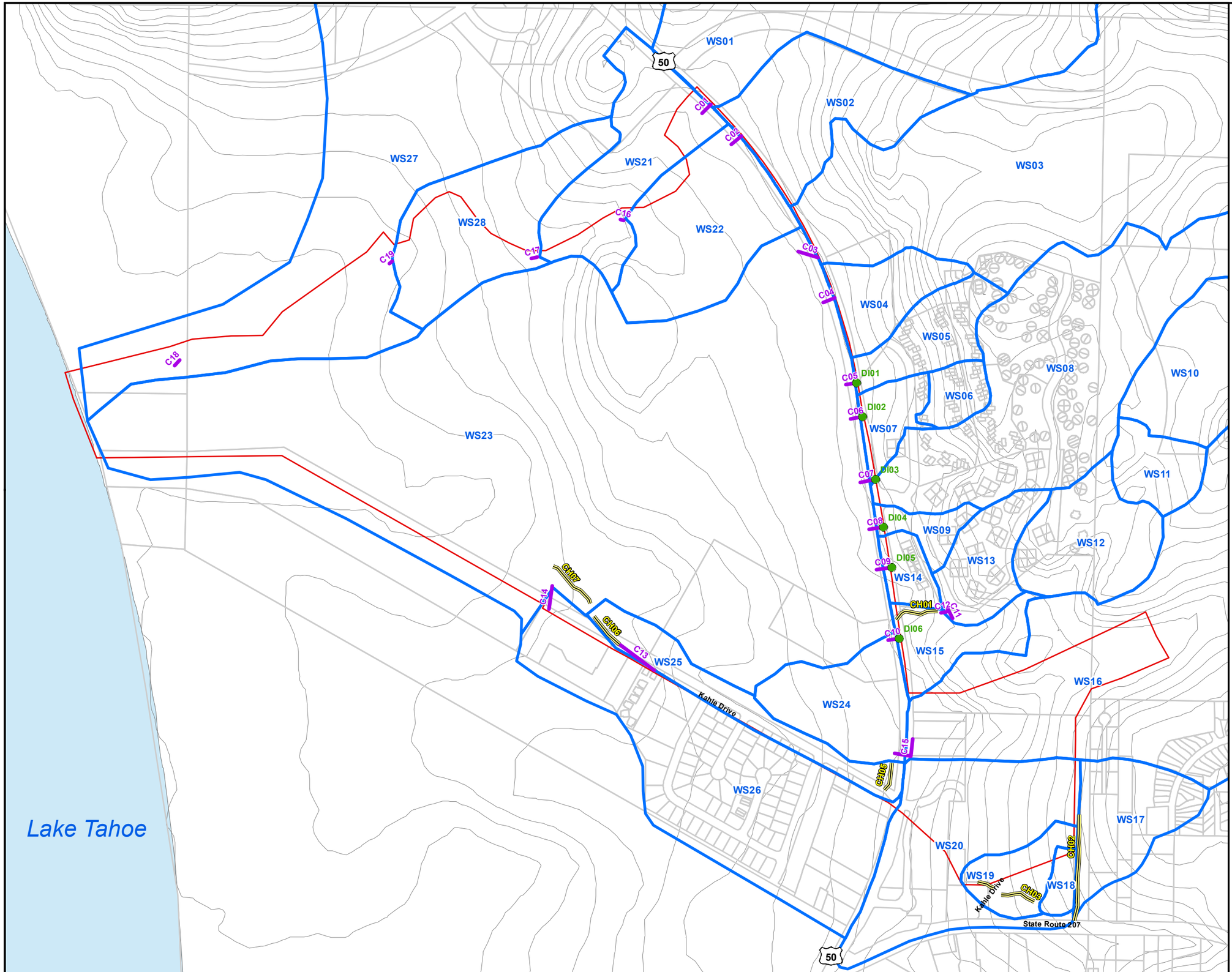
FIGURE 12: ANALYZED DRAINAGE FEATURES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



NORTH

0 250 500

FEET

- Drop Inlet
- Channel
- Culvert
- 10' contour
- Parcel Boundary
- Subwatershed Boundary
- Master Plan Project Area

NOTES:
Topo: USGS

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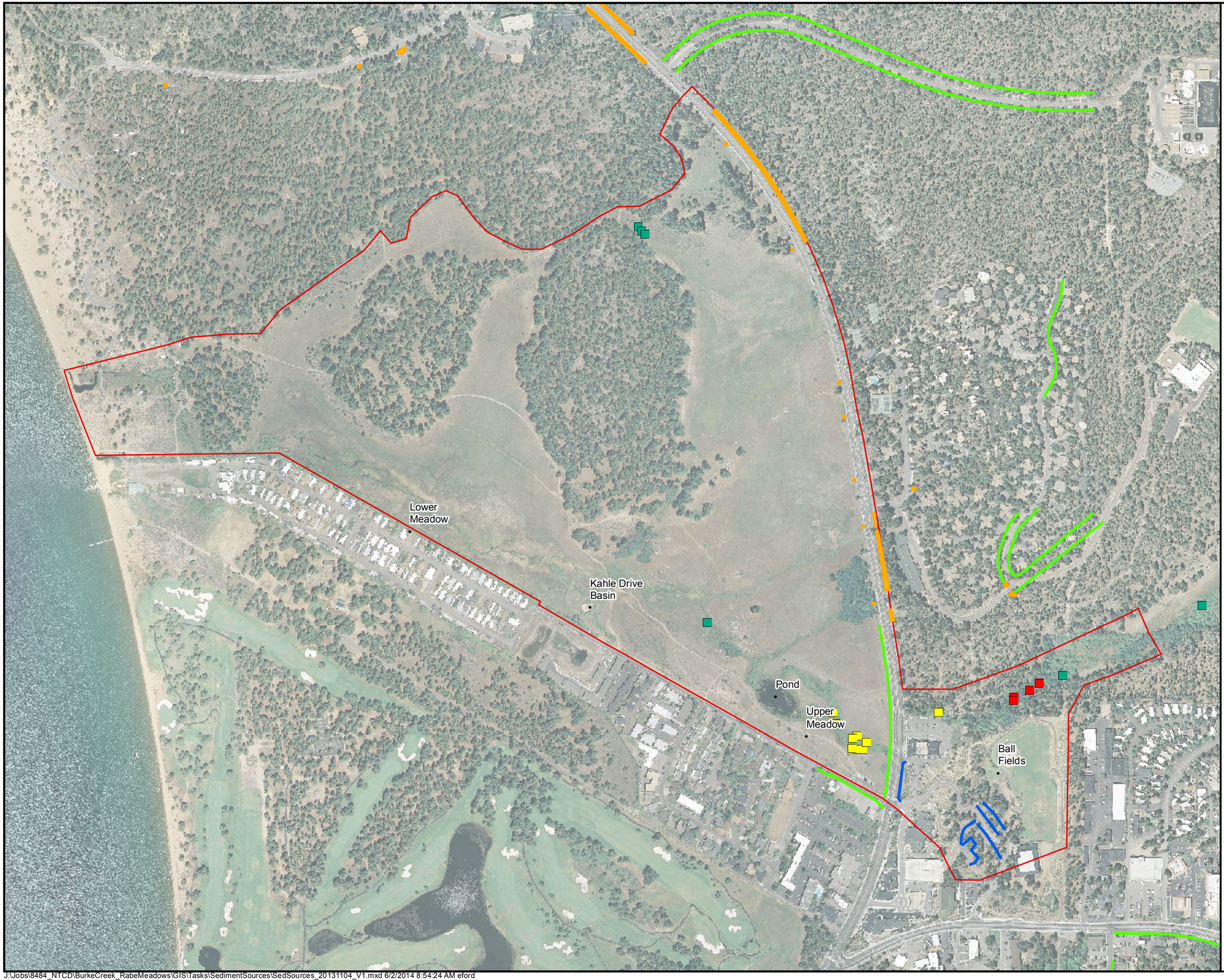
FIGURE 13: SEDIMENT SOURCES

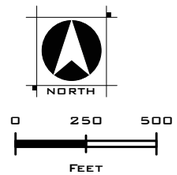
BURKE CREEK-RABE MEADOWS

MASTER PLAN

DOUGLAS COUNTY, NV

JUNE, 2014





- Headcuts
- Channel Incising
- Avulsion
- Bare Slopes
- Erodible Shoulder
- Bare Soil
- Project Boundary

NOTES:
IMAGERY: DOUGLAS COUNTY
SEDIMENT SOURCES: NTCD

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FIGURE 14: TMDL LAND USE

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

Parcel Boundary

Project Boundary

TMDL Land Use

- Commercial / Institutional / Communications / Utility, Impervious
- Commercial / Institutional / Communications / Utility, Pervious
- Multi Family Residential, Impervious
- Multi Family Residential, Pervious
- Transportation, Impervious
- Transportation, Pervious
- Vegetated, Pervious

NOTES:
IMAGERY: DOUGLAS COUNTY
PARCELS: DOUGLAS COUNTY
TOPOGRAPHY: OPEN TOPOOGRAPHY

Arthur Drive
Eugene Drive
Kahle Drive
Lake Tahoe Boulevard (US50)
Lake Village Drive
Echo Drive
Irwin Drive
Laura Drive
Kahle Drive
Shady Lane
Manor Drive
State Route 207

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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FIGURE 15: TMDL ROAD RISK

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

Road Risk

- Primary, High
- Primary, Moderate
- Primary, Low
- Secondary, High
- Secondary, Moderate
- Secondary, Low
- Project Boundary
- Parcel Boundary

NOTES:
PARCELS: DOUGLAS COUNTY

Arthur Drive
Eugene Drive
Kahle Drive
Irwin Drive
Laura Drive
Lake Tahoe Boulevard (US 50)
Lake Village Drive
Echo Drive
Kahle Drive
Shady Lane
Manor Drive
State Route 207

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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FIGURE 16: TMDL SHOULDER CONDITIONS

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

PLRM Shoulder Condition

- Erodible
- Protected
- Stable
- Stable & Protected
- Parcel Boundary
- Project Boundary

Arthur Drive
Eugene Drive
Kahle Drive
Irwin Drive
Laura Drive
Lake Tahoe Boulevard (US 50)
Lake Village Drive
Echo Drive
Kahle Drive
Shady Lane
Manor Drive
State Route 207

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

NOTES:
PARCELS: DOUGLAS COUNTY

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FIGURE 17: PLRM ROADWAY DCIA / ICIA

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

DCIA / ICIA

- DCIA
- ICIA
- Parcel Boundary
- Project Boundary

Arthur Drive
Eugene Drive
Kahle Drive
Irwin Drive
Laura Drive
Lake Tahoe Boulevard (US 50)
Lake Village Drive
Echo Drive
Kahle Drive
Shady Lane
Manor Drive
State Route 207

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

NOTES:
PARCELS: DOUGLAS COUNTY

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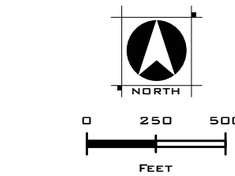
FIGURE 18: PLRM MET GRID

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014



PLRM Met Grid
Parcel Boundary
Project Boundary

NOTES:
PARCELS: DOUGLAS COUNTY

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FIGURE 19: VEGETATION TYPES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

- Spring
- Ephemeral Flow
- Perennial Flow
- Tahoe Yellow Cress Fence Area
- AI: Anthropoenic Influence
- CF: Coniferous Forest
- CF/SL: Coniferous Forest/Shrubland
- DM: Dry Meadow
- DM/SL: Dry Meadow/Shrubland
- OW: Open Water
- SL: Shrubland
- UPL: Upland
- WM: Wet Meadow
- WM/DM: Wet Meadow/Dry Meadow
- WM/WR: Wet Meadow/Woody Riparian
- WR: Woody Riparian
- Project Boundary

NOTES:
IMAGERY: DOUGLAS COUNTY
PARCELS: DOUGLAS COUNTY
VEGETATION TYPES: WOOD RODGERS

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FIGURE 20: POTENTIAL JURISDICTIONAL RESOURCES

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 100 200
FEET

- 5-foot Contours
- Feature 1
- Feature 2
- Delineation Boundary
- Wetland

NOTES:
AERIAL: DOUGLAS COUNTY 2007
TOPOGRAPHY: SURVEY & LIDAR FROM OPEN TOPOGRAPHY

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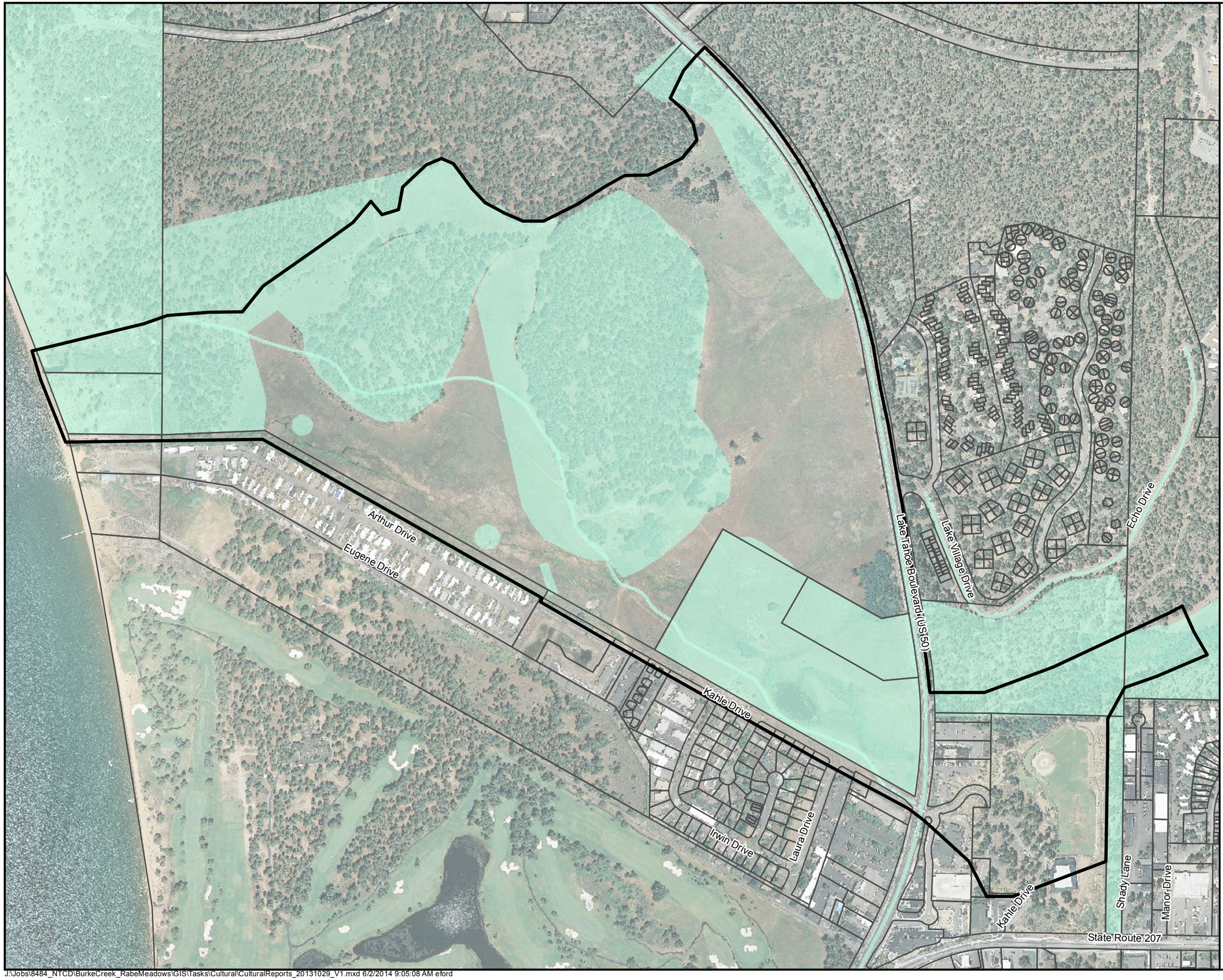

FIGURE 21: CULTURAL REPORT LOCATION MAP

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014

NORTH

0 250 500
FEET

- Previously Studied Area
- Project Boundary
- Parcel Boundary

NOTES:
CULTURAL: ZEIER & ASSOC.
IMAGERY: DOUGLAS COUNTY
PARCELS: DOUGLAS COUNTY

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J:\Jobs\8484_NTCD\BurkeCreek_RabeMeadows\GIS\Tasks\Cultural\CulturalReports_20131029_V1.mxd 6/2/2014 9:05:08 AM eford

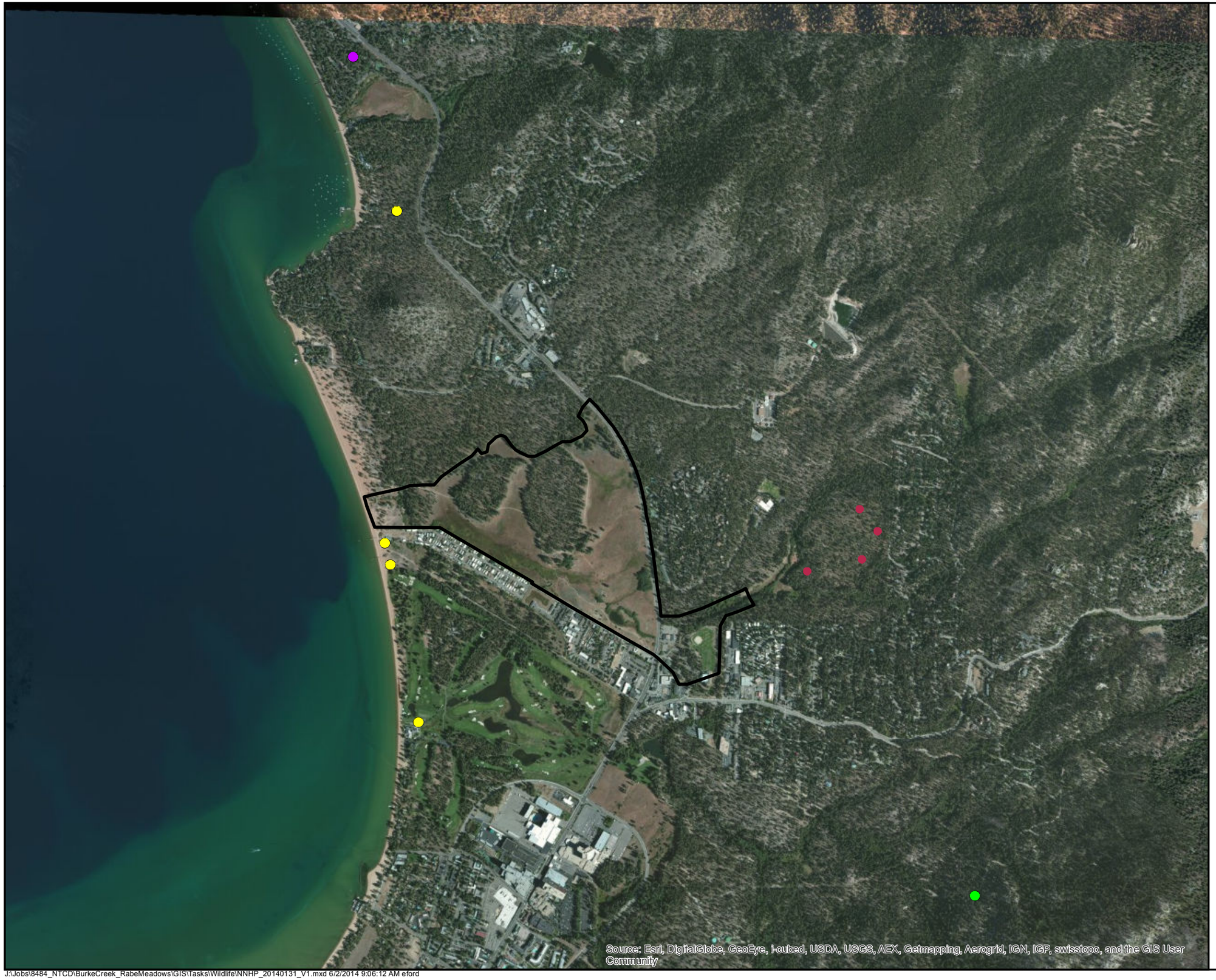
FIGURE 22: SENSITIVE SPECIES

BURKE CREEK-RABE MEADOWS

MASTER PLAN

DOUGLAS COUNTY, NV

JUNE, 2014



NOTES:
IMAGERY: DOUGLAS COUNTY

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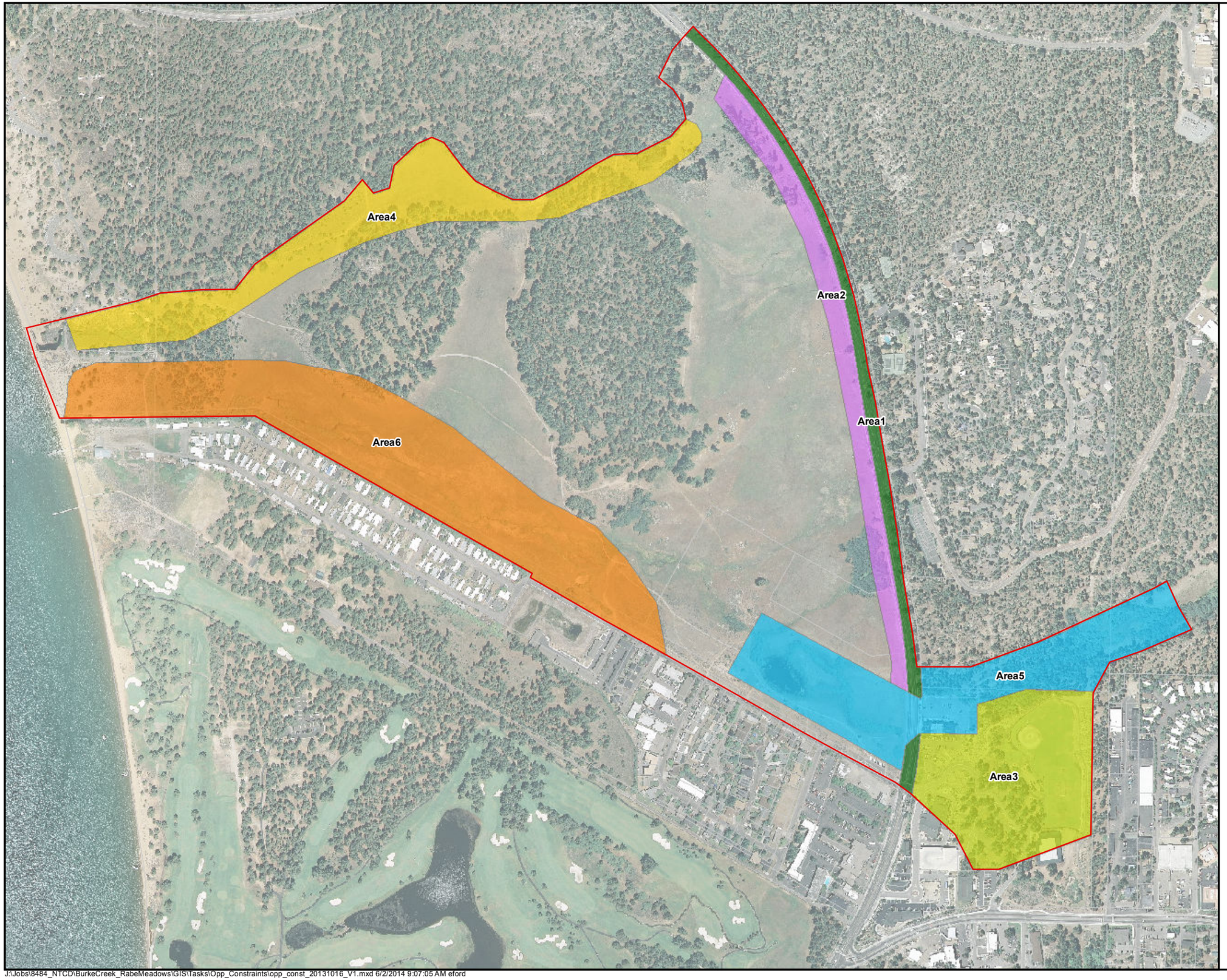
FIGURE 23: FOCUS AREAS

BURKE CREEK-RABE MEADOWS

MASTER PLAN

DOUGLAS COUNTY, NV

JUNE, 2014



- Project Boundary
- Parcel Boundary

Focus Area

- Area 1
- Area 2
- Area 3
- Area 4
- Area 5
- Area 6

NOTES:
IMAGERY: DOUGLAS COUNTY

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TABLES

Table 1
Existing 2-year, 25-year, 50-year and 100-year Peak Flows

Subwatershed/ Concentration Point	Contributing Drainage Area (acres)	2-Year Peak Discharge (cfs)	25-Year Peak Discharge (cfs)	50-Year Peak Discharge (cfs)	100-YearPeak Discharge (cfs)
WS16	1547.1	9.4	152	362.7	668.1
WS16B	3.5	1.9	7.1	8.9	11.1
WS03	371.5	0.9	15.2	21.3	52.6
WS23	150.6	2.9	55.4	80.7	112.8
WS18	4.4	11.7	36.9	45	54.8
WS17	20.9	7.7	22	26.9	32.8
J-WS18	25.3	20.7	55.4	67.7	87.4
WS19	4.5	2.3	8.1	10.2	12.7
J-WS19	29.8	22.8	66.5	81.4	99.5
WS20	8.3	3.8	15.2	19.3	24.3
WS20b	14.1	11	32.4	39.7	48.5
J-WS20	43.9	34.2	105.8	130.5	160.4
WS25	9.2	0.1	4.3	6.5	9.3
J-WS25	53.1	36.7	111.8	137.5	178.4
WS10	18.5	0.2	4.5	8.2	13.1
WS11	4.9	0	0.2	0.7	1.6
J-WS11	23.4	0.2	4.6	8.9	14.7
WS12	10.9	0.1	3	5.3	8.4
J-WS12	34.3	0.3	7.4	13.9	22.7
WS13	6.5	0.1	4.5	6.4	9
J-WS13	40.8	0.4	11.4	19.9	31.2
WS15	5.7	0.1	0.8	1.3	2.1
J-WS15	46.5	0.5	11.6	20.2	31.7
WS08	39.6	0.3	5.2	11.1	19.1
WS26	33.3	17.3	53.2	65.4	80.3
WS24	9.6	1.5	11.6	15.5	20.3
WS05	6.5	0.1	3.3	5.1	7.3
WS06	2.7	0	1.2	1.9	2.8
J-WS05	9.2	0.1	4.5	7	10.1
WS04	6.2	0	0.1	0.2	0.3
WS07	3.5	0	1.4	2.2	3.3
WS09	2.5	0	1.7	2.5	3.5
WS14	2.6	0	1.3	1.9	2.8
J-WS23	2402.6	52.4	383.3	661.3	1046.7
WS27	388.7	6.1	115.3	173.5	248
WS01	220.4	0.7	9.9	21.7	51.2
WS22	16.3	0.2	7.8	12.1	17.6
WS02	14.8	0	0.4	0.5	0.7
J-WS22	31.1	0.2	7.8	12.1	17.6
WS21	14.3	0	0.5	0.7	1.7
J-WS21	265.8	0.9	12	29.2	64.9
WS28	16.7	0.1	1	2.8	5.5
J-WS27	671.2	6.6	124.3	203.8	314.1

Table 2a
Drop Inlet Analysis
Burke Creek-Rabe Meadows Master Plan

Existing Label	Location	Gutter/ Roadway Longitudinal Slope (ft/ft)	Gutter Cross-Slope (ft/ft)	Gutter Width (ft)	Pavement Cross-Slope (ft/ft) or Channel Side Slope (H:V)	Manning's n	Number of grates	Grate Width (ft)	Grate Length (ft)	25-Year				Allowable Spread (ft)	50-Year				100-Year			
										Peak Flow (cfs)	Drop Inlet Interception (cfs)	Bypass (cfs)	Existing Spread (ft)		Peak Flow (cfs)	Drop Inlet Interception (cfs)	Bypass (cfs)	Existing Spread (ft)	Peak Flow (cfs)	Drop Inlet Interception (cfs)	Bypass (cfs)	Existing Spread (ft)
DI01	Shoulder	0.01	0.09	2.5	0.02	0.016	1	2.5	3	5.0	3.4	1.6	9.2	14.0	7.4	4.5	2.9	11.6	10.5	5.7	4.8	13.7
DI02	Shoulder	0.01	0.09	4	0.02	0.016	2	4	4	0.9	0.9	0.0	2.8	13.0	1.5	1.5	0.0	3.3	2.1	2.1	0.0	3.9
DI03	Gutter	0.01	0.09	2.5	0.02	0.016	1	2.5	10	4.8	4.4	0.4	10.0	19.0	10.5	8.2	2.4	14.3	18.5	12.4	6.1	18.1
DI04	Shoulder	0.01	0.09	3	0.02	0.016	1	2.83	10	0.7	0.7	0.0	3.7	15.0	2.5	2.5	0.0	5.6	1.3	1.3	0.0	7.3
DI05	Shoulder	0.01	0.09	2	0.02	0.016	1	2	2	1.3	1.2	0.1	4.9	19.0	1.9	1.6	0.3	6.5	2.8	2.0	0.8	7.9
DI06	Gutter	0.01	0.09	4	0.02	0.016	1	4	4	11.6	9.7	2.0	12.4	14.0	19.8	14.1	5.7	16.8	31.7	18.8	12.9	20.9

Table 2b
Culvert Analysis
Burke Creek-Rabe Meadows Master Plan

ID	Pipe Size	Material	Inlet Type	Length (ft)	Slope (%)	Pipe Capacity	25-year Peak Flow (cfs)	50-year Peak Flow (cfs)	100-year Peak Flow (cfs)	Notes
C01	15	CMP	Projecting	71	2.8	8.0	9.9	21.7	52.3	Estimated Inverts
C02	24	CMP	Projecting	77	2.6	27.2	0.4	0.5	0.7	Estimated Inverts
C03	18	CMP	Projecting	120	3.3	4.4	15.2	21.3	52.6	Estimated Inverts
C04	18	CMP	Projecting	74	5.4	7.6	0.1	0.2	0.3	Estimated Inverts
C05	18	RCP	Drop Inlet	63	9.5	8.8	5.0	7.4	10.5	Estimated Inverts
C06	15	RCP	Drop Inlet	71	5.7	7.9	0.9	1.5	2.1	Estimated Inverts
C07	24	RCP	Projecting	90	2.2	13.3	4.8	10.4	18.5	Estimated Inverts
C08	24	RCP	Drop Inlet	82	2.4	13.3	0.7	1.0	1.3	Estimated Inverts
C09	24	CMP	Drop Inlet	90	4.4	13.3	1.3	1.9	2.8	Estimated Inverts
C10	24	RCP	Drop Inlet	66	3.0	4.9	11.6	20.2	31.7	Estimated Inverts
C11	24	RCP	Manhole	67	3.0	13.3	11.4	19.9	31.2	Estimated Inverts
C12	24	RCP	Manhole	34	26.4	13.3	11.4	19.9	31.2	Estimated Inverts
C13	36	RCP	Manhole	249	1.6	85.2	109.0	135.2	167.7	Estimated Inverts
C14	18	RCP	Manhole	137	1.5	12.8	53.2	65.4	80.3	Estimated Inverts
C15	24	CMP	Projecting	195	4.0	20.3	152.0	362.7	668.1	Burke Creek Crossing
C16	12	CMP	Projecting	20	5.0	12.8	7.8	12.1	17.6	partially blocked
C17	18	RCP	Headwall	36	2.8	8.8	12.0	29.2	64.9	
C18	18	CMP	Projecting	45	1.1	5.0	124.3	203.8	314.1	partially blocked
C19	18	CMP	Projecting	20	1.3		12.8	30.5	67.2	Estimated Inverts

Yellow highlighting indicates inadequate capacity

Table 2c
Channel Analysis
Burke Creek-Rabe Meadows Master Plan

ID	Length (ft)	Δ Elevation (ft)	Slope (ft/ft)	Bottom Width (ft)	Depth (ft)	Side Slopes (H:V)	Manning's n	Channel Lining Description	Channel Capacity (cfs)	25-year Peak Flow (cfs)	50-year Peak Flow (cfs)	100-year Peak Flow (cfs)	25-yr Flow Depth (ft)	Full Flow Velocity (fps)	25-yr Flow Velocity (fps)
CH01	267	16	0.060	12	2	2	0.033	Articulated Block	468.2	11.4	19.9	31.2	0.3	14.6	4.0
CH02	616	26	0.042	2	1	2	0.033	Natural	7.0	22.0	26.9	32.8	0.9	6.7	6.4
CH03	205	14	0.068	5	2	1	0.033	Rock-Lined	197.2	63.5	77.6	94.9	1.0	14.1	10.1
CH04	97	8	0.082	5	2	1	0.033	Rock-Lined	216.5	63.5	77.6	94.9	1.0	15.5	10.7
CH05	166	6	0.036	8	4	2	0.022	Natural	1499.5	4.3	6.5	9.3	0.2	23.4	3.5
CH06	220	4	0.018	8	1	3	0.033	Natural	118.2	109.6	135.2	167.7	1.0	10.8	10.5
CH07	313	4	0.013	5	3	2	0.033	Natural	374.9	109.6	135.2	167.7	1.6	11.4	8.2

Yellow highlighting indicates inadequate capacity

Table 3
Summary of PLRM Results

Existing Conditions Modeling Results	FSP (lbs/yr)	TP (lbs/yr)	TN (lbs/yr)
DCA	2020	7.8	29.9
LV01	1592	9.4	33.5
OP01	663	4.2	26
5006	5014	13.25	42.43
5007	1741	5.72	21.08
5008	932	2.37	7.16
5009	1115	2.83	8.57
20701	1638	5.39	19.84
TOTAL:	**15,107**	**52.86**	**200.28**

APPENDIX A

Appendix A
Hydrologic Support Documents

Table/Supporting Documentation No.	Table/Supporting Documentation Name
A.1	Existing Conditions Percentage Land Use and CN Values
A.2	Existing Conditions Lag Time Calculations
A.3	Existing Conditions Flow Routing
A.4	Hydrologic Soil Group Map
-	NOAA Atlas 14 Precipitation Data

Table A.1
Existing Conditions Percentage Land Use and CN Values
Burke Creek-Rabe Meadows Master Plan

Subwatershed	Total Area (ac)	Total Area (sq. mi.)	$CN_{unimproved}$								$CN_{impervious}$		$CN_{combined}$
			Hydro Soil Group A	Hydro Soil Group A Area (%)	Hydro Soil Group B	Hydro Soil Group B Area (%)	Hydro Soil Group C	Hydro Soil Group C Area (%)	Hydro Soil Group D	Hydro Soil Group D Area (%)	Impervious	Impervious Area (%)	
1	220.4	0.344	36	46.79	60	52.55	73	0.00	79	0.00	98	0.66	49.0
2	14.8	0.023	36	77.86	60	21.11	73	0.00	79	0.00	98	1.04	41.7
3	371.5	0.580	36	53.17	60	44.83	73	0.03	79	0.00	98	1.97	48.0
4	6.2	0.010	36	90.41	60	3.16	73	0.90	79	0.00	98	5.53	40.5
5	6.5	0.010	36	59.46	60	0.00	73	0.00	79	0.00	98	40.54	61.1
6	2.7	0.004	36	60.45	60	0.00	73	0.00	79	0.00	98	39.55	60.5
7	3.5	0.005	36	61.97	60	0.00	73	0.00	79	0.00	98	38.03	59.6
8	39.6	0.062	36	67.07	60	7.18	73	0.00	79	0.00	98	25.75	53.7
9	2.5	0.004	36	55.12	60	0.00	73	0.10	79	0.00	98	44.77	63.8
10	18.5	0.029	36	41.61	60	43.13	73	0.00	79	0.00	98	15.26	55.8
11	4.9	0.008	36	55.02	60	37.63	73	0.00	79	0.00	98	7.35	49.6
12	10.9	0.017	36	45.15	60	36.22	73	0.00	79	0.00	98	18.63	56.2
13	6.5	0.010	36	54.16	60	0.13	73	0.00	79	0.00	98	45.71	64.4
14	2.6	0.004	36	60.30	60	0.00	73	0.00	79	0.00	98	39.70	60.6
15	5.7	0.009	36	17.52	60	76.82	73	3.15	79	0.00	98	2.50	57.2
16	1547.1	2.417	36	39.79	60	52.68	73	0.64	79	3.89	98	3.00	52.4
16B	3.5	0.006	36	0.00	60	13.08	73	7.82	79	35.20	98	43.91	84.4
17	9.1	0.014	36	0.00	60	0.00	73	0.00	79	36.21	98	63.79	91.1
18	15.4	0.024	36	0.00	60	0.00	73	0.00	79	33.46	98	66.54	91.6
19	4.4	0.007	36	0.00	60	0.00	73	0.00	79	70.15	98	29.85	84.7
20	8.18	0.013	36	0.00	60	0.00	73	0.00	79	84.17	98	15.82	82.0
20b	13.99	0.022	36	0.00	60	0.00	73	0.09	79	41.29	98	58.71	90.2
21	14.3	0.022	36	69.35	60	23.73	73	1.17	79	0.00	98	5.74	45.7
22	16.3	0.025	36	37.18	60	0.00	73	57.38	79	0.00	98	5.44	60.6
23	150.6	0.235	36	28.48	60	0.00	73	62.11	79	4.86	98	4.55	63.9
24	9.6	0.015	36	6.50	60	0.00	73	84.25	79	0.00	98	9.25	72.9
25	9.2	0.014	36	36.96	60	0.00	73	49.88	79	2.59	98	10.57	62.1
26	33.4	0.052	36	0.16	60	0.00	73	30.35	79	6.89	98	62.60	89.0
27	388.7	0.607	36	21.88	60	56.27	73	1.24	79	4.62	98	15.98	61.9
28	16.7	0.026	36	54.70	60	14.71	73	24.45	79	6.15	98	0.00	51.2

Notes:
CN values based on Technical Release 55 Urban Hydrology for Small Watersheds manual.
Cover type of "Sagebrush with grass understory" was applied.
A Hydrologic Condition of "Poor - <30% ground cover" was applied.
See HMS Time of Concentration Table for all contributing watersheds for watersheds denoted above with a "+".

Table A.2
Existing Conditions Lag Time Calculations
Burke Creek-Rabe Meadows Master Plan

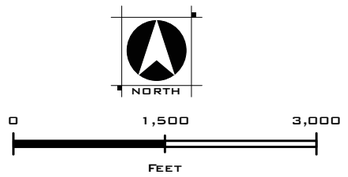
Watershed	Total Area (ac)	Time of Concentration														
		Initial Sheet Flow					Shallow Conc. Flow				Channel Flow				Total	
		L_i (ft)	n	P_2 (in)	S (ft/ft)	T_i (min)	L_s(ft)	S (ft/ft)	V(ft/s)	T_{t1} (min)	L_t (ft)	S (ft/ft)	V (ft/s)	T_{t2} (min)	T_c(min)	Tlag(min)
WS01	220.41	99	0.130	2.79	0.32	3.07	1425.11	0.29	5.3	4.44	3339.28	0.06	6.6	8.46	15.97	9.58
WS02	14.82	99	0.130	2.79	0.04	7.15	513.23	0.13	3.6	2.35	554.93	0.07	6.6	1.41	10.90	6.54
WS03	371.50	99	0.130	2.79	0.15	4.18	2081.49	0.11	3.3	10.54	6958.37	0.11	8.5	13.71	28.43	17.06
WS04	6.24	99	0.130	2.79	0.12	4.52	321.39	0.23	4.8	1.12	385.47	0.14	9.7	0.66	10.00	6.00
WS05	6.52	99	0.130	2.79	0.19	3.80	342.05	0.21	4.5	1.26	525.75	0.12	8.8	1.00	10.00	6.00
WS06	3.49	99	0.130	2.79	0.17	3.93	195.77	0.21	1.0	3.26	145.07	0.15	10.1	0.24	10.00	6.00
WS07	2.69	99	0.050	2.79	0.19	1.75	196.60	0.12	3.4	0.96	69.66	0.14	9.6	0.12	10.00	6.00
WS08	39.61	99	0.130	2.79	0.05	6.71	252.39	0.04	2.1	2.01	2739.74	0.06	6.2	7.36	16.08	9.65
WS09	2.51	99	0.130	2.79	0.10	4.94	332.71	0.20	4.4	1.25	221.54	0.06	6.1	0.61	10.00	6.00
WS10	6.48	99	0.130	2.79	0.11	4.65	515.41	0.12	3.4	2.49	1220.94	0.03	4.8	4.26	11.40	6.84
WS11	18.51	99	0.130	2.79	0.04	7.03	0.00	0.00	0.0	0.00	320.38	0.04	5.4	0.99	10.00	6.00
WS12	4.87	99	0.130	2.79	0.04	6.95	0.00	0.00	0.0	0.00	727.23	0.05	6.1	2.00	10.00	6.00
WS13	10.87	99	0.130	2.79	0.07	5.73	0.00	0.00	0.0	0.00	460.02	0.07	6.8	1.14	10.00	6.00
WS14	2.60	99	0.130	2.79	0.13	4.39	208.52	0.03	1.8	1.90	75.94	0.04	4.9	0.26	10.00	6.00
WS15	5.68	99	0.130	2.79	0.11	4.73	190.02	0.17	4.1	0.78	635.30	0.08	7.1	1.49	10.00	6.00
WS16	1547.11	99	0.130	2.79	0.06	5.98	2280.99	0.16	4.0	9.43	15742.05	0.09	7.9	33.25	48.66	29.20
WS16B	3.53	99	0.130	2.79	0.02	9.28	348.47	0.11	3.3	1.76	427.90	0.08	7.0	1.02	12.06	7.24
WS17	9.08	99	0.130	2.79	0.03	7.79	603.63	0.05	2.3	4.32	653.44	0.04	5.0	2.20	14.31	8.59
WS18	15.35	99	0.130	2.79	0.22	3.53	745.55	0.04	3.1	4.01	929.68	0.04	4.7	3.33	10.87	6.52
WS19	4.43	99	0.130	2.79	0.26	3.30	420.13	0.04	2.1	3.37	141.02	0.09	7.9	0.30	10.00	6.00
WS20	8.18	99	0.130	2.79	0.34	2.99	752.08	0.10	3.1	4.01	271.69	0.01	2.1	2.16	10.00	6.00
WS20B	13.99	99	0.130	2.79	0.06	6.01	180.27	0.07	2.6	1.17	1360.76	0.05	5.7	3.95	11.13	6.68
WS21	14.31	99	0.130	2.79	0.07	5.59	0.00	0.00	0.0	0.00	1147.25	0.04	5.4	3.57	10.00	6.00
WS22	16.38	99	0.130	2.79	0.02	8.61	0.00	0.00	0.0	0.00	734.24	0.04	5.0	2.46	11.07	6.64
WS23	150.61	99	0.130	2.79	0.05	6.37	0.00	0.00	0.0	0.00	5206.77	0.02	3.3	26.54	32.91	19.74
WS24	9.64	99	0.130	2.79	0.05	6.59	0.00	0.00	0.0	0.00	806.14	0.03	4.2	3.21	10.00	6.00
WS25	16.38	99	0.130	2.79	0.04	7.01	0.00	0.00	0.0	0.00	1963.30	0.03	4.3	7.70	14.71	8.82
WS26	33.42	99	0.130	2.79	0.13	4.38	622.15	0.03	1.6	6.30	2286.93	0.02	3.2	11.87	22.55	13.53
WS27	388.71	99	0.130	2.79	0.21	3.62	1622.00	0.25	5.0	5.43	8549.00	0.05	5.5	25.86	34.91	20.95
WS28	16.68	99	0.130	2.79	0.04	7.04	1488.00	0.06	2.4	10.16	0.00	0.00	0.0	0.00	17.20	10.32

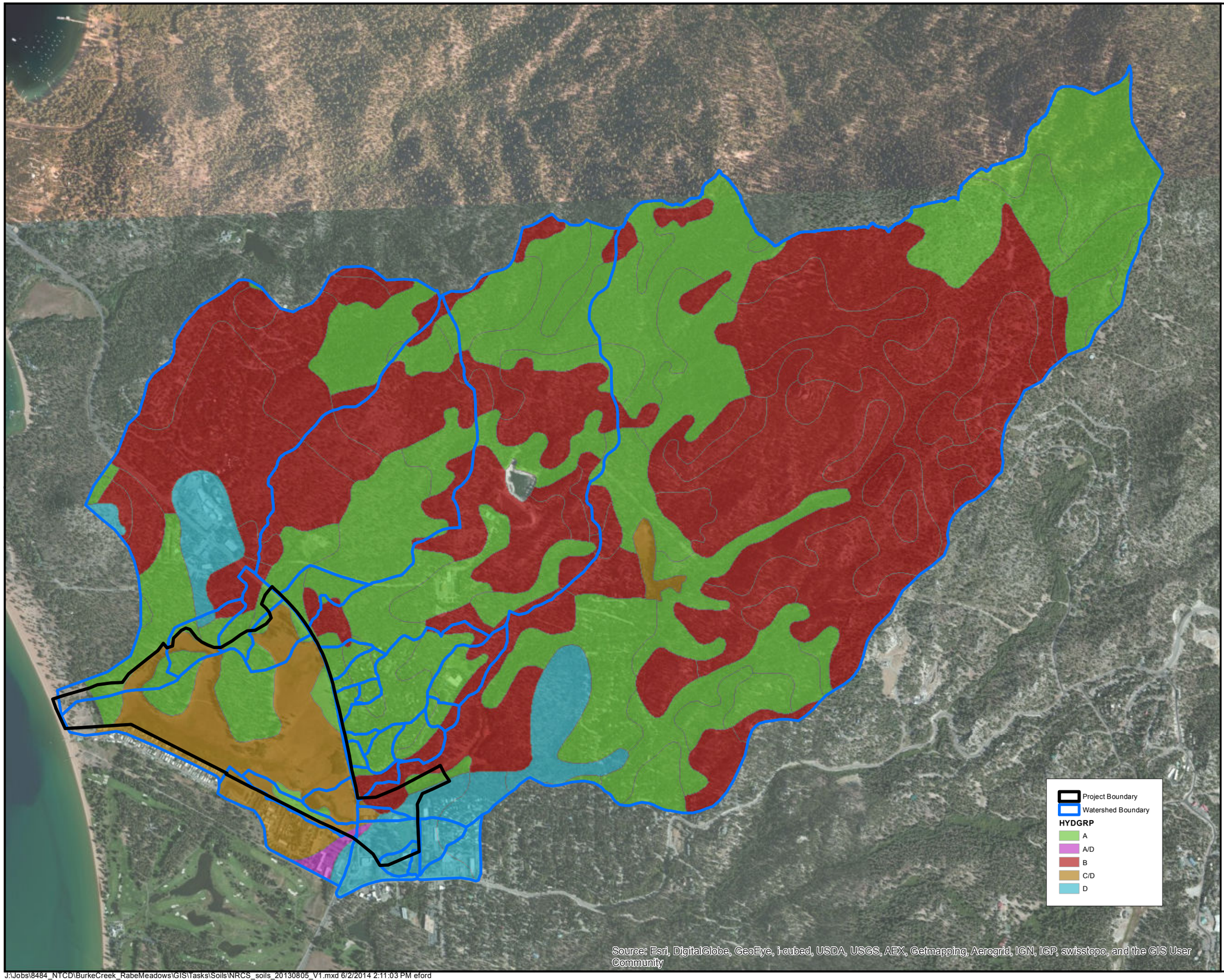
Table A.3
Existing Conditions Flow Routing
Burke Creek - Rabe Meadows Master Plan

From	To	Length (ft)	Slope (ft/ft)	Shape	Bottom Width (ft)	Side Slope (H:1)	Manning s
WS01	WS21	1147	0.043	Trapezoid	1	3	0.035
WS02	WS22	734	0.037	Trapezoid	1	3	0.035
WS03	outlet	5207	0.016	Trapezoid	1	3	0.035
WS03	outlet	5207	0.016	Trapezoid	1	3	0.035
WS04	outlet	5140	0.017	Trapezoid	1	3	0.035
WS05	outlet	4934	0.020	Trapezoid	1	3	0.035
WS06	WS05	480	0.020	Circular	1.5	-	0.013
WS07	outlet	4810	0.020	Trapezoid	1	3	0.035
WS08	outlet	4855	0.020	Trapezoid	1	3	0.035
WS09	outlet	4681	0.020	Trapezoid	1	3	0.035
WS10	WS11	320	0.044	Circular	2	-	0.013
WS11	WS12	727	0.055	Circular	2	-	0.013
WS12	WS13	460	0.068	Circular	2	-	0.013
WS13	WS15	635	0.076	Circular	2	-	0.013
WS14	outlet	4940	0.019	Trapezoid	1	3	0.035
WS15	outlet	5003	0.018	Trapezoid	1	3	0.035
WS16	outlet	5124	0.018	Trapezoid	1	3	0.035
WS17	WS18	110	0.018	Circular	2	-	0.013
WS18	WS19	204	0.040	Trapezoid	1	3	0.035
WS19	WS20	960	0.050	Circular	2	-	0.013
WS20	WS25	2110	0.016	Trapezoid	1	3	0.035
WS21	outlet	1993	0.066	Trapezoid	1	3	0.035
WS21	WS28	832	0.051	Trapezoid	1	3	0.035
WS22	WS21	473	0.051	Trapezoid	1	3	0.035
WS24	outlet	4139	0.014	Trapezoid	1	3	0.035
WS25	outlet	3066	0.007	Trapezoid	1	3	0.035
WS26	outlet	2808	0.007	Trapezoid	1	3	0.035

A.4 - HYDROLOGIC SOIL GROUP

BURKE CREEK-RABE MEADOWS COMPLEX
MASTER PLAN
DOUGLAS COUNTY, NV
JUNE, 2014





NOTES:
IMAGERY: DOUGLAS COUNTY
PARCELS: DOUGLAS COUNTY
TOPOGRAPHY: OPEN TOPOOGRAPHY

Nevada Tahoe Conservation District

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NOAA Atlas 14, Volume 1, Version 5
Location name: Kingsbury, Nevada, US*
Coordinates: 38.9830, -119.9200
Elevation: 6780 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.126 (0.110–0.145)	0.156 (0.138–0.182)	0.203 (0.178–0.236)	0.247 (0.215–0.287)	0.317 (0.267–0.369)	0.379 (0.310–0.445)	0.454 (0.359–0.539)	0.544 (0.413–0.657)	0.688 (0.492–0.851)	0.824 (0.557–1.04)
10-min	0.191 (0.168–0.221)	0.238 (0.210–0.278)	0.310 (0.271–0.360)	0.377 (0.327–0.437)	0.483 (0.406–0.562)	0.578 (0.471–0.677)	0.692 (0.546–0.819)	0.829 (0.628–1.00)	1.05 (0.748–1.30)	1.25 (0.848–1.59)
15-min	0.237 (0.208–0.274)	0.295 (0.261–0.344)	0.384 (0.335–0.446)	0.467 (0.405–0.542)	0.599 (0.503–0.697)	0.716 (0.584–0.839)	0.858 (0.677–1.02)	1.03 (0.779–1.24)	1.30 (0.928–1.61)	1.55 (1.05–1.97)
30-min	0.319 (0.280–0.369)	0.397 (0.351–0.463)	0.517 (0.451–0.600)	0.629 (0.545–0.730)	0.806 (0.678–0.938)	0.964 (0.787–1.13)	1.16 (0.912–1.37)	1.38 (1.05–1.67)	1.75 (1.25–2.16)	2.09 (1.42–2.65)
60-min	0.395 (0.346–0.457)	0.492 (0.434–0.573)	0.639 (0.558–0.743)	0.778 (0.675–0.904)	0.998 (0.839–1.16)	1.19 (0.974–1.40)	1.43 (1.13–1.69)	1.71 (1.30–2.07)	2.16 (1.55–2.68)	2.59 (1.75–3.28)
2-hr	0.557 (0.506–0.625)	0.688 (0.621–0.771)	0.855 (0.768–0.958)	1.00 (0.896–1.13)	1.22 (1.06–1.38)	1.41 (1.21–1.61)	1.62 (1.36–1.87)	1.88 (1.52–2.20)	2.31 (1.79–2.77)	2.73 (2.05–3.35)
3-hr	0.704 (0.642–0.773)	0.870 (0.799–0.960)	1.06 (0.968–1.17)	1.22 (1.10–1.35)	1.44 (1.29–1.60)	1.62 (1.42–1.82)	1.82 (1.57–2.05)	2.07 (1.75–2.37)	2.46 (2.03–2.88)	2.88 (2.31–3.43)
6-hr	1.10 (1.00–1.20)	1.36 (1.24–1.49)	1.64 (1.49–1.80)	1.86 (1.68–2.04)	2.15 (1.93–2.37)	2.38 (2.10–2.63)	2.59 (2.26–2.91)	2.83 (2.44–3.21)	3.14 (2.65–3.62)	3.40 (2.81–3.98)
12-hr	1.62 (1.46–1.80)	2.02 (1.82–2.25)	2.50 (2.24–2.78)	2.87 (2.56–3.20)	3.38 (2.98–3.80)	3.77 (3.29–4.26)	4.17 (3.58–4.75)	4.56 (3.85–5.27)	5.07 (4.19–5.97)	5.45 (4.42–6.51)
24-hr	2.23 (1.97–2.54)	2.79 (2.47–3.18)	3.48 (3.08–3.97)	4.05 (3.57–4.60)	4.83 (4.24–5.49)	5.45 (4.76–6.18)	6.09 (5.29–6.92)	6.75 (5.82–7.69)	7.66 (6.54–8.74)	8.37 (7.09–9.60)
2-day	2.88 (2.52–3.31)	3.62 (3.18–4.16)	4.64 (4.07–5.33)	5.49 (4.80–6.31)	6.71 (5.83–7.71)	7.71 (6.65–8.86)	8.78 (7.52–10.1)	9.93 (8.42–11.5)	11.6 (9.67–13.4)	12.9 (10.7–15.1)
3-day	3.26 (2.84–3.78)	4.14 (3.60–4.80)	5.39 (4.67–6.23)	6.43 (5.55–7.42)	7.91 (6.79–9.13)	9.12 (7.78–10.5)	10.4 (8.82–12.1)	11.8 (9.91–13.7)	13.8 (11.4–16.1)	15.5 (12.6–18.1)
4-day	3.65 (3.16–4.26)	4.66 (4.02–5.43)	6.14 (5.28–7.14)	7.36 (6.31–8.54)	9.11 (7.75–10.6)	10.5 (8.91–12.2)	12.1 (10.1–14.0)	13.7 (11.4–16.0)	16.1 (13.2–18.8)	18.0 (14.6–21.2)
7-day	4.44 (3.82–5.20)	5.69 (4.89–6.66)	7.54 (6.46–8.83)	9.04 (7.72–10.6)	11.2 (9.47–13.0)	12.9 (10.9–15.0)	14.7 (12.3–17.2)	16.6 (13.8–19.5)	19.4 (15.9–22.8)	21.6 (17.5–25.5)
10-day	5.16 (4.47–5.98)	6.63 (5.73–7.67)	8.74 (7.55–10.1)	10.4 (8.97–12.0)	12.7 (10.9–14.7)	14.6 (12.4–16.8)	16.5 (14.0–19.1)	18.5 (15.6–21.5)	21.3 (17.7–24.9)	23.6 (19.4–27.6)
20-day	7.05 (6.13–8.11)	9.02 (7.85–10.4)	11.8 (10.2–13.5)	13.9 (12.0–15.9)	16.7 (14.4–19.2)	18.8 (16.2–21.7)	21.0 (18.0–24.3)	23.3 (19.8–27.0)	26.3 (22.1–30.6)	28.7 (23.9–33.5)
30-day	8.54 (7.42–9.79)	11.0 (9.52–12.6)	14.3 (12.4–16.4)	16.9 (14.6–19.3)	20.3 (17.5–23.2)	22.9 (19.7–26.3)	25.6 (21.9–29.5)	28.4 (24.1–32.7)	32.1 (27.0–37.1)	34.9 (29.2–40.5)
45-day	10.5 (9.20–11.9)	13.5 (11.8–15.3)	17.6 (15.4–20.0)	20.7 (18.1–23.6)	24.8 (21.6–28.2)	27.9 (24.1–31.8)	31.0 (26.7–35.5)	34.2 (29.3–39.2)	38.4 (32.6–44.2)	41.6 (35.1–48.2)
60-day	12.2 (10.5–13.9)	15.7 (13.6–18.0)	20.5 (17.8–23.5)	24.0 (20.7–27.5)	28.4 (24.4–32.5)	31.6 (27.2–36.3)	34.8 (29.8–40.0)	37.9 (32.3–43.7)	41.9 (35.5–48.5)	44.9 (37.8–52.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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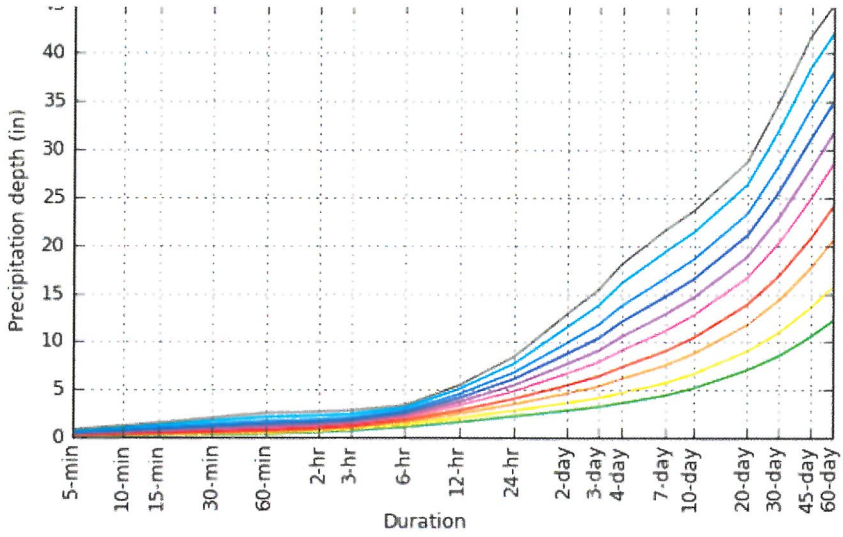
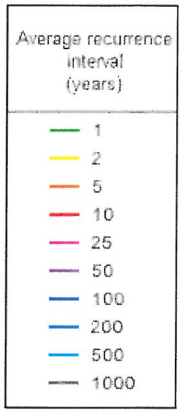
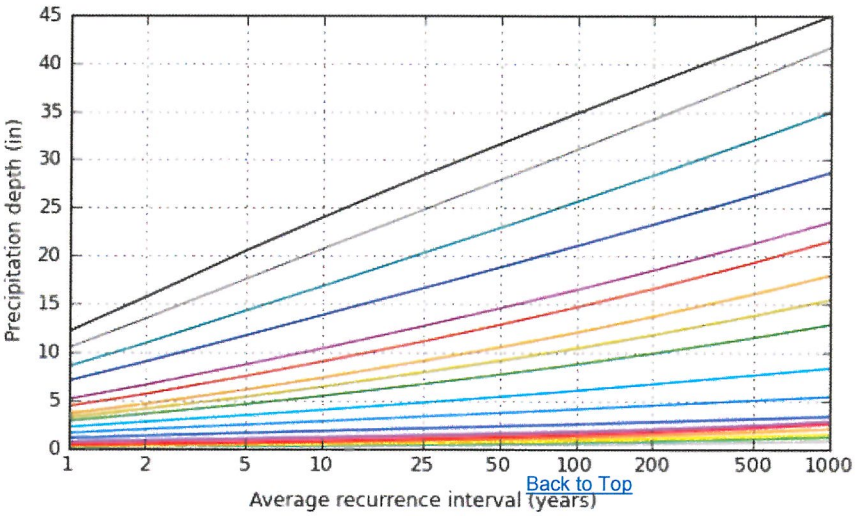
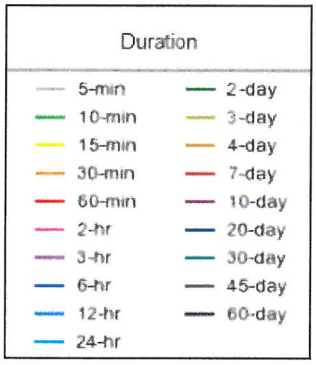
PF graphical









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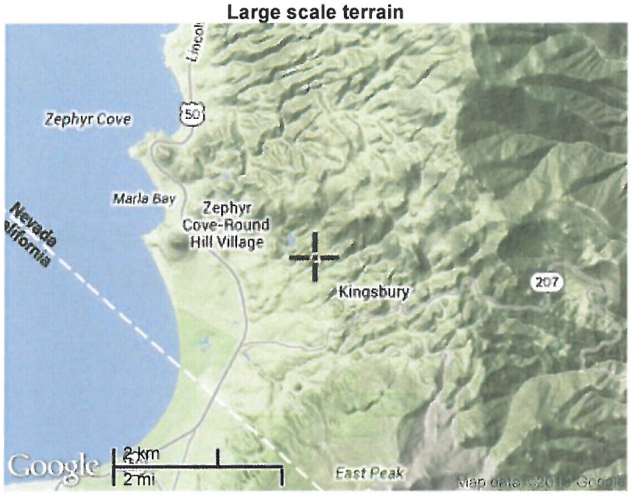
Maps & aerials

NOAA/NWS/OHD/HDSC

Created (GMT): Wed Sep 18 17:36:49 2013

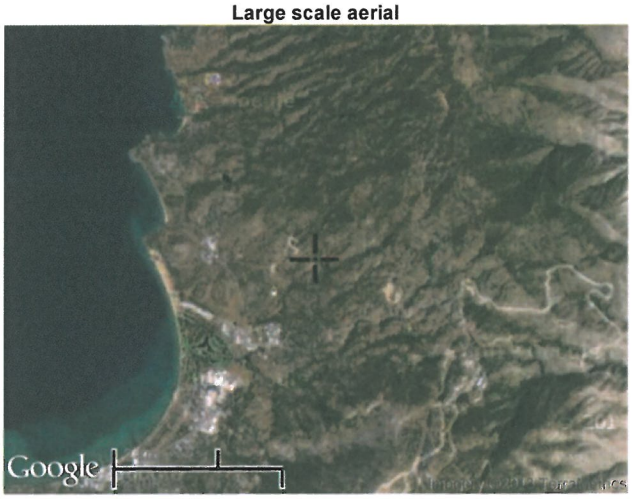
Small scale terrain

Large scale terrain



Large scale map

Large scale aerial



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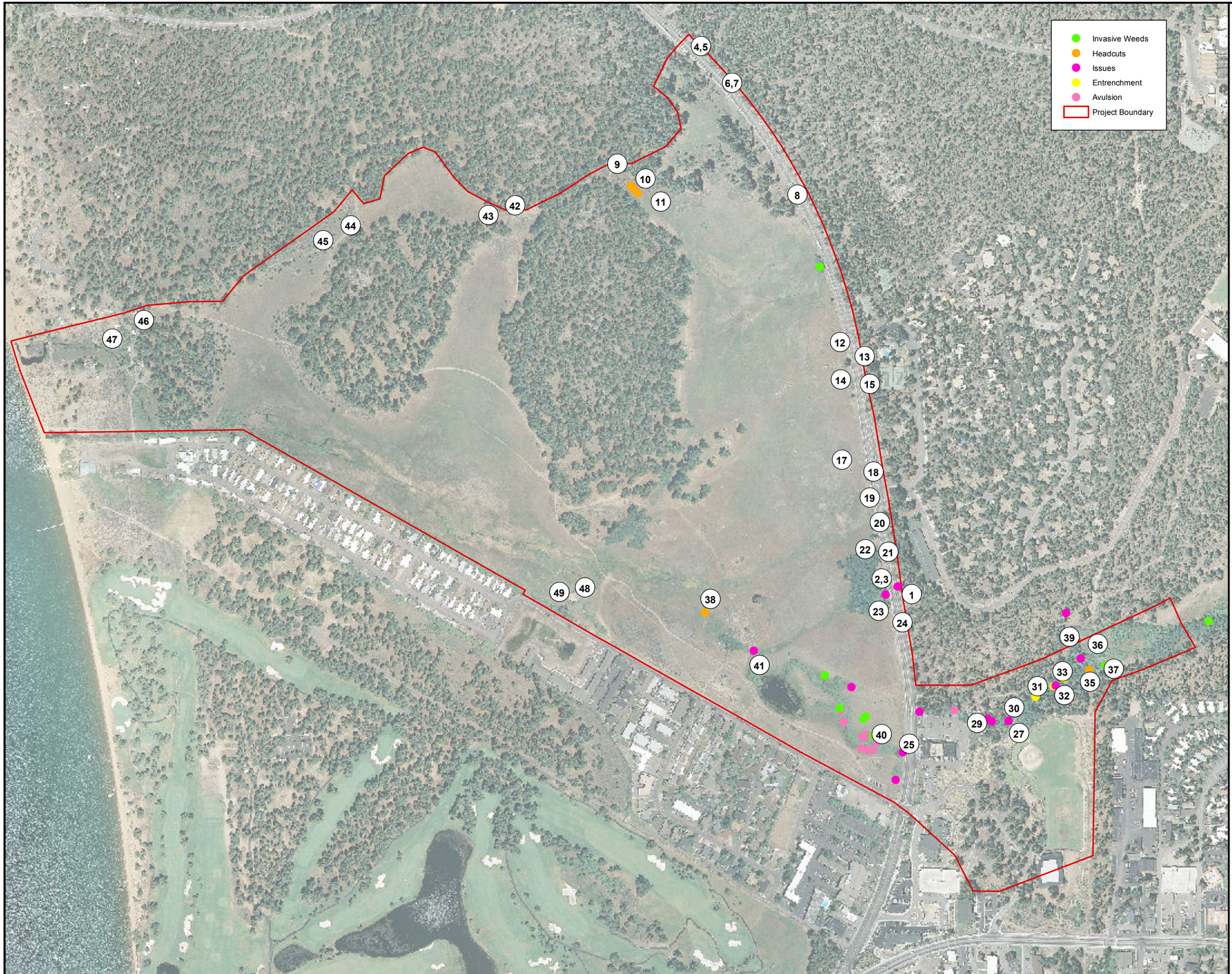
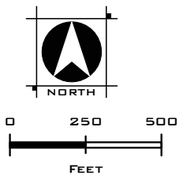
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910

APPENDIX B

APPENDIX B: FIELD PHOTO LOCATIONS

BURKE CREEK-RABE MEADOWS
MASTER PLAN
DOUGLAS COUNTY, NV
FEBRUARY, 2014





NOTES:
IMAGERY: DOUGLAS COUNTY

Nevada Tahoe Conservation District

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
5440 Reno Corporate Drive Tel: 775.823.4068
Reno, NV 89511 Fax: 775.823.4066

J:\Jobs\8484_NTCD\BurkeCreek_RabeMeadows\GIS\Tasks\ExistingFacilities\Photos_20131007_V1.mxd 2/3/2014 2:44:06 PM asantti

Lake Village Phase II outfall from rock-lined swale to NDOT trench drain DCCD0168.

ID = 1

HWY 50 flooding area.

ID = 2

Hwy 50 flooding of eastbound lanes #1 and 2.

ID = 3

Discharge point of culvert DCCP0457 from HWY 50 culvert crossing.

ID = 4

Spreading area of culvert DCCP0457 discharge point from HWY 50 crossing.

ID = 5

Discharge point of rock-lined channel DCCD0166 and culvert DCCP0458 from HWY 50 culvert crossing.

ID = 6

Spreading area of Rip Rap dissipater DCBS0191.

ID = 7

Spreading area of rip rap dissipater DCBS0134 and discharge point of HWY 50 crossing culvert DCCP0460.

ID = 8

Looking downstream at meadow drainage and culvert crossing use trail at north end of Rabe Meadow.

ID = 9

18” head cut (worst in a series) at the meadow drainage to culvert crossing the use trail at north end of Rabe Meadow. Drainage has a slope change and narrows before the culvert.

ID = 10

Looking downstream at the meadow drainage at north end of Rabe Meadow. Three head cuts and narrowing of drainage begin at the sage brush line.

ID = 11

Discharge point of HWY 50 culvert crossing DCCP0462 and rip rap dissipater DCBS0135.

ID = 12

Spreading area of rip rap dissipater DCBS0135 and discharge point of HWY 50 crossing culvert DCCP0462.

ID = 13

Discharge point of HWY 50 culvert crossing DCCP0463 and rip rap dissipater DCBS0136.

ID = 14

Spreading area of rip rap dissipater DCBS0136 and discharge point of HWY 50 crossing culvert DCCP0463.

ID = 15

Outfall DCOF0074 of HWY 50 culvert crossing DCCP0464 and rip rap dissipater DCBS0137.

ID = 16

Spreading area (north split) of rip rap dissipater DCBS0137 and of HWY 50 crossing culvert DCCP0464 at outfall DCOF0074.

ID = 17

Spreading area (south split) of rip rap dissipater DCBS0137 and of HWY 50 crossing culvert DCCP0464 at outfall DCOF0074.

ID = 18

Outfall DCOF0044 of HWY 50 culvert crossing DCCP0465 and rip rap dissipater DCBS0138.

ID = 19

Spreading area of rip rap dissipater DCBS0138 and of HWY 50 crossing culvert DCCP0465 at outfall DCOF0044.

ID = 20

Discharge Point DCDP0087 of HWY 50 culvert crossing DCCP0466. A small natural basin exists at the discharge point.

ID = 21

The small natural basin at the discharge point DCDP0087 of HWY 50 culvert crossing DCCP0466.

ID = 22

Outfall DCOF0045 of HWY 50 drop inlet DCST0309. Outfall is located less than 10’ away from Folsom Spring and is considered directly connected.

ID = 23

Discharge Point DCDP0088 of HWY 50 culvert crossing DCCP0469. The runoff is discharged to private property.

ID = 24

Eroded flow path from concentrated runoff along HWY 50 near Burke Creek. The runoff discharges to a use trail and eventually Kahle Ditch.

ID = 25

Levee adjacent to commercial parking lot where flows above 45 cfs escape the channel and enter a private stormdrain system.

ID = 26

Drainage flow path from ballfield runoff. Runoff has been observed bypassing the flowpath further uphill and entering the commercial parking lot instead of Burke Creek.

ID = 27

Automobile gas tank lodged in stream bank.

ID = 28

Use trail and bridge over Burke Creek.

ID = 29

Mudslide area where ballfield slope gave way in 1997 storm event. Mudslide is pinching the Burke Creek floodplain and burying tree trunks. Mudslide is close to 3’ high at bottom.

ID = 30

Downstream end of channel entrenchment.

ID = 31

Eroded and undercut banks. Burke Creek has cut banks 3’ deep.

ID = 32

Use trail and bridge crossing Burke Creek in the channel entrenchment section.

ID = 33

Ephemeral drainage entering Burke Creek from the north on Sierra Colina property.

ID = 34

Channel split and upper end of headcuts (2 headcuts –1 on each split channel). Logs pictured were once buried and are now exposed due to creek undercutting.

ID = 35

3’ deep headcut on the north channel split.

ID = 36

Headcut on the south channel split. Stream upstream of the headcuts appears in good shape for the most part.

ID = 37

4’ deep headcut in upper meadow area.

ID = 38

Manmade ditch on Sierra Colina property. Perhaps this is the berm referenced in the Winzler & Kelly report?

ID = 39

Channel avulsion in meadow just below HWY 50. Wetland vegetation is replacing meadow vegetation. Lots of young alder and willow are present.

ID = 40

3’ Headcut and plunge pool in lower meadow just below the Jennings pond.

ID = 41

Looking downstream at meadow drainage and culvert crossing Stateline to Stateline bike path at north end of Rabe Meadow. 18”RCP. 6’ wide channel x 9” deep. Erosion Control Blanket/revegetation substrate.

ID = 42

Spreading area of rip rap dissipater discharge point of Stateline to Stateline bike path culvert.

ID = 43

Looking downstream at meadow drainage and culvert crossing use trail at north end of Rabe Meadow toward Nevada Beach. 8” aluminum culvert w/ crushed end. 4’ wide x 12” deep channel. Native vegetation/soil substrate in channel. 1 rock weir installed in channel to hold grade. Some deposited sand bars.

ID = 44

Flow path of drainage from culvert crossing use trail at north end of Rabe Meadow toward Nevada Beach. 6’ wide x 8” deep channel. Vegetation/sand substrate. 2 rock weirs installed in channel to hold grade.

ID = 45

Looking upstream at meadow drainage from the culvert crossing the Nevada Beach campground road. 18” aluminum culvert. 6’ wide x 18” deep channel. Pine needle/veg substrate.

ID = 46

Flow path of drainage from culvert crossing the Nevada Beach campground road. Burke Creek is ~125' from the culvert outlet. 18" aluminum culvert. 3' wide x 12" deep channel. Leaves/organic debris substrate.

ID = 47

Kahle Basin standpipe DCDO0025 with no sump. Basin had 18” sump when constructed.

ID = 48

Kahle Basin DCDB0020 with very little treatment capacity remaining.

ID = 49

APPENDIX C

Burke Creek Hwy 50 Crossing & Realignment Project Noxious Weed Risk Assessment

Nevada Tahoe Conservation District

9/18/2013

Contents

Tables

Figures

Introduction

The purpose of this document is to conduct an initial baseline assessment for noxious weeds (or invasive non-native species that satisfies the Tahoe Regional Planning Agency (TRPA) requirements for the Burke Creek Hwy 50 Crossing and Realignment Project (Project). The Noxious Week Risk Assessment will provide Nevada Tahoe Conservation District (NTCD) with relevant noxious weed data within the Project area, and guide the decision making process during Project construction. This assessment summarizes the literature review and research findings, field assessment data, and potential eradication methods of the noxious weeds within and adjacent to the Project area. Noxious weed species are those identified by the Nevada Department of Agriculture Nevada Administrative Code (NAC) 555.010 and the United States Forest Service Lake Tahoe Basin Management Unit (USFS LTBMU).

Project Description

In 1997, the TRPA developed a Basin-wide Environmental Improvement Program (EIP) that defines various projects which, once implemented, would assist in attaining and maintaining TRPA Environmental Threshold Carrying Capacities (ETCC). The Burke Creek Hwy 50 Crossing and Realignment Project is encompassed under TRPA EIP #409. NTCD proposes to implement the Project in the 2014 and 2015 construction seasons to assist with meeting the goals of the EIP. The Project is a joint effort between NTCD, Nevada Department of Transportation (NDOT), United States Forest Service (USFS), Douglas County and private parcel owners (Sierra Colina).

The purpose of the Project is to plan, design and implement a project that improves stormwater conveyance capacity at Highway 50, reduce Highway 50 flooding, improve stream and riparian habitat, increase stream connectivity to the floodplain, and treat stormwater runoff. An undersized and lengthy culvert at Highway 50 is the prominent issue necessitating the need for the Project. A new Highway 50 culvert will improve the Burke Creek crossing by installing an open bottom arch culvert capable of passing 50 year stream flows (94 cfs). The new culvert will provide increased hydraulic capacity, improve flood conveyance and improve sediment transport capabilities—resulting in less maintenance for NDOT.

The Project will improve stream and riparian habitat by relocating the stream into its natural floodplain along with conducting spot treatments at head cuts and stream incisions, which will increase the stream connectivity to its floodplain.

The main water quality issue that exists within the project area is the concentration and discharge of directly connected stormwater runoff to Burke Creek. The Project will disconnect the stormwater runoff and augment the existing conveyance system with pretreatment units and utilize the abandoned downstream stream channel for stormwater treatment.

Project Location

The Project is located in Stateline Nevada in portions of Sections 22 and 23, Township 13 North Range 18 East South Lake Tahoe (1982), U.S. Geological Survey 7.5-minute topographic quadrangle. The Burke Creek Hwy 50 Crossing and Realignment Project is located along Highway 50 and is bound to the north by Lake Village Drive and to the south by Kahle Drive. Along Kahle Drive it is bound to the west by Jennings Pond and to the east by Kahle Community Center (Figure 1). The project area encompasses approximately 13.5 acres in proximity to Burke Creek, east and west of Highway 50, and just north of the intersection with Kahle Drive. Below Highway 50, the Project area lies within Rabe Meadow. Annual precipitation occurs mostly in the form of winter snow and/or spring rain. Summers typically are dry and warm, with average daytime temperatures in the 70-80 degree (F) range. Elevation of the project area ranges from 6287 at Jennings Pond to 6400 feet at the upstream boundary.

The project area is located within TRPA Plan Area Statement (PAS) 070B (Rabe), PAS 073 (Lake Village SA #1), 076 (Kingsbury Commercial) and 060 (Genoa Park). The properties consist of recreation, residential, commercial and residential.

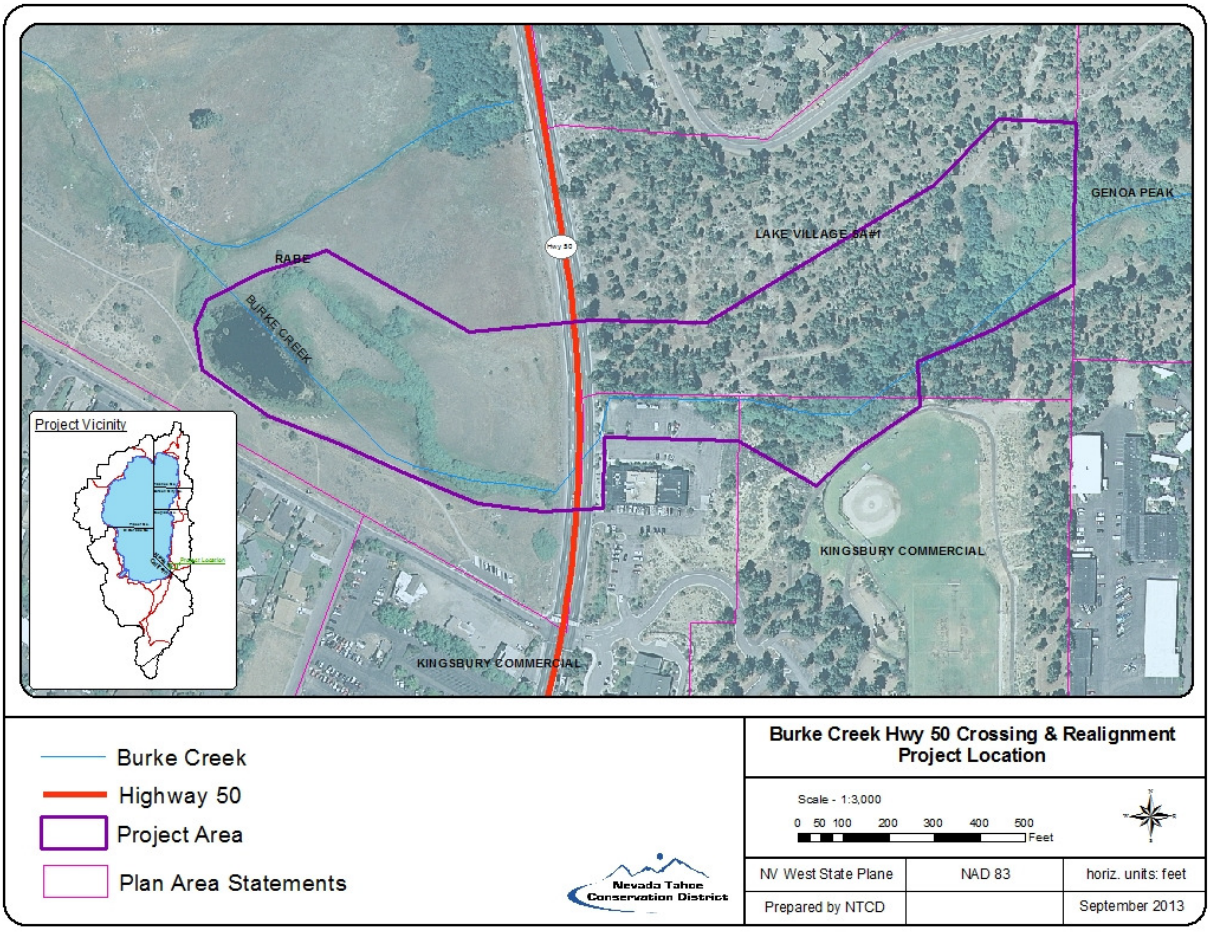


Figure 1. Burke Creek Hwy 50 Crossing & Realignment Project Location

Soils

Soils within the project area have been mapped by the Natural Resources Conservation Services (NRCS) during field work in support of the 2007 *Soil survey of the Tahoe Basin Area, California and Nevada.* Soils within the project area and the vicinity have been altered by development of commercial and residential properties and through historic timber extraction and irrigation to support grazing activities. Therefore it is uncertain that the soil map unit descriptions reflect current soil attributes.

The project area consists of mainly Tahoe complex, 0 to 2 percent slopes to the west of HWY 50 and Cagwin-Rock outcrop complex, 5 to 15 percent slope, extremely stony to the east of HWY 50. At the eastern boundary, Oxyaquic Cryorthents-Aquic Xerothents-Tahoe complex, 0 to 15 percent slopes is present in small amount. At the southern boundary, Jabu coarse sandy loam, 0 to 9 percent slopes and Oneidas coarse sandy loam 5 to 15 percent slopes are present in small amounts.

Vegetation

Vegetation within the project area is distributed along an elevational gradient reflecting current hydrology and soils. The uplands surrounding the stream corridor east of Highway 50 are characterized by second growth Jeffrey pine (*Pinus jeffreyi*) forest, while the riparian corridor is dominated by quaking aspen (*Populus tremuloides*), willow species (*Salix* spp.) and mountain alder (*Alnus incana* ssp. *tenuifolia*). Wetlands are found as freshwater emergent, herbaceous wetlands and forest/shrub wetlands adjacent to Burke Creek. Native vegetation west of Highway 50 can be described as grasses, sedges, willow/alder thickets along the stream channel with outcrops of Jeffery pine in the uplands (Appendix A).

Records and Information Search

A literature and database review was conducted to identify the State of Nevada Department of Agriculture noxious weeds (Appendix B) and those listed as noxious by the USFS LTBMU (Appendix C).

State or federal law classifies noxious weeds as undesirable, noxious, harmful, injurious, or poisonous. They generally have one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, carrier or host of serious insects or disease, and generally non-native. All noxious weeds are invasive, but not all invasive weeds are noxious. The Lake Tahoe Basin Weeds Coordinating Group (LTBWCG), the go to group for weed information in the Lake Tahoe Basin, has a 'Priority Invasive Weeds' list, thus, the weeds will be referred to as invasive non-native species, not noxious, for the remainder of this report.

Invasive non-native species generally lack the competition and natural mechanisms that limit native plant populations, making them difficult to control and often resulting in their out - competing native plants. The results are loss of resource value and diversity. The LTBWCG refers to invasive weeds by two groups: Group 1 species if found, should be reported and

eradicated immediately, Group 2 species when found, should be managed/controlled to prevent further spread with a goal of eradication. Cheat grass (Bromus tectorum), bull thistle (Cirsium vulgare) and spotted knapweed (Centaurea biebersteinii) fall into Group 2 species and are considered so widespread that eradication and most treatments are not practical. New invasions of Group 2 species will be eliminated where possible and existing populations will be managed to avoid spread.

Most ground-disturbing activity can promote invasive non-native species disturbance and should be carefully monitored.

Field Assessments and Surveys

Invasive non-native weed field investigations and surveys were conducted by four different organizations within the last couple of years. Tahoe Resource Conservation District (TRCD) surveyed locations of cheat grass adjacent and within the Project area during July and August of 2011. Surveys followed Lake Tahoe Basin Weed Coordinating Group Mapping Protocols and employed Trimble Geo Explorer and Garmin GPSmap 62stc GPS units. Data were adjusted with differential correction and analyzed with ESRI ArcGIS software.

The USFS LTBMU mapped locations of sulfur cinquefoil (2,500 plants) and bull thistle (50 plants) adjacent to and within the Project area in summers of 2012 and 2013. NTCD mapped bull thistle locations adjacent to and within the Project area in summer of 2013 using a Trimble GeoXH 6000 Series GPS unit. Data were adjusted with differential correction by the Douglas County GIS Department and analyzed with ESRI ArcGIS software. Douglas County Weed Control mapped and treated invasive weeds adjacent to the project area beginning in 2010 and continuing through 2013. Table 1 lists the invasive weed species found in the project area and Figure 2 shows the invasive weed locations.

Table 1. Burke Creek Hwy 50 Crossing & Realignment Project Area Invasive Weeds

FAMILY	SCIENTIFIC NAME	COMMON NAME
Rosaceae	*Potentilla recta*	Sulfur cinquefoil
Asteraceae	*Cirsium vulgare*	Bull thistle
Poaceae	*Bromus tectorum*	Cheatgrass

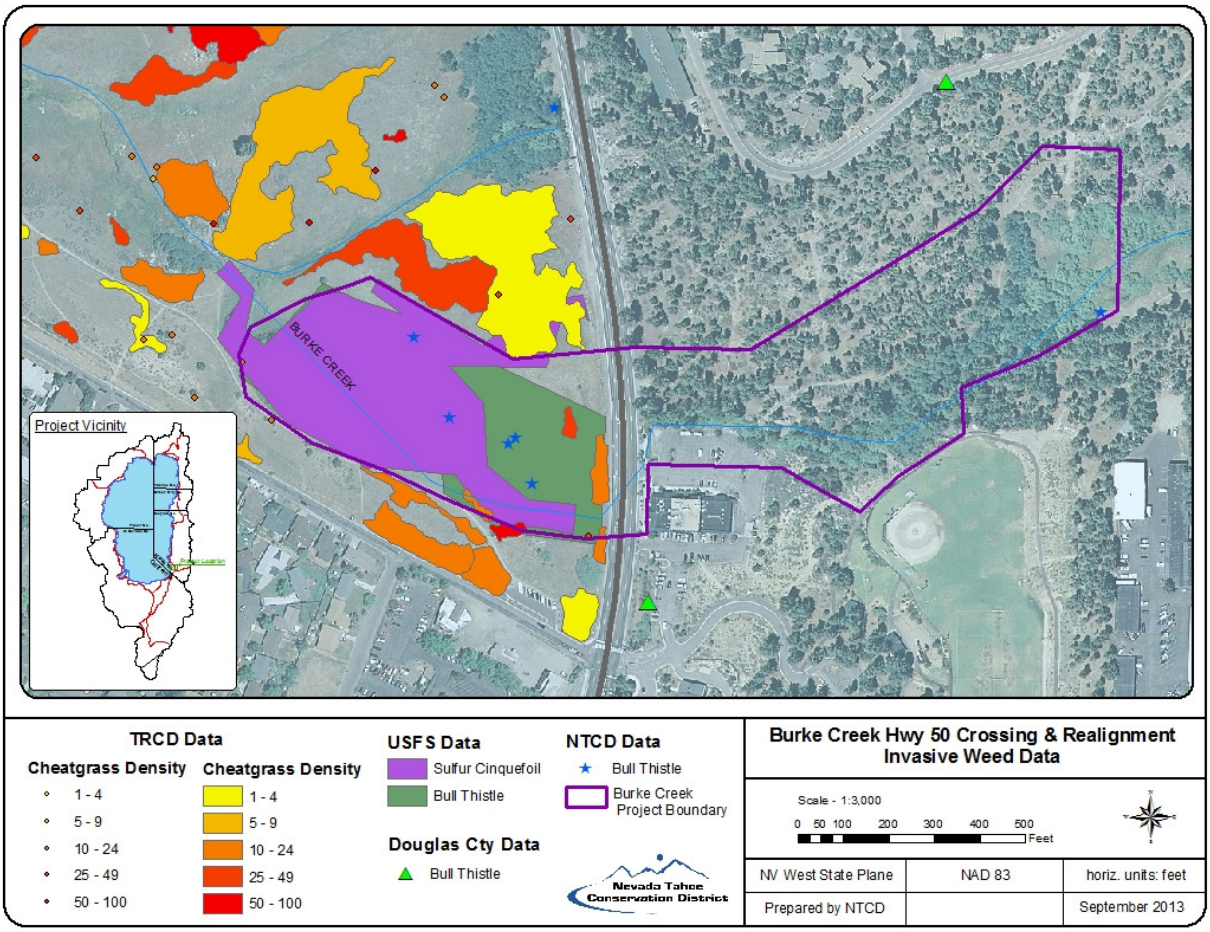


Figure 2. Burke Creek Hwy 50 Crossing & Realignment Project Invasive Weed Data

Summary

The project area represents a typical environment found within the Lake Tahoe Basin. The area consists of NDOT's Highway 50, a USFS recreation area with high foot and bicycle traffic, a commercial development, undeveloped private parcels and the relocated Burke Creek stream channel. The Douglas County Kahle Community Center and Lake Village Condominiums border the project area, which contribute to the number of informal foot trails found near Burke Creek and through the undeveloped parcels. In short, the presence of invasive weeds, while not wanted, is not surprising considering the long history of disturbance, the adjacent developed areas and the high vehicular and pedestrian traffic.

The Douglas County Weed Control Division treats noxious weeds within the Douglas County, Carson City and Washoe County right-of-ways in the Lake Tahoe Basin. Depending on the final Project design, NTCD will treat any invasive weeds found within the project area.

References

Lake Tahoe Basin Weed Coordinating Group: http://tahoeinvasiveweeds.org/weeds/priority.php

Tahoe Regional Planning Agency Environmental Improvement Program: http://www.trpa.org/about-trpa/how-we-operate/environmental-improvement-program/

U.S. Department of Agriculture Natural Resources Conservation Service Invasive Species Policy: http://directives.sc.egov.usda.gov/ViewRollUp.aspx?hid=17018&sf=1

U.S. Department of Agriculture Natural Resources Conservation Service Nevada State-listed Noxious Weeds: http://plants.usda.gov/java/noxious?rptType=State&statefips=32

U.S. Department of the Interior Bureau of Land Management Nevada Noxious Weeds & Invasive Species: http://www.blm.gov/nv/st/en/prog/more_programs/invasive_species.print.html

U.S. Forest Service Lake Tahoe Basin Management Unit: http://www.fs.usda.gov/detail/ltbmu/landmanagement/resourcemanagement/?cid=fsm9_046522

University of Nevada Cooperative Extension Invasive Weeds of the Lake Tahoe Basin: http://www.unce.unr.edu/publications/files/nr/2009/sp0906.pdf

University of Nevada Cooperative Extension Nevada Weeds Project “Weed Identification and Control Guide”: http://www.unce.unr.edu/publications/files/nr/other/eb9801.pdf

Winzler & Kelly, et. al. June 2009. Burke Creek Restoration Project Alternatives Analysis Report. pp. 51

Appendix A: October 2007 Vegetation Inventory, courtesy of Winzler & Kelly et. al.

Appendix B: Nevada State-listed Noxious Weeds

Appendix C: Priority Invasive Weeds of the Lake Tahoe Basin

Appendix A: October 2007 Vegetation Inventory, courtesy of Winzler & Kelly et. al.

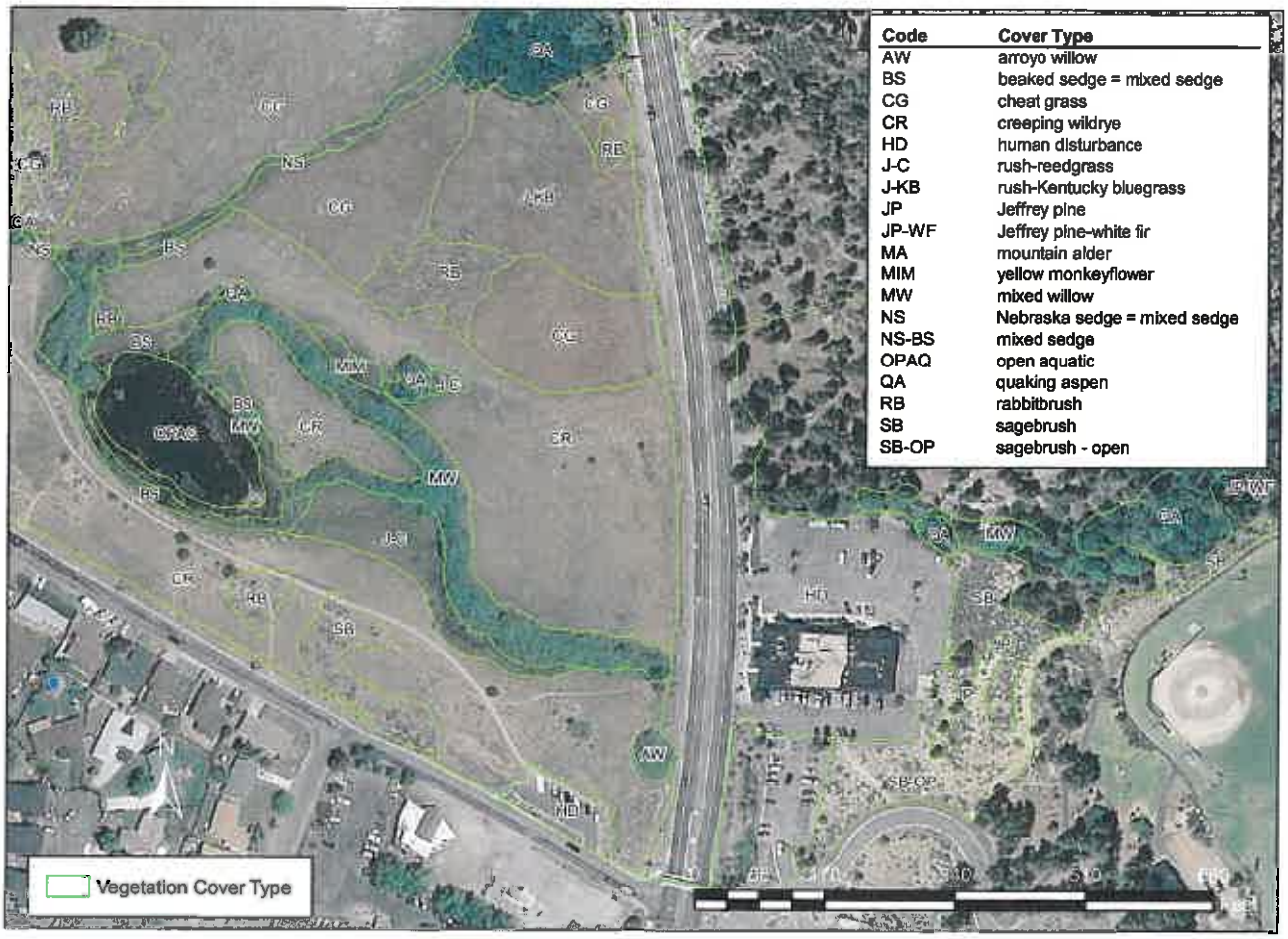


Figure 20: Inventory of vegetation cover types occurring within the Burke Creek Environmental Study Limit (ESL), mapped in October 2007.

Appendix B: Nevada State-listed Noxious Weeds

Priority Invasive Weeds of the Lake Tahoe Basin
Lake Tahoe Basin Weeds Coordinating Group
Revised April 2011

This list is prepared by the Lake Tahoe Basin Weeds Coordinating Group and reviewed and updated annually. It is utilized by the group and stakeholders as a guide in evaluating annual action plans, treatment protocols and new project proposals.

Group 1 Species: Watch For, Report, and Eradicate Immediately:

These species are:

a) Not currently present in the Lake Tahoe Basin and are documented in areas adjacent to the basin where potential for introduction is high OR
b) Present only as small, eradicable populations.

The letter following each species in Group 1 denotes the infestation type as detailed above. Aggressive treatment will be pursued when these species are found. Educational programs will target early detection and reporting of these species.

1. Musk thistle (*Carduus nutans)* - a
2. Scotch thistle (*Onopordum acanthium*) – a
3. Tamarisk/saltcedar (*Tamarix spp.)* - a
4. Medusahead (*Taeniatherum caput-medusae*) - a
5. Stinkwort (*Dittrichia graveolens*) – a
6. Reed canarygrass (*Phalaris arundinacea*) – a
7. Dyer's woad (*Isatis tinctoria*) – a
8. Purple starthistle (*Centaurea calcitrapa*) – a
9. Canada thistle (*Cirsium arvense*) – b
10. Diffuse knapweed (*Centaurea diffusa*) - b
11. Hoary cress (*Cardaria species*) – b
12. Rush skeletonweed (*Chondrilla juncea*) - b
13. Russian knapweed (*Centaurea repens*) – b
14. Sulfur cinquefoil (*Potentilla recta*) - b
15. Teasel (*Dipsacus fullonum*) - b
16. Yellow starthistle (*Centaurea solstitialis*) – b
17. Tree of Heaven (*Ailanthus altissima*) – b
18. Purple loosestrife (*Lythrum salicaria*) - b

Group 2 Species: Manage Infestations With a Goal of Eradication

Encourage the management/control of populations of these species to prevent further spread in the Lake Tahoe Basin. Isolated populations will be targeted for eradication.

19. Bull thistle (*Cirsium vulgare*)
20. Dalmatian toadflax (*Linaria dalmatica*)
21. Klamathweed (*Hypericum perforatum*)
22. Oxeye daisy (*Chrysanthemum leucanthemum*)
23. Perennial pepperweed (*Lepidium latifolium*)
24. Scotch broom (*Cytisus scoparius*)
25. Spotted knapweed (*Centaurea biebersteinii*)
26. Yellow toadflax (*Linaria vulgaris*)

Appendix C: Priority Invasive Weeds of the Lake Tahoe Basin

Nevada State-listed Noxious Weeds
52 records returned

Noxious weeds that are synonyms retain their noxious status, and are indented beneath the current PLANTS accepted name.

Nevada Administrative Code. 2003. *Control of insects, pests, and noxious weeds* (http://www.leg.state.nv.us/NAC/NAC-555.html, 20 October 2003). State of Nevada.

Symbol	Scientific Name	Noxious Common Name	State Noxious Status†	Native Status*
ACRE3	*Acroptilon repens* (L.) DC.			L48 (I), CAN (I)
CERE6	*Centaurea repens* L.	Russian knapweed	NW	
ALMA12	*Alhagi maurorum* Medik.			L48 (I)
ALCA	*Alhagi camelorum* Fisch.	camelthorn	NW	
ANCO2	*Anthemis cotula* L.	mayweed chamomile	NW	L48 (I), AK (I), HI (I), CAN (I)
CADR	*Cardaria draba* (L.) Desv.	whitetop, hoary cress	NW	L48 (I), CAN (I)
CANU4	*Carduus nutans* L.	musk thistle	NW	L48 (I), CAN (I)
CECA2	*Centaurea calcitrapa* L.	purple starthistle	NW	L48 (I), CAN (I)
CEDI3	*Centaurea diffusa* Lam.	diffuse knapweed	NW	L48 (I), CAN (I)
CEIB	*Centaurea iberica* Trevir. ex Spreng.	Iberian starthistle	NW	L48 (I)
CEME2	*Centaurea melitensis* L.	Malta thistle	NW	L48 (I), HI (I), CAN (I)
CESO3	*Centaurea solstitialis* L.	yellow starthistle	NW	L48 (I), CAN (I)
CESTM	*Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek			L48 (I), HI (I), CAN (I)
CEMA4	*Centaurea maculosa* auct. non Lam.	spotted knapweed	NW	
CEVIS2	*Centaurea virgata* Lam. ssp. *squarrosa* (Willd.) Gugler			L48 (I)
CEVIS	*Centaurea virgata* Lam. var. *squarrosa*	squarrose knapweed	NW	

	(Willd.) Boiss.			
CHJU	*Chondrilla juncea* L.	rush skeletonweed	NW	L48 (I), CAN (I)
CIMA2	*Cicuta maculata* L.	water hemlock	NW	L48 (N), AK (N), CAN (N)
CIAR4	*Cirsium arvense* (L.) Scop.	Canada thistle	NW	L48 (I), AK (I), CAN (I), GL (I), SPM (I)
COMA2	*Conium maculatum* L.	poison hemlock	NW	L48 (I), CAN (I)
CRVU2	*Crupina vulgaris* Cass.	common crupina	NW	L48 (I)
CYOF	*Cynoglossum officinale* L.	houndstongue	NW	L48 (I), CAN (I)
EUES	*Euphorbia esula* L.	leafy spurge	NW	L48 (I), CAN (I)
GAOF	*Galega officinalis* L.	goats rue	NW	L48 (I), CAN (I)
HYVE3	*Hydrilla verticillata* (L. f.) Royle	hydrilla	NW	L48 (I)
HYNI	*Hyoscyamus niger* L.	black henbane	NW	L48 (I), CAN (I)
HYPE	*Hypericum perforatum* L.	Klamath weed	NW	L48 (I), HI (I), CAN (I), SPM (I)
ISTI	*Isatis tinctoria* L.	dyer's woad	NW	L48 (I), CAN (W)
LELA2	*Lepidium latifolium* L.	perennial pepperweed	NW	L48 (I), CAN (I)
LIDA	*Linaria dalmatica* (L.) Mill.	Dalmatian toadflax	NW	L48 (I), CAN (I)
LIVU2	*Linaria vulgaris* Mill.	yellow toadflax	NW	L48 (I), AK (I), CAN (I), GL (I), SPM (I)
LYSA2	*Lythrum salicaria* L.	purple loosestrife	NW	L48 (I), CAN (I), SPM (I)
LYVI3	*Lythrum virgatum* L.	purple loosestrife	NW	L48 (I)
MYSP2	*Myriophyllum spicatum* L.	Eurasian water-milfoil	NW	L48 (I), AK (I), CAN (I)
ONAC	*Onopordum acanthium* L.	Scotch thistle	NW	L48 (I), CAN (W)
PEHA	*Peganum harmala* L.	African rue	NW	L48 (I)
PORE5	*Potentilla recta* L.	sulfur cinquefoil	NW	L48 (I), CAN (I)
ROAU	*Rorippa austriaca* (Crantz) Besser	Austrian fieldcress	NW	L48 (I), CAN (I)
SAAE	*Salvia aethiopis* L.	Mediterranean sage	NW	L48 (I)

SAMO5	*Salvinia molesta* Mitchell	giant salvinia	NW	L48 (I), HI (I)
SOCA3	*Solanum carolinense* L.	Carolina horsenettle	NW	L48 (N), CAN (I)
SOEL	*Solanum elaeagnifolium* Cav.	white horsenettle	NW	L48 (N), HI (I), PR (N)
SOAR2	*Sonchus arvensis* L.	sowthistle	NW	L48 (I), AK (I), CAN (I), SPM (I)
SOAL	*Sorghum almum* Parodi	Columbus grass	NW	L48 (I)
SOBI2	*Sorghum bicolor* (L.) Moench	perennial sweet Sudan	NW	L48 (I), HI (I), PR (I), VI (I), CAN (I)
SOHA	*Sorghum halepense* (L.) Pers.	johnsongrass	NW	L48 (I), HI (I), PR (I), CAN (I)
SOPR3	*Sorghum propinquum* (Kunth) Hitchc.	sorghum	NW	
SPSA3	*Sphaerophysa salsula* (Pall.) DC.	Austrian peaweed	NW	L48 (I), CAN (I)
TACA8	*Taeniatherum caput-medusae* (L.) Nevski	medusahead	NW	L48 (I)
TAPA4	*Tamarix parviflora* DC.	saltcedar, tamarisk	NW	L48 (I)
TARA	*Tamarix ramosissima* Ledeb.	saltcedar, tamarisk	NW	L48 (I)
TRTE	*Tribulus terrestris* L.	puncturevine	NW	L48 (I), HI (I), CAN (W)

†Code	**Noxious Status**
NW	Noxious weed

***Code**	**Native Status**
I	Introduced
N	Native
W	Waif

*Code	Native Status Jurisdiction
L48	Lower 48 States
AK	Alaska
HI	Hawaii
PR	Puerto Rico
VI	Virgin Islands
CAN	Canada
GL	Greenland
SPM	St. Pierre and Miquelon

Additional information about noxious plants in this state can be found at:

- NV-Invasive Weed Identification for Nevada
- NV-Nevada Agriculture Experiment Station
- NV-Nevada Division of Plant Industry
- NV-Nevada Invasive Species Initiative
- NV-University of Nevada Extension Publications
- NV-Wanted Weeds of Nevada

APPENDIX D

Appendix D
Burke Creek-Rabe Meadows Wetlands Delineation Plant Species List
2012

Family	Scientific Name	Common Name	Wetland Indicator Status Region 8 1988*	Wetland Indicator Status Nevada WMVC 2012**
Apiaceae	*Heracleum maximum (H. lanatum)*	cow parsnip	FACU	FAC
Apocynaceae	*Apocynum androsaemifolium*	spreading dogbane	UPL	FACU
Asteraceae	*Achillea millefolium*	common yarrow	FACU	FACU
	Artemesia tridentata ssp. vaseyana	mountain sagebrush	UPL	UPL
	Cirsium vulgare	bull thistle	FAC	FACU
	Conyza canadensis	Canadian horseweed	UPL	FACU
	Ericameria nauseosa ssp. nauseosa	rubber rabbitbrush	UPL	UPL
	Lactuca serriola	prickly lettuce	FAC	FACU
	Symphyotrichum sp. *(S. spathulatum/S.ascendens)*	mountain or western aster	FAC	FAC, FACU
	Taraxacum officinale	common dandelion	FACU	FACU
	Tragopogon dubius	goatsbeard	UPL	UPL
	Wyethia mollis	wooly mule's ears	UPL	UPL
Betulacaceae	*Alnus incana* ssp. *tenuifolia (A. tenuifolia)*	mountain alder	NI	FACW
	Betula occidentalis/or escaped ornamental	water birch white birch?	FACW	FACW
Brassicaceae	*Boechera platysperma*	pioneer rockcress	UPL	UPL
	Draba verna	spring draba	UPL	UPL
	Sisymbrium altissimum	tall tumble mustard	FACU-	FACU
Cyperaceae	*Carex amplifolia*	big-leaf sedge	OBL	OBL
	Carex deweyana ssp. leptopoda (C. leptopoda)	short-scale sedge	FACW	FAC
	Carex nebrascensis	Nebraska sedge	OBL	OBL
	Carex phaeocephala	mountain hare sedge	FACU	UPL
	Carex sp. Rhizomateous	sedge	FACW-OBL	FACW-OBL
	Scirpus microcarpus	smallfruit bulrush	OBL	OBL
Ericaceae	*Arctostaphylos patula*	green-leaf manzanita	UPL	UPL
	Sarcodes sanguinea	snow plant	UPL	UPL
Equisetaceae	*Equisetum arvense*	field horsetail	FAC	FAC
Fabaceae	*Lathyrus sp.*	peavine	NI	UPL
	Lupinus grayi	Gray's lupine	UPL	UPL
	Melilotus sp.	sweetclover	FACU	FACU
Grossulariaceae	*Ribes nevadense*	Sierra currant	UPL	FAC
Juncaceae	*Juncus balticus ssp. ater (J.arcticus)*	Baltic rush	FACW	FACW

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2012

Family	Scientific Name	Common Name	Wetland Indicator Status Region 8 1988*	Wetland Indicator Status Nevada WMVC 2012**
	Juncus ensifolius	three-stamen rush	FACW	FACW
	Juncus sp.	rush	FAC-OBL	FAC-OBL
Montiaceae	*Montia linearis*	narrowleaf minerslettuce	UPL	FAC
Onagraceae	*Epilobium brachycarpum*	tall annual willowherb	UPL	UPL
	Epilobium ciliatum	hairy willowherb	FACW	FACW
Paeoniaceae	*Paeonia brownii*	Brown's peony	UPL	UPL
Pinaceae	*Abies concolor*	white fir	UPL	UPL
	Pinus jeffreyi	Jeffrey pine	UPL	UPL
Phrymaceae	*Mimulus guttatus*	common yellow monkeyflower	OBL	OBL
	Mimulus primuloides	primrose monkeyflower	OBL	OBL
Plantaginaceae	*Collinsia parviflora*	blue-eyed Mary	UPL	UPL
	Veronica sp.	speedwell	OBL	OBL
Poaceae	*Agrostis exerata*	spike bentgrass	FACW	FACW
	Agrostis stolonifera	creeping bentgrass	FACW	FAC
	Avena sativa	common oat	UPL	UPL
	Bromus carinatus	California brome	UPL	UPL
	Bromus tectorum	cheatgrass	UPL	UPL
	Deschampsia cespitosa	tufted hairgrass	FACW	FACW
	Deschampsia danthonioides	annual hairgrass	FACW	FACW
	Elymus glaucus	blue wildrye	FACU	FACU
	Elymus hispidus aka Elytrigia intermedium	intermediate wheatgrass	UPL	UPL
	Elymus trachycaulus ssp. *trachycaulus (Agropyron trachycaulum)*	slender wheatgrass	FACU	FAC
	Festuca idahoensis	Idaho fescue	UPL	FACU
	Festuca sp. aka Vulpia sp.	annual fescue	FACW-UPL	FACU
	Glyceria elata	tall manna grass	OBL	FACW
	Hordeum brachyantherum	meadow barley	FACW	FACW
	Poa fendleriana	Fendler's bluegrass	UPL	UPL
	Poa bulbosa	bulbous bluegrass	UPL	UPL
	Poa palustris	fowl bluegrass	FACW	FAC
	Poa pratensis ssp. pratensis	Kentucky bluegrass	FACU	FAC
Polemoniaceae	*Microsteris gracilis*	graceful phlox	FACU	FACU

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Burke Creek-Rabe Meadows Wetlands Delineation Plant Species List
2012

Family	Scientific Name	Common Name	Wetland Indicator Status Region 8 1988*	Wetland Indicator Status Nevada WMVC 2012**
Polygonaceae	*Eriogonum umbellatum*	sulphur flower	UPL	UPL
	Rumex crispus	curly dock	FACW	FAC
Ranunculaceae	*Myosurus sp.*	mousetail	FAC-OBL	FAC,OBL
Rhamnaceae	*Ceanothus cordulatus*	mountain whitethorn	UPL	UPL
	Ceanothus prostratus	prostrate ceanothus	UPL	UPL
Ruscaceae	*Maianthemum stellatum (Smilacena sptellata)*	false Solomon's seal	FAC	FAC
Rosaceae	*Geum macrophyllum*	big leaf avens	OBL	FAC
	Purshia tridentata	antelope bitterbrush	UPL	UPL
	Rosa woodsii ssp. ultramontana	Wood's rose	FAC	FACU
Salicaceae	*Populus tremuloides*	quaking aspen	FAC	FACU
	Populus trichocarpa	black cottonwood	FACW	FAC
	Salix exigua	coyote willow	OBL	FACW
	Salix lemmonii	Lemmon's willow	OBL	FACW
	Salix lasiolepis	arroyo willow	FACW	FACW
	Salix lasiandra var. lasiandra	Pacific willow	OBL	FACW
	Salix scouleriana	Scouler's willow	FAC	FAC
Typhaceae	*Typha sp.*	cattail	OBL	OBL
Violaceae	*Viola adunca*	Western dog violet	FAC	FAC

Note: Nomenclature follows B. Baldwin et al. 2012. The Jepson Manual: Vascular Plants of California 2nd ed.

* Reed, P.B.,Jr. 1988. *National list of plant species that occur in wetlands:1988 national summary*.
Biological Report 88 (24). Washington D.C.: U.S. Fish and Wildlife Service. Nevada - Region 8

**Lichvar,R.W. and J.T. Kartesz. 2009.North American Digital Flora:National Wetland Plant List, Version 2.4.0
STATE OF NEVADA - NWPL FINAL DRAFT RATINGS,U.S. ARMY CORPS OF ENGINEERS, COLD REGIONS RESEARCH AND ENGINEERING LABORATORY (CRREL)

OBL - Plants that occur almost always (estimated probability > .99%) in wetlands under natural conditions.

FACW - Plants that occur usually (estimated probability > 67% to 99%) in wetlands, but also occur (estimated probability 1% to 33%) in nonwetlands.

FAC - Plants with a similar likleihood (estimated probability 33% to 67%) of occurring in both wetlands and nonwetlands.

FACU - Plants that occur sometimes (estimated probability 1% to 33%) in wetlands, but occur more often (estimated probability > 67% to 99%) in nonwetlands.

UPL - Plants that occur almost always (estimated probability > .99%) in uplands under natural conditions.

NI - reviewed but given no regional indicator

APPENDIX E

TAC COMMENTS – BURKE CREEK-RABE MEADOW COMPLEX EXISTING CONDITIONS REPORT

SECTION	PAGE(S)	INDIVIDUAL/ AGENCY	COMMENT	RESPONSE TO COMMENT
COVER , TABLE OF CONTENTS AND EXECUTIVE SUMMARY				
SECTION 1.0 - INTRODUCTION				
1.0	1	SF/TRPA	I would omit EIP # 01.02.03 and simply state this project is EIP # 01.02.03.01. If you are going leave in the 1st number I would re-word it to say that is it the Restoration of Nevada Priority Watersheds and Burke Creek and been identified as a priority watershed.	Revised
1.1	2 (1st paragraph)	SF/TRPA	The project should focus on more than removal of fine sediment. It is an EIP project and therefore should also focus on restoring fish and wildlife habitat and enhancing the riparian corridor.	Revised
1.0	1.1 &1.2	SF/TRPA	The introduction makes it seem like any project done off this ECAM would be an erosion control project, when I thought a large chunk of it was stream restoration. The objectives and methods do not really reflect and SEZ restoration activities.	Revised
SECTION 2.0 – PROJECT AREA CHARACTERISTICS				
SECTION 3.0 – EXISTING HYDROLOGIC AND HYDRAULIC CONDITIONS				
3.1	12	SF/TRPA	What was the approach/method prescribed by NDOT?	Revised
3.3	12	SF/TRPA	According the TRPA Code 60.4.7.D, drainage conveyances through a SEZ shall be designed for a minimum of 50-year storm. This may or may not apply to this.	Revised

SECTION	PAGE(S)	INDIVIDUAL/ AGENCY	COMMENT	RESPONSE TO COMMENT
3.4	13	SF/TRPA	Is it true that the section of Burke Creek from US50 to upstream of the meadow is stable? I thought it was an incised channel.	Portions of the upstream channel do appear stable but the stream has a restricted floodplain and therefor the amount of fish and wildlife habitat has been minimized. This would be revised by restoring the stream channel into a low flow channel with an adjacent floodplain would increase habitat and stream functionality.
SECTION 4.0 – WATER QUALITY				
4.3	15	SF/TRAP	Typo in 2nd paragraph, PLEM should be PLRM.	Revised
SECTION 5.0 – BIOLOGICAL/CULTURAL EXISTING CONDITIONS ANALYSIS				
SECTION 6.0 – OPPORTUNITIES AND CONSTRAINTS FOR WATER QUALITY IMPROVEMENTS				
6.0	19	SF/TRPA	Not positive that installing curb and gutter where water sheet flows onto bare soil is the best opportunity. I think stabilizing the road shoulder and allowing water to sheet flow would be better than collecting and concentrating the water, unless it can be conveyed to an infiltration facility.	Added to opportunities.
SECTION 7.0 – REFERENCES				
FIGURES				
	6	SF/TRPA	There is a dry basin that collects water from the trailhead parking lot off of Kahle dr. that is not shown on this figure	Added

SECTION	PAGE(S)	INDIVIDUAL/ AGENCY	COMMENT	RESPONSE TO COMMENT
	10	SF/TRPA	What is BMP - 50%? Since there is not a lot of developed parcels within the project boundary, not sure how critical this information is.	There has been discussion that private party BMPs installed prior to 2008 only function at 50%, therefor pre-2008 BMPs receive 50% credit and 2008-present receive 100% credit. Noted- provided for informational purposes.
	15	SF/TRPA	Explain the justification of the Roads in lake Village being high risk. They seem moderate risk to me. It says they are erodible but I thought that was fixed with the most recent EIP project completed in that area.	Because these are outside of the project area these were left as the default values. These might be high risk because of the steep slope on these roadways.
TABLES				
APPENDICES				