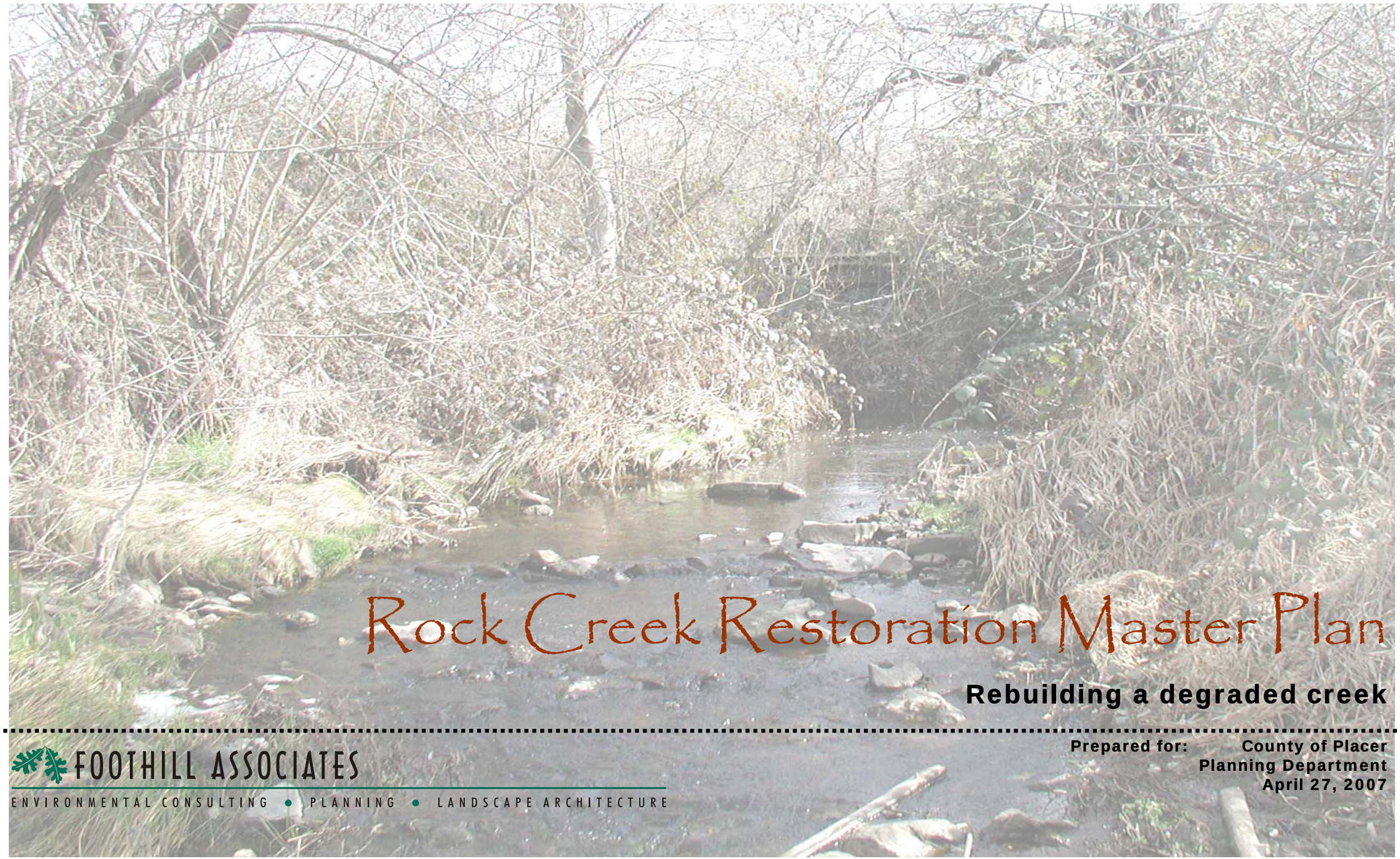

# Rock Creek Restoration Master Plan

**Rebuilding a degraded creek**

FOOTHILL ASSOCIATES
ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE

**Prepared for:** County of Placer
Planning Department
April 27, 2007

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Rock Creek Restoration

# Introduction

## *Purpose*

The purpose of this restoration master plan is to recommend ecologically beneficial improvements to an approximately ½ mile section of a tributary to Rock Creek in Auburn, California. These improvements are focused on the areas of habitat enhancement, hydro-geomorphic improvements, water quality enhancement and increasing recreational opportunities.

Three teams visited the project site on February 4, 2005 to perform site assessments. These teams included staff from Placer County Department of Planning, Placer County Facility Services, Foothill Associates and HDR, Inc. Each team was focused on evaluation of existing conditions, opportunities and constraints within several functional areas: 1) water quality, hydrology and geomorphology; 2) vegetation and wildlife; and 3) recreation. Teams spent from four to six hours in the field collecting data and making observations. The vegetation and wildlife team also returned to the site on a different occasion to refine the botanical observations. Team observations were synthesized into a separate technical report, which summarized existing conditions. The majority of this report is contained in the first two sections of this master plan.

Draft goals and objectives were established and refined with input from local landowners during a public meeting held on May 12, 2005. The team then synthesized the site assessment data and prepared a draft conceptual design, which was further developed into design criteria and the final conceptual design presented in sections three and four.

Section five contains implementation strategies for this plan, including potential grant funding sources and recommended phasing. Guidelines for maintenance and management of the project site are included in section six. Recommendations cover such areas as adaptive management, performance criteria, monitoring, vegetation, nuisance wildlife, trails and others. Finally, section seven presents an estimate of probable cost in 2006 dollars. Given the potential for rapidly changing prices of materials such as asphalt, this estimate should be used as a general guideline only.

The tributary to Rock Creek studied in this project has been significantly degraded due to urbanization of the surrounding area and alteration in land-use practices on adjacent land. Construction of commercial sites such as the adjacent Target shopping center has potentially increased instantaneous peak flow rates in the creek and has introduced additional stormwater pollutants into the system. The presence of an undersized culvert at Rock Creek Road, designed prior to construction of the Target and other commercial properties, has led to an increase in adjacent upstream wetlands and die-off of some of the native oaks. The proximity of apartments at Rock Creek Road on the east bank of the creek constrains the size of the riparian buffer, which limits the ability to filter stormwater from roads and parking lots or to provide significant habitat for riparian species. Additional instream structures and Beaver dams have also impacted the creek ecosystem. This plan includes recommendations for improving human and natural systems in this area to account for some of the above mentioned impacts, such as

Trail construction to link the target shopping center to Auburn Regional Park, including interpretive exhibits and bridges;

Realignment of the creek channel to increase the riparian buffer between the creek and the apartment complex,

The use of in-stream structures to enhance fish and other aquatic species habitat;

Improvement of riparian areas through revegetation, invasive species management and creation of stream terraces;

Integration of Low Impact Development (LID) concepts into adjacent development; and

Incorporation of a mixed-use commercial/residential development with outdoor gathering space that utilizes permeable paving, filtration wetlands and other LID techniques and Leadership in Energy and Environmental Design (LEED) concepts.

## *Background*

Rock Creek is a perennial stream located in Placer County north of the City of Auburn within the Coon Creek watershed (Figure 1). The main stem of Rock Creek originates just above Rock Creek Lake in the foothills west of the community of Bowman. The stream course continues below the Rock Creek Lake dam where it is joined by a minor tributary branch located to the south. This tributary is the subject of this feasibility study and originates near the intersection of Bell Road and Highway 49 on the north side of the Target Store parking lot (Figure 2). Below the confluence of this tributary with the main stem, Rock Creek passes under Highway 49 and progresses northwesterly through the Auburn District Regional Park to its confluence with Dry Creek, a tributary to Coon Creek. Rock Creek is part of the Nevada Irrigation District's (NID) commercial water delivery system.

While much of the property immediately adjacent to the Rock Creek tributary is undeveloped, urban land uses within its watershed have had a significant impact on its condition. These land uses include residential development, apartments, a church, local roads, Highway 49, and commercial shopping centers. The Target Store and its parking lot, which were completed in the last several years, are located in the area where the tributary used to originate. The proposed enhancement of the Rock Creek tributary is part of the environmental mitigation required for this impact. However, the Target project is not the only source of degradation to the tributary.

The physical, chemical, and biological integrity of the Rock Creek tributary has been modified over time as a result of the various urbanized improvements in the watershed. Observations of the site indicate that significant channelization, channel degradation, and habitat alteration has occurred. In some cases, increases in the amount of impervious surfaces and installation of in-stream structures have changed hydrologic and sediment transport regimes, causing channel degradation and local bank erosion. This, in turn, now threatens heritage status oaks and other natural resources along the project reach. Increased sedimentation also has the potential to adversely impact salmonid spawning habitat downstream in Coon Creek and reduce conveyance capacity in the NID system. While the increased urban runoff is providing more flow to the creek, it likely carries higher levels of pollutants than in historic times.

Non-native invasive plant species have out-competed native species in specific areas of the site, further reducing habitat value. Significant seasonal wetland areas are also becoming established in response to the changes in the hydrologic and sediment transport regimes. Since part of the site consists of Henneke-Rock outcrop complex (which includes serpentine rock outcrop) the site may also be habitat for rare endemic plant species that are know to occur only on serpentine rock and soil.

Introduction

Rock Creek Restoration

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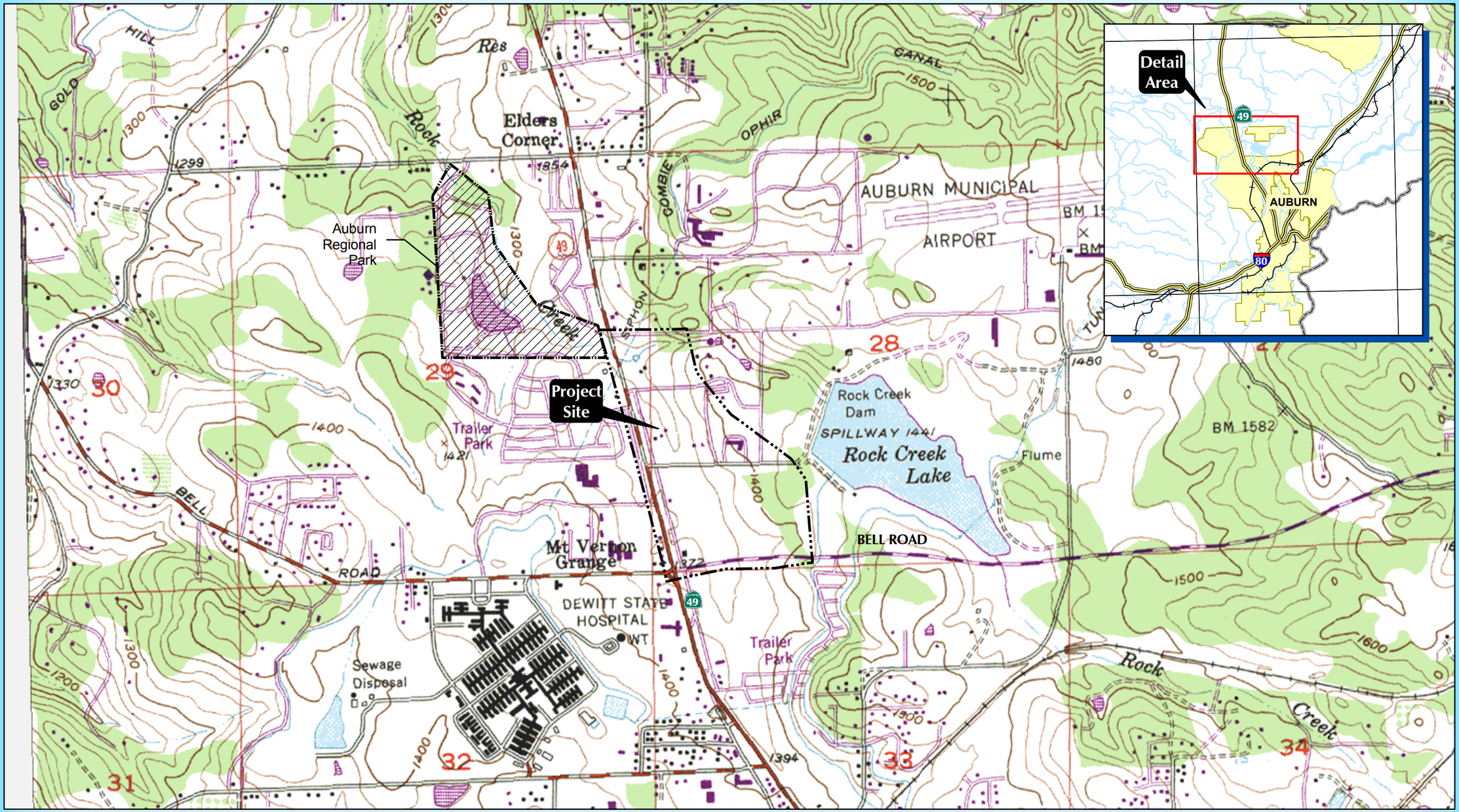
# ROCK CREEK RESTORATION

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SCALE IN FEET

N

## SITE & VICINITY

FIGURE 1



color_site_&_vicinity 11x17.mxd


# SITE AERIAL

## ROCK CREEK RESTORATION

**LEGEND**

Parcel Lines

N

0 150 300

SCALE IN FEET

FIGURE 2

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## Authorization

This work product has been prepared by Foothill Associates as a contractor for the County of Placer (the County) as part of the Master Services Agreement made by and between the County and Foothill Associates, dated Nov 22, 2003.

## Scope of Work

Table 1 summarizes the tasks conducted while completing this restoration planning project. The majority of the field work was completed in 2005. The total span of this project was approximately 24 months.

**Table 1 — Summary of Tasks Conducted in Preparation of This Feasibility Study**

| Task | Description |
|---|---|
| Data Background Collection and Review | Conduct background research to identify literature, data, maps, drawings, and other sources of information providing details on existing and historical site conditions. |
| Evaluation of Geomorphic and Hydrologic Conditions | Perform site reconnaissance and visual inspection of existing conditions related to existing morphology, substrate, sediment transport/erosion, surrounding geology, potential causes of degradation, and future opportunities. |
| Evaluation of Existing In-Stream Structures | Perform site reconnaissance and visual inspection of existing in-channel structures. |
| Evaluation of Existing Biological Resources | Perform site reconnaissance and visual inspection to determine the presence or potential presence of recognized sensitive species and to evaluate existing biological resources. |
| Assessment of Existing Public Access | Identify opportunities and constraints to the public use of property for passive recreational use. |
| Evaluation of Water Quality | Perform a visual inspection of the subject site and identify potential sources of water quality impairment. |
| Evaluation of Hydrologic and Hydraulic Conditions | Review existing hydrologic and hydraulic data. Develop HEC-RAS model of subject reach. Perform existing and proposed conditions model run. Identify hydraulic impacts. Evaluate in-channel and floodplain hydraulics. |
| Recon Level Feasibility Assessment | Develop recon level project objectives, constraints, and performance criteria. Establish design preliminary criteria. Develop preliminary concept summarizing primary project features |
| Stakeholder Workshops | Conduct a public workshop to obtain input from local stakeholders in regards to the proposed stream and public access rehabilitation project. |
| Development of Recommended Conceptual Rehabilitation Plan | Prepare a report summarizing the results of the above mentioned work efforts. |

## Project Objectives

The goal of this project is to develop a comprehensive framework to enhancing the Rock Creek tributary that satisfies multiple stakeholder interests while enhancing diversity of habitats, water quality, and passive recreation benefits. The project site currently offers an opportunity to provide an off-street pedestrian and bicycle connection between Auburn District Regional Park, residential areas to the north, the commercial center at Highway 49 and Bell and the proposed commercial site between Rock Creek Road and Target. It is critical for this project to occur prior to development of the commercially zoned property that abuts the creek channel along Highway 49 since such development may dramatically constrain future enhancement options.

The following general goals and objectives have been proposed for the Rock Creek Restoration Project. These goals and objectives have been developed by the project team, with input from Placer County and the stakeholders that attended a public workshop in May 2005.

### Goals:

- Improve the physical, chemical and biological integrity of the Rock Creek tributary.
- Improve recreational and public access opportunities.
- Enhance educational opportunities for nearby schools and residents.
- Ensure long-term sustainability of the restoration projects

### Objectives:

*Goal: Improve the physical, chemical and biological integrity of the Rock Creek tributary.*

- Provide a sustainable creek morphology scaled to contemporary hydrologic conditions,
- Reduce bank erosion and channel scour due to local urbanization,
- Improve channel/floodplain connectivity throughout the subject reach,
- Improve in-channel hydraulic diversity,
- Develop strategies for improvement of existing in-channel structures,
- Facilitate passive treatment of stormwater originating on- and off-site,
- Identify potential sources of water quality impairment,
- Improve terrestrial, riparian, and aquatic habitat where feasible,
- Enhance existing wetlands,
- Manage the beaver population such that beaver activities do not compromise the flood capacity or biological integrity of the creek and adjacent riparian areas, or impact the operations of the Placer County Department of Facility Services,
- Discourage illegal camping activity that has the potential to degrade creek integrity,
- Reduce invasive non-native plants.

*Goal: Enhance recreational trail connections.*

- Provide a trail connection between Target and Auburn Regional Park,
- Provide a trail connection from Locksley Lane to Auburn Regional Park and Target,
- Improve the Highway 49 bridge crossing to more safely accommodate bicycle and pedestrian traffic,
- Utilize realignment of the sewer line for shared sewer line and trail easement,
- Integrate proposed trails with the proposed commercial development.

*Goal: Enhance educational opportunities for nearby schools and residents.*

- Provide interpretive signage for creek realignment, riparian habitat restoration and enhanced wetlands,
- Improve stakeholder and high school participation in local creek maintenance and stewardship activities.

*Goal: Ensure long-term sustainability of the restoration projects.*

- Coordinate with local landowners to ensure landowner support of improvements,
- Manage implementation costs so that proposed improvements are financially feasible given anticipated funding sources.

# Site Conditions

## *Regional Setting and Site Location*

Rock Creek is a perennial stream located in Placer County north of the City of Auburn within the Coon Creek watershed. The project site is situated north east of the intersection of Bell Road and State Highway 49 and includes a tributary that joins Rock Creek just upstream of the Highway 49 Bridge. An existing trail connects to the site from the Target shopping center located on the corner of Bell Road and Highway 49. The site is bisected by the private Rock Creek Road, which provides access to Highway 49 from an apartment complex and church located east of the site. On the west side of Highway 49 is a low income housing tract accessed from Quartz Drive, and a storage facility southwest of the Rock Creek Bridge over 49. The project site spans seven privately held lots, one of which includes a single family residential home. The remaining six parcels are currently undeveloped, although plans have been proposed for construction of a commercial complex on the parcel adjacent to Target. An "L" shaped easement crosses the site from Quartz Drive to Locksley Lane. A connecting road with bridges crossing the tributary and Rock Creek has been proposed for this easement to eliminate the need to turn left onto Highway 49 from Locksley; however, this project may not be constructed due to the cost of the structures. The Auburn District Regional Park is located less than ¼ mile northwest of the project site and includes a narrow parcel that connects to Highway 49 at the Rock Creek Bridge.

## *Geology and Soils*

The Rock Creek Tributary is situated in the western foothills of the northern Sierra Nevada range in Placer County California. Within Placer County, the Sierra Nevada is a west-tilted, uplifted block composed of granitic rocks of the Mesozoic batholith. The Rock Creek Tributary lies west within the Western Metamorphic Terrane upon two volcanic assemblages known as the Smartville and Lake Combie Complexes. The Smartville Complex is situated between the County corporate line and the Wolf Creek Fault which roughly coincides with the alignment of State Highway 49 through Placer County. It is composed primarily of mafic to intermediate volcanic, hypabyssal, and plutonic rocks that were formed during the Jurassic period. The Lake Combie Complex is bounded on the east by the Weimar Fault and on the west by the Wolf Creek Fault. The Lake Combie Complex is similar to the Smartville Complex but contains more volcanic derived metasedimentary rock. The two complexes are separated by a narrow band of serpentine as observed in several outcrops within the subject area. Clipper Gap Formations may also be found in this narrow band. Thus, chert and argillite rock types may be present. The above composition accounts for the presence of bedrock, fractured bedrock, and serpentine formations observed within the study limits.

Soils present within the subject area are classified as shallow Group D type soils. Generally, these soil types possess high run-off potential and typically contribute to high stormwater run-off rates. Infiltration rates can vary from 0.04 in/hr to 0.05 in/hr as suggested by the Placer County Stormwater Management Manual (1990). Impervious areas are expected to have zero constant losses. Initial losses are also assumed to be zero. Soil classification boundaries for the study site are summarized in Table 2 and illustrated in Figure 3.

**Table 2 — Classification of Rock Creek Soils**

| Unit No. | Unit Name | Drainage Class | Restrictive Layer | Depth |
|---|---|---|---|---|
| 114 | Auburn Silt Loam | D | Bedrock | 20-24 in |
| 115 | Auburn-Argonaut Complex | D | Bedrock | 20-30 in |
| 117 | Auburn-Rock Outcrop Complex | D | Bedrock | 20-24 in |
| 119 | Auburn-Sorbant-Rock Outcrop Complex | D | Bedrock | 20-44 in |
| 125 | Boomer-Rock Outcrop Complex | B | Bedrock | 58-62 in |
| 144 | Exchequer Very Stony Loam | D | Bedrock | 11-15 in |
| 148 | Henneke-Rock Outcrop Complex | D | Bedrock | 18-22 in |
| 191 | Sorbante Silt Loam | D | Bedrock | 20-40 in |
| 196 | Xerorthents, Cut and Fill | D | N/A | N/A |
| 197 | Xerorthents, Placer | D | N/A | N/A |
| 198 | Water | N/A | N/A | N/A |

Source: Soil Survey Geographic (SSURGO) Data Provided by USDA – Natural Resources Conservation Service.

The underlying bedrock provides a restrictive layer that inhibits the transport of groundwater below the stream channel and blocks the main channel from degrading vertically downward. This local bedrock layer is lithic and paralithic such that the soil and bedrock interface contains a larger portion of fractured rocks. During site reconnaissance, a small test pit was excavated to examine immediate subsurface conditions. Observations concur with the literature. A large portion of fractured bedrock exists within a matrix of fine grained soils most closely possessing clay-like properties and containing sands.

## *Surface Hydrology*

### Watersheds

The Rock Creek Tributary watershed drains approximately 614 acres (0.96 mi2) beginning southeast of Bell Road and traveling in a northwest direction to its confluence with Rock Creek near the Rock Creek/Highway 49 over-crossing. It is divided into two subwatersheds with surface areas of 358 and 256 acres. Both subwatersheds are composed of predominantly commercial and industrial land with a variable band of open space following the Rock Creek Tributary alignment. Areas possessing high levels of impervious surfaces also have a defined drainage system of swales and storm drains. Storm drainage is routed through developments and facilities and is discharged via open outfall to the subject area in several locations. Elevations vary from 1560 feet at the watershed's uppermost extent to 1,332 feet at the intersection of Rock Creek/ Highway 49. Figure 4 illustrates the extents of the local Rock Creek watersheds and identifies the drainage areas for the Rock Creek Tributary.

| Unit No. | Unit Name | Drainage Class | Restrictive Layer | Depth |
|---|---|---|---|---|
| 114 | Auburn Silt Loam | D | Bedrock | 20-24 in |
| 115 | Auburn-Argonaut Complex | D | Bedrock | 20-30 in |
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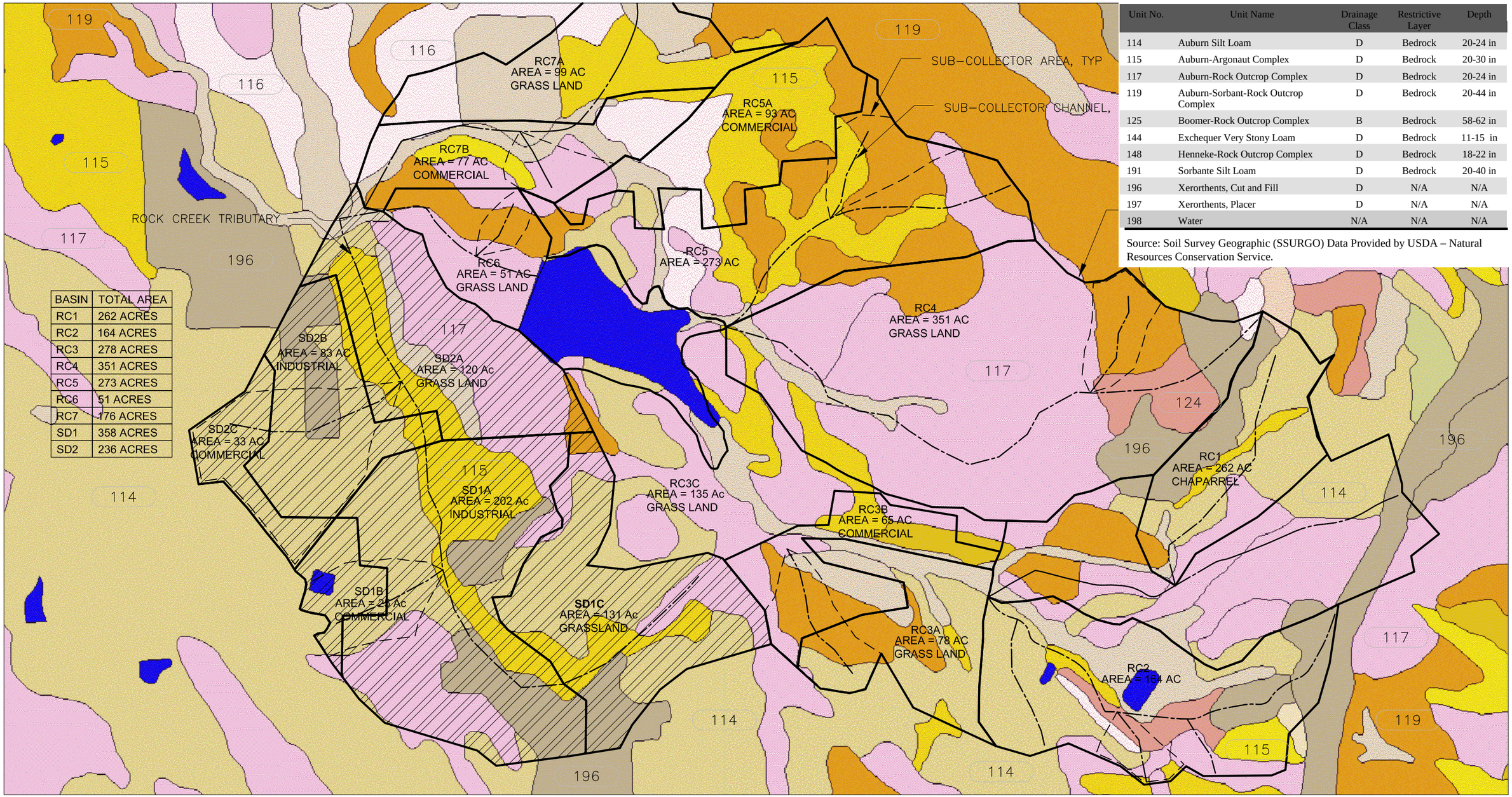
| 197 | Xerorthents, Placer | D | N/A | N/A |
| 198 | Water | N/A | N/A | N/A |

Source: Soil Survey Geographic (SSURGO) Data Provided by USDA – Natural Resources Conservation Service.

| BASIN | TOTAL AREA |
|---|---|
| RC1 | 262 ACRES |
| RC2 | 164 ACRES |
| RC3 | 278 ACRES |
| RC4 | 351 ACRES |
| RC5 | 273 ACRES |
| RC6 | 51 ACRES |
| RC7 | 176 ACRES |
| SD1 | 358 ACRES |
| SD2 | 236 ACRES |




N

600 0 600 1,200
SCALE: 1"=1,200'

LEGEND

SUB-COLLECTOR AREA BOUNDARY
CHANNEL ALIGNMENT
USCS SOIL TYPE XXX

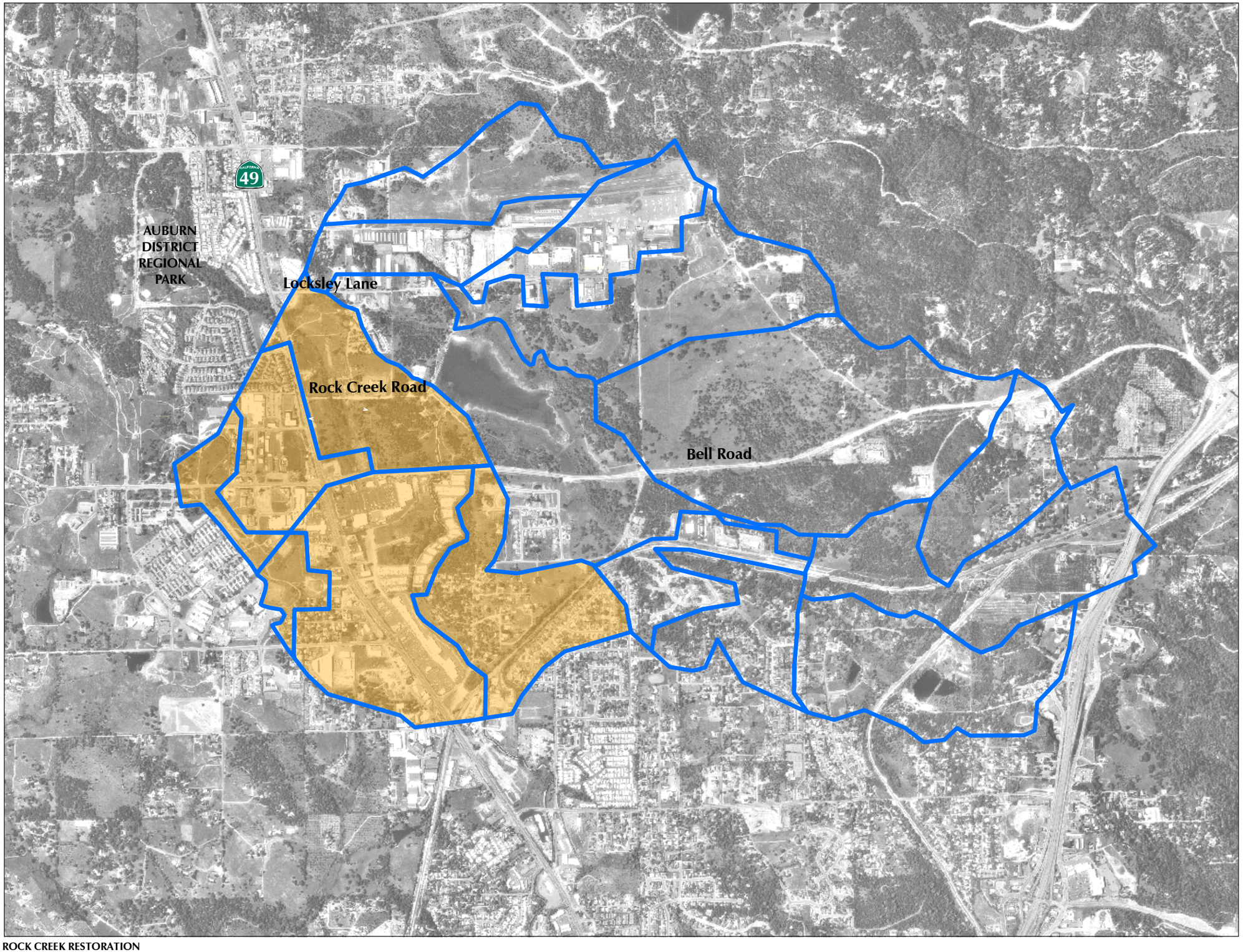
HDR Engineering, Inc.

# SUMMARY OF WATERSHEDS AND SOIL CHARACTERISTICS

ROCK CREEK RESTORATION MASTER PLAN

Date
SEP 2006

Sheet
FIGURE 3




# ROCK CREEK WATERSHED

## ROCK CREEK RESTORATION

Watershed and Subbasin Boundaries

Tributary sub-basin

N

0 840 1,680

SCALE IN FEET

FIGURE 4

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**Figure 5 — Stormwater Discharge Locations**

## Stormwater

Stormwater originating off-site is discharged to the project area at five primary locations, as illustrated in Figure 5. These five locations drain stormwater from the west of Highway 49, Rock Creek Road and the apartment complex, and from the Target shopping center. Storm-water outfalls 1, 2, and 3 discharge commercial and industrial classified stormwater originating west of Highway 49. Outfall 1 (SW1) is a 30-inch corrugated metal pipe (CMP) located near the tributary confluence with Rock Creek. Outfall 2 (SW2) is a 24-inch CMP located just south of SW1. Discharge from SW1 and SW2 is routed via swale along the east toe of the Highway 49 embankment. Stormwater is then discharged to Rock Creek at the Rock Creek tributary con-fluence. Outfall 3 is an 18-inch CMP located just south of Rock Creek Road. Discharge from SW3 is routed east via swale along the toe of the Rock Creek Road embankment. Stormwater from SW3 is discharged to the project tributary near the Rock Creek Road culvert. Stormwater outfalls 4 and 5 discharge residential and commercial stormwater collected on Rock Creek Road and the Apartment Complex. They include an 18-inch CMP (SW4) west of the subject tributary and a 30-inch CMP (SW5) east of the tributary. Both SW4 and SW5 discharge directly to the project tributary.

Stormwater originating on-site is collected and routed by existing swales, overland flow and shallow subsurface lateral flow to the project tributary. Figure 5 and Table 3 summarize these stormwater discharge locations.

**Table 3 — Summary of Stormwater Discharges to Study Area**

| ID | Description | Discharge Location | Origin |
|---|---|---|---|
| SW1 | Open outfall from culvert discharging to swale. Swale routed to Rock Creek. | Rock Creek Tributary Station 0+00. | Highway 49. Other unknown sources. |
| SW2 | Open outfall from culvert discharging to swale. Swale routed along Rock Creek Road. | Rock Creek Tributary Station 16+50. | Highway 49. Other unknown sources. |
| SW3 | Open outfall from major sub watershed collector. | Rock Creek Tributary Station 22+95. | Commercial, residential, and State Highway 49. |
| SW4 | Open outfall from 30" CMP storm drain. | Rock Creek Tributary Station 16+00 | Apartment and residential buildings |
| SW5 | Open outfall | Rock Creek Tributary Station 22+95. | Target Shopping Center and other commercial. |

## Peak Flow Events

Limited daily and annual flow data exist for the Rock Creek Tributary. Previous studies have estimated annual instantaneous peak flow events for flood control purposes. Peak flow events for the Rock Creek Tributary were estimated using HEC-1 hydrologic model runs in the Auburn/Bowman Community Plan Hydrology Study (JMM, 1992) and in the 100% Hydrology and Hydraulics Report for the Quartz Drive Extension (HDR, 2004). Figure 6 provides the corresponding flood frequency curve for the Rock Creek Tributary.

Table 4 presents the updated values calculated by HDR (2004). The 100 year peak flow values presented by HDR (2004) are comparable with the Auburn/Bowman Community Plan Hydrology Study and are conservative by 6 cfs (0.6 percent). The 100 peak flow is estimated to be 982 cfs. By interpolation, the 1.5-year peak flow is estimated to be 262 cfs.

**Table 4 — Estimated Peak Flows for Rock Creek Tributary at Various Recurrence Intervals**

| | ESTIMATED PEAK FLOW EVENT (cfs) | | | |
|---|---|---|---|---|
| STATION | 2-YEAR | 10-YEAR | 25-YEAR | 100-YEAR |
| SD1 | 206 | 396 | 508 | 686 |
| SD2 | 115 | 222 | 286 | 380 |
| Combined Rock Creek Tributary | 309 | 584 | 746 | 982 |
| Combined Rock Creek At HIGHWAY 49 | 867 | 1448 | 1798 | 2407 |

## In-Stream Structures

Overall, three in-steam structures exist along the Rock Creek Tributary. All three in-stream structures are flow conveyance structures located beneath road crossings. They are composed of two CMPs (INSS1 and 3) and one single span bridge (INSS2).

Table 5 provides a summary of the existing in-stream structures present throughout the study reach. Rock Creek Road crosses the tributary at INSS3.

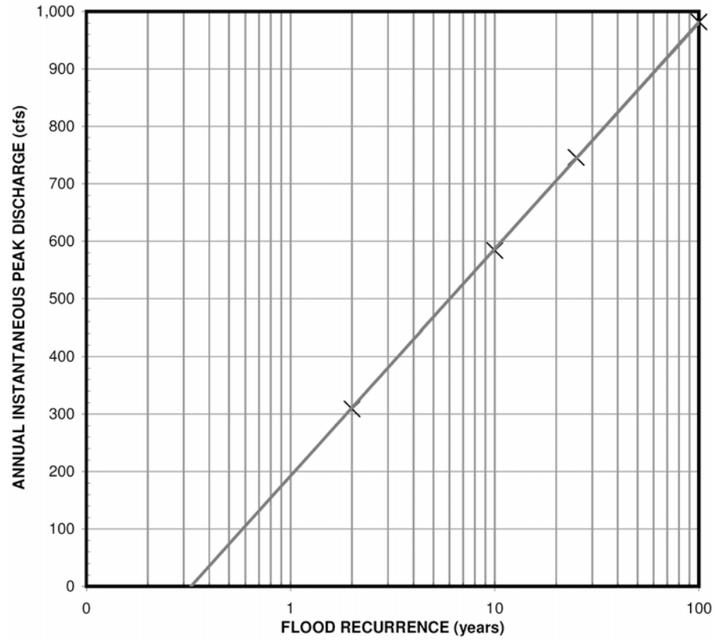



**Figure 6 — Estimated Annual Peak Discharge**

**Table 5 — Summary of Existing In-Stream Structures**

| Structure ID | Approximate Station | Structure Type | Details | Approximate Size |
|---|---|---|---|---|
| INSS1 | 3+50 ft | Culvert | Corrugated Metal Pipe | 72-inch, embedded 27-inches. |
| INSS2 | 5+00 ft | Bridge | Natural bottom with vertical concrete abutments. Wooden deck. | 12-feet wide x 3-feet tall |
| INSS3 | 16+25 ft | Culvert | Corrugated Metal Arch Pipe | 72-inches wide x 45-inches tall |

# Site Conditions

Rock Creek Restoration

The in-stream structures were observed during site reconnaissance and notes regarding general condition were made. These notes paraphrased and provided with structure photography below. Photographs of INSS1, INSS2, and INSS3 are shown in Figure 7, Figure 8, and Figure 9 respectively.

**Figure 7 — In-Stream Structure 1 (INSS1)**

Condition of INSS1 is considered to be poor. Stream flow conveyance is obstructed by a non-standard trash rack, accumulated debris, and a deformed structure shape. The non-standard trash rack is currently constructed of heavy-duty metal t-type fence posts and a thin sheet of metal held in place by cobbles and several more metal fence posts. Debris composed of cobbles and tightly compacted small woody debris has blocked a portion of the trash rack. In addition, it appears as if improper installation of the culvert has deformed the culvert over time. This is most likely caused by the lack of design for traffic surcharges, lack of embedment cover, and use of inadequate fill materials. This structure requires replacement.

The condition of INSS2 is considered fair. Stream flow conveyance is reduced by narrow concrete walls oriented at a slight angle from the upstream flow line. There is some indication of some scour and bank instability. However, the condition does not seem severe. The concrete abutments seem intact and in fair condition. The steel parallel chord support beams were observed to be in fair condition.

The wooden travel deck is in disrepair and would benefit from repair or replacement.

**Figure 8 — In-Stream Structure 2 (INSS2)**

**Figure 9 — In-Stream Structure 3 (INSS3)**

The Condition of INSS3, the Rock Creek Road crossing, is considered very poor. During observation it was apparent that the culvert floor has rusted away and is virtually missing from the structure. Stream flow obstructions at the culvert inlet include shopping carts and small and large woody debris. Due to an apparent reduction in conveyance, backwater conditions are observed above the culvert inlet. This is evident due to the settling out of fines upstream of the culvert as well as the development of wetland type habitat upstream of the culvert.

**Figure 10 — Wood Deck Bridge On-Site**

# Site Conditions

Rock Creek Restoration

## *Utilities*

Utility research was conducted by obtaining as-built plans from Placer County and by reviewing existing plans and surveys obtained from developers, engineers, and various work products. Submittal of a formal Utility Verification Letter to potential utility holders was not included in this effort. A summary of the utility holders identified to date, occurring within the proposed project area, is provided in Table 6. Upon receipt of utility holder information, the approximate utility locations were plotted in AutoCAD. Figure 11 illustrates the location of potential utility conflicts.

Given the current knowledge of existing utilities occurring within the proposed project boundary, it is apparent that two utility conflicts currently exist. The first utility conflict occurs along Placer County's Sanitary Sewer line that runs across the Rock Creek Tributary. The recommended approach for dealing with this utility would be to abandon a short section of the existing utility and realign the utility to eliminate any conflict between the sewer line and the proposed project. The proposed action is discussed further in Section 4.

The second utility conflict may occur with the existing potable water line that runs along Rock Creek Road. If Rock Creek Road is realigned or removed as part of this project, it is possible that this water line will have to be relocated. It is believed that this potable water line is owned and operated by the Nevada Irrigation District (NID).

**Table 6 — Summary of Utility Holders Present within the Proposed Project Area**

| *Company Contacted* | *Utilities* | *Utilities Present* |
|---|---|---|
| Placer County | YES | Sanitary Sewer |
| Nevada Irrigation District | YES | Potable Water |
| Caltrans | YES | Numerous CMP Storm Drains<br>Traffic Signals |
| Comcast Cable | YES | Unknown |
| Pacific Gas and Electric | YES | Overhead Lines |

**Figure 11 — Summary of Utilities**

## Geomorphology

The Rock Creek Tributary is a first order perennial stream situated within the western foothills of the Sierra Nevada draining to Rock Creek and ultimately to Auburn Ravine, Coon Creek, and the Sacramento River. It is composed of a single main channel with gradients ranging from 0.03 ft/ft near its origin to 0.009 ft/ft near its confluence with Rock Creek. Within the study area, the average gradient of the Rock Creek Tributary is most nearly 0.009 ft/ft. The main channel is moderately confined, restricted below by natural bedrock and confined to a narrowed floodplain bounded by intermediate gradient valley hill slopes. A shallow terrace exists on the left bank separating the channel floodplain from the hill slopes.

The presence of instream structures, channelization, and discharge of stormwater directly to the creek has degraded the creek in several instances. Instream structures have both confined and obstructed flow causing an increase in velocity in some locations and detention of flow in others. The related shift in sediment-flow equilibrium has resulted in channel degradation and aggregation. Within reaches where channel constriction has occurred, degradation has occurred in the form of incision to bedrock and subsequent bank erosion. Conversely, the reach upstream of the Rock Creek Road Culvert has aggregated fine sediments due to the obstruction of flow through the culvert. Currently, fine sediments have accumulated near the tributary margins, stands of wetland vegetation have been established, and standing wetlands backing up to the Rock Creek Road embankment have developed.

### General Planform

The study reach is composed of a single relatively uniform main channel with a length of 2,240 feet. The channel has very little curvature and does not meander across the width of the available floodplain. This lack of channel curvature indicates a very low level of channel sinuosity. Sinuosity refers to the level of curvature or channel meandering and is expressed mathematically as a ratio. The sinuosity ratio is simply the actual channel length divided by the overall valley length. In this case, the Rock Creek Tributary has a corresponding sinuosity ratio slightly above 1.0. Stream channels that have high levels of curvature and that meander back and forth have much higher sinuosity ratios of 1.5 to 2.

The floodplain width varies from 100 to 150 feet and is controlled in some areas by the presence of a shallow primary terrace. Existing bankfull channel top-widths were measured to range from 20 to 30 feet with a low-flow channel width of 4 to 10 feet.

The planform of the Rock Creek Tributary has remained relatively stable over time. Review of aerial photography (Figure 12) has indicated that the tributary alignment has been encroached but has not been significantly realigned. Channel widths have most likely increased over time due to the increase in peak flows caused by the presence of year-round urban run-off and increased stormwater discharges.

### Channel Substrate

The channel is composed of bed rock forced substrate where bed elevations are controlled by the underlying bedrock and the channel is laterally controlled by erosion resistant soils. The mix of sands, gravels, and rock fragments are typically poorly graded and are separated dependant upon the local gradient and presence of bedrock. Poorly graded refers to the presence of only a few size classes rather than particle sizes being evenly distributed from the smallest to largest diameters. Natural hydraulic control structures such as riffles are sporadic, occurring only where larger particle sizes are trapped by bedrock or are formed by bedrock alone. Natural hydraulic controls are formed primarily during channel forming flows where scour occurs to bedrock and pools are immediately backfilled with sands and small gravels as flood flows recede. Long straight extended runs are filled with rock fragments and poorly graded cobbles ranging from 2 to 10 inches. The even distribution of substrate material laterally across the channel indicates the presence of uniform hydraulic conditions.

**Rock Creek Tributary**

**Sampling substrate**

# Site Conditions

Rock Creek Restoration

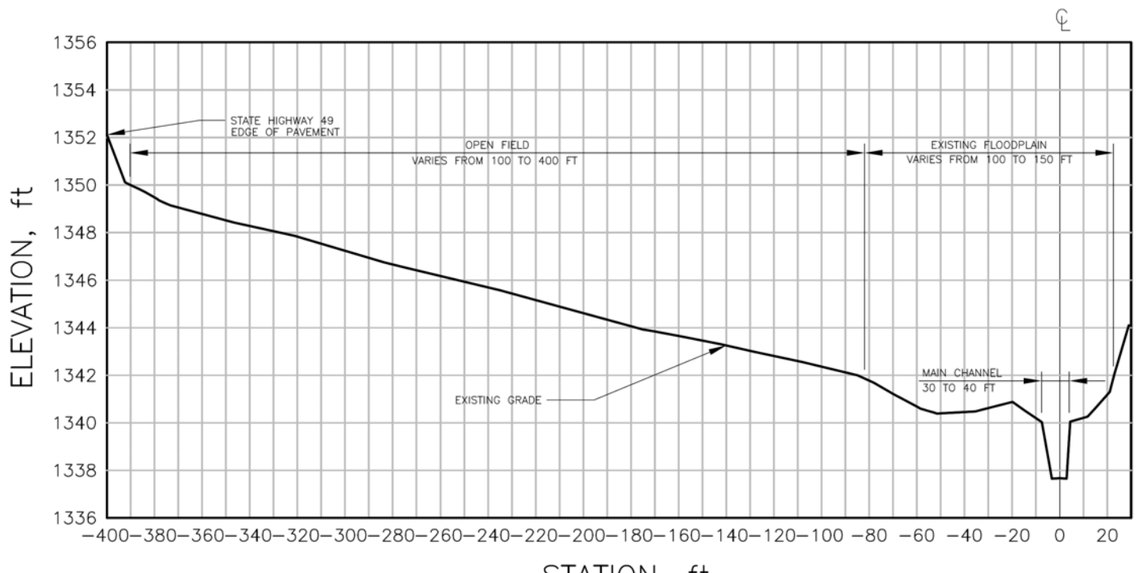
**Figure 12 — Comparison of Rock Creek Tributary Aerial Photography**

## Cross-Sectional Geometry

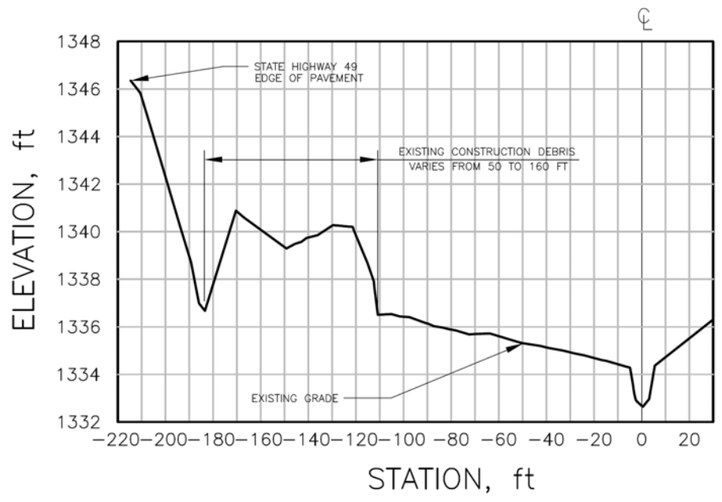
Cross-sectional geometry along the Rock Creek Tributary varies above and below Rock Creek Road. In general, the channel downstream of the Rock Creek Road crossing is relatively flat bottomed with steep, shallow banks. Bankfull depths range from 2 feet in riffle/run locations and up to 4 feet in pools. When the bankfull depths are exceeded, stream discharges flow over the channel banks into the adjacent floodplain. Upstream of Rock Creek Road, stream flows appear to be reduced and thus the channel dimensions diminish in size. The channel in this area becomes much more non-descript and is heavily choked with blackberries. By observation, the main low-flow channel in this area looked rectangular in nature. Bankfull characteristics were not apparent due to the fact that water backs up significantly at the Rock Creek Road culvert.

Observations indicate that the channel downstream of the Rock Creek Road crossing has degraded vertically exposing bedrock in many portions of the study reach. This is most likely due to the presence of erosion resistant soils and heavily vegetated banks which tend to resist lateral erosion. Channel banks are nearly vertical except at the most upstream portions of the study reach. Figure 13 provides typical existing cross-sections occurring along the project reach.

**Figure 13 — Existing Cross-Sectional Channel Geometry**




(TYPICAL FOR MAIN CHANNEL DISTANCE 7+00 TO 16+08 FT)




(TYPICAL FOR MAIN CHANNEL DISTANCE4+00 TO 6+50 FT)

## Erosion and Sediment Transport

Due to the presence of bedrock, the channel is not expected to degrade vertically any further. Active lateral erosion near in-stream structures and along channel banks is evident and is expected to worsen as urbanization along the study reach occurs. Due to the resisting nature of the natural soils along the channel banks, the erosion process is muted and will continue to occur at a slow rate until the channel is in equilibrium (with the exception of the occurrence of major flood flow events). The extent and duration of lateral erosion and channel widening is dependant upon several factors. These factors are primarily associated with the potential for further increases in stormwater discharge if any is to occur as the area is developed, modifications of existing stormwater outfalls, modification of existing flow conveyance facilities, and modifications to channel banks (i.e. armoring, bank stabilization, etc.). All of these factors affect the natural geomorphic processes in streams and may affect natural sediment transport and erosion processes.

The existing channel gradients are steep enough to facilitate the transport of bed load and wash load through the system. Bed load refers to particles that hop, roll, and skip down the bottom of the channel and are typically composed of gravels, cobbles, and boulders. Wash load refers to particles that are entrained in the water column and are literally washed downstream. From observation, it is apparent most of the fine grained particles have been mobilized and transported out of the system. Fine grained particles such as sand and silts are typically only seen in the bottom of pools. Cobbles, in the form of bedrock fragments are left behind, forming the foundation of uniform channel runs. As mentioned previously, these larger particles are mobilized during the higher flow events

# Site Conditions

Rock Creek Restoration

# *Vegetation and Wildlife*

## Vegetation

The vegetation communities occurring on the site include valley oak, blue oak, California annual grassland, bulrush-cattail, and seasonal wetland.

Valley oak community occurs along the banks and within the floodplain of the channelized drainage which is tributary to Rock Creek. This vegetation community consists of a dominant over story of valley oak (*Quercus lobata*) and is typically associated with perennial creeks or valley bottoms where saturated soil conditions are seasonally common; it also occurs on the lower slopes and summit valleys within the Great Central Valley. Composition of vegetation on site varies from a two-layered canopy of trees and herbs (riparian woodland) to a multi-layered canopy of canopy trees, subcanopy trees, shrubs, herbs, and grasses (riparian forest). A mixed canopy of valley oak, willow (*Salix* sp.), and blue oak (*Quercus douglasii*) make up the majority of tree species that occur along the tributary with the exception of a dense stand of Fremont's Cottonwood (*Populus fremontii*) primarily occurring within the Dwelle Enterprises parcel. A mixed subcanopy of shrubs such as Himalayan blackberry (*Rubus discolor*) and holly-leaf redberry (*Rhamnus ilicifolia*) and herbs such as smartweed (*Polygonum* sp.) occur throughout this vegetation community. Dominant plant species observed within this vegetation community on site are listed in Table 7.

Blue oak community occurs within the eastern portion of the site east of the tributary. This vegetation community consists of a dominant over story of blue oak and is typically associated with gentle to steep slopes where the soils are shallow with extensive rock fragments and rock outcrops. Stands made up of this type of vegetation composition are commonly described as blue oak woodland. Composition of vegetation on site consists of an intermittent canopy of blue oak and foothill pine (*Pinus sabiniana*) with the understory consisting of shrubs such as coyote brush (*Baccharis pilularis*), buck brush (*Ceanothus cuneatus*), and non-native grasses such as ripgut grass (*Bromus diandrus*), and medusahead (*Taeniatherum caput-medusae*). Dominant plant species observed within this vegetation community on site are listed in Table 7.

California annual grassland community occurs interspersed throughout the site concentrated within open areas east and west of the tributary. This vegetation community consists of a myriad of native and non-native annual plant species and occurs throughout the majority of the State. Composition of this vegetation community varies depending on distribution, geographic location and land use. Additional major influences on this vegetation community include soil type, annual precipitation and fall temperatures. Onsite, the dominant grass species consists of soft chess (*Bromus hordeaceous*), ripgut brome (*Bromus diandrus*), foxtail fescue (*Vulpia myuros*), and wild oat (*Avena fatua*). Common dominant herbaceous non-natives include yellow star thistle (*Centaurea solstitialis*), and Italian thistle (*Carduus pycnocephalus*). Rock outcrops occur within the eastern portion of the site. Dominant plant species observed within the vegetation community on site are listed in Table 7.

Bulrush-cattail community occurs interspersed throughout the tributary in areas of slow moving water and portions of the site which receive seasonal flooding or seepage from the tributary. The dominant component of this community on site is broad-leaved cattail (*Typha latifolia*). Typically, Bulrush-cattail vegetation communities occur in semi or permanently flooded wetlands, such as the depressional perennial marsh within the adjacent parcel just southwest of the site. Composition of this community on site consists of shrubs such as Himalayan blackberry, herbs such as curly dock (*Rumex crispus*), grasses such as dallisgrass (*Paspalum dilatatum*), and subcanopy trees such as willows. Dominant plant species observed within the vegetation community on site are listed in Table 7.

Seasonal wetlands occur naturally within depressional areas adjacent to the tributary due to flooding and seepage. In addition, the western portion of the site along the channelized tributary shows evidences of a historic creek bed and is functioning as a seasonal wetland. Seasonal wetlands are those depressions within the topography that inundate or flow for short periods of time following intense rains but do not maintain seasonal aquatic or saturated soils conditions for durations long enough for colonization by perennial, obligate plant species. As such, plant species in seasonal wetlands are generally of two types: species that can tolerate short periods of inundation but have not adapted to withstand sustained aquatic or saturated soils conditions, and short-lived (primarily annual) species that take advantage of ephemeral aquatic and/or saturated soils conditions. Dominant plant species observed within the vegetation community on site are listed in Table 7.

## Wildlife

The dominant wildlife habitat types on site consist of riparian forest which is associated with a perennial drainage (the Rock Creek tributary). The adjacent wildlife habitat types gradually transition from riparian to seasonal wetlands and savannah-like oak woodlands. Riparian habitats provide food, water, and nesting and thermal cover for abundance of wildlife year round. This habitat type also provides migration and dispersal corridors and predation escape opportunities. The seasonal wetland habitats provide nesting and foraging opportunities to both resident and migratory species and are especially important to breeding amphibians, reptiles, and invertebrate species. The adjacent open grassland and oak woodland areas provide upland habitat adjacent to perennial water sources. The open grassland also provides optimal foraging opportunities for birds of prey. During field reconnaissance, several stick nests were observed within the trees on the site. Stick nests are built by both migrant and locally breeding birds. Other observations made during field reconnaissance include animal tracks and scat, owl pellets, beaver dams, and small mammal burrows. Wildlife species observed during field reconnaissance are listed in Table 8.

Additionally, the site contains a small area of serpentine soils. Serpentine soils typically have a high degree of floristic diversity and also have the potential to foster several rare endemic plant species. Over 25 percent of the 1300 plant species considered rare in California occur on serpentine soils (McCarten 1988). It has been estimated that serpentine endemic plant species represent between 10 and 15 percent of all endemic flora in California (Kruckeberg 1984) and (McCarten 1987).

**Table 7 — Dominant Plant Species within the Rock Creek Restoration Site**

| Common Name | Species Name |
|---|---|
| ***Valley Oak Community*** | |
| Smartweed | ***Polygonum* sp.** |
| Fremont's Cottonwood | ***Populus fremontii*** |
| Blue Oak | ***Quercus douglasii*** |
| Valley Oak | ***Quercus lobata*** |
| Interior Live Oak | ***Quercus wislizeni*** |
| Arroyo willow | ***Salix lasiolepis*** |
| Periwinkle | *Vinca major* |
| Holly-Leaf Redberry | ***Rhamnus ilicifolia*** |
| Hoary Coffeeberry | ***Rhamnus tomentella*** |
| Firethorn | *Pyracantha angustifolia* |
| Himalayan Blackberry | *Rubus discolor* |
| ***Blue Oak Community*** | |
| Coyote Brush | ***Baccharis pilularis*** |
| Blue Oak | ***Quercus douglasii*** |
| Valley Oak | ***Quercus lobata*** |
| Interior Live Oak | ***Quercus wislizenii*** |
| Foothill Pine | ***Pinus sabiniana*** |
| Buck Brush | ***Ceanothus cuneatus*** |
| Bedstraw | ***Galium* sp.** |
| Snowberry | ***Symphoricarpos albus*** |
| ***California Annual Grassland Community*** | |
| Ripgut Grass | *Bromus diandrus* |
| Soft Brome | *Bromus hordeaceus* |
| Coyote Brush | ***Baccharis pilularis*** |
| Yellow Star-Thistle | *Centaurea solstitialis* |
| Tarweed | ***Centromadia* sp.** |
| Common Soap Plant | ***Chlorogalum pomeridianum*** |
| Dogtail | *Cynosurus echinatus* |
| Queen Anne's Lace | *Daucus carota* |
| California Poppy | ***Eschscholzia californica*** |
| Filaree | *Erodium botrys* |
| Fescue | ***Festuca* sp.** |
| Geranium | *Geranium molle* |
| Mediterranean Barley | *Hordeum marinum* ssp. *gussoneanum* |
| Perennial Ryegrass | *Lolium perenne* |
| Spider Lupine | ***Lupinus benthamii*** |
| Lotus | *Lotus* sp. |
| Deergrass | ***Muhlenbergia rigens*** |
| Olive Tree | *Olea europaea* |
| Common gold back fern | ***Pentagramma triangularis*** |
| Non-native Rose | *Rosa* sp. |
| Common groundsel | *Senecio vulgaris* |
| Chickweed | *Stellaria media* |
| Milk Thistle | *Silybum marianum* |
| Spreading Hedge-parsley | *Torilis arvensis* |
| Medusahead | *Taeniatherum caput-medusae* |
| Clover | ***Trifolium* spp.** |
| Hairy Vetch | *Vicia villas* |
| Blue Dicks | ***Dichelostemma capitatum*** |
| ***Seasonal Wetland*** | |
| Onion | ***Allium* sp.** |
| Sedge | ***Carex* sp.** |
| Thistle | *Cirsium* sp. |
| Common Four Spot | ***Clarkia quadrivulnera*** |
| Miner's lettuce | ***Claytonia perfoliata*** |
| Pampas Grass | *Cortaderia jubatam* |
| Non-native Spikerush | *Eleocharis pachycarpa* |
| Common Velvet Grass | *Holcus lanatus* |
| Mediterranean Barley | *Hordeum marinum* ssp. *gussoneanum* |
| Iris | *Iris* sp. |
| Soft Rush | ***Juncus effusus*** |
| Mexican Rush | ***Juncus mexicanus*** |
| Harding Grass | *Phalaris aquatica* |
| **Bulrush-cattail Community** | |
| Broad-leaved Cattail | ***Typha latifolia*** |
| Curly dock | *Rumex crispus** |
| Dallisgrass | *Paspalum dilatatum* |
| Buttercup | *Ranunculus* sp.* |
| Water Crest | ***Rorippa nasturtium officinale*** |
| Himalayan Blackberry | *Rubus discolor* |
| Arroyo Willow | ***Salix lasiolepis*** |
| Johnsongrass | *Sorghum halepense* |
| **Noxious Weeds** | |
| Pampas Grass | *Cortaderia jubatam noxious weed* |
| Medusahead | *Taeniatherum caput-medusae* |
| Yellow Star-Thistle | *Centaurea solstitialis noxious weed* |
| Himalayan Blackberry | *Rubus discolor* |

| Common Name | Species Name |
|---|---|
| ***Note: BOLD font = native species*** | |

**Table 8 — Wildlife Species Observed within the Rock Creek Restoration Site**

| Common Name | Species Name |
|---|---|
| Scrub-jay | *Aphelocoma californica* |
| Oak titmouse | *Baeolophus inornatus* |
| Cedar waxwing | *Bombycilla cedrorum* |
| Red-tailed hawk | *Buteo jamaicensis* |
| Red-shouldered hawk | *Buteo lineatus* |
| Anna's hummingbird | *Calypte anna* |
| Lesser goldfinch | *Carduelis psaltria* |
| House Finch | *Carpodacus mexicanus* |
| Beaver (dams) | *Castor canadensis* |
| Turkey vulture | *Cathartes aura* |
| Northern flicker | *Colaptes auratus* |
| Yellow-rumped warbler | *Dendroica coronata* |
| White-tailed kite | *Elanus leucurus* |
| Brewer's Blackbird | *Euphagus cyanocephalus* |
| Black-tailed jackrabbit (scat) | *Lepus californicus* |
| Acorn woodpecker | *Melanerpes formicivorus* |
| Song sparrow | *Melospiza melodia* |
| Northern Mockingbird | *Mimus polyglottos* |
| Nuttail's woodpecker | *Picoides nuttallii* |
| Spotted towhee | *Pipilo maculatus* |
| Raccoon (tracks) | *Procyon lotor* |
| Bushtit | *Psaltriparus minimus* |
| Ruby-crowned kinglet | *Regulus calendula* |
| Western bluebird | *Sialia mexicana* |
| California ground squirrel (burrow) | *Spermophilus beecheyi* |
| Western meadowlark | *Sturnella neglecta* |
| American Robin | *Turdus migratorius* |
| White-crowned sparrow | *Zonotrichia leucophrys* |

# Site Conditions

## Rock Creek Restoration

# *Recreation*

## Existing Conditions

Current recreation facilities on the project site are limited. A paved bike and pedestrian trail connects the south boundary of the site to the Target shopping complex and adjacent businesses on the south, but no formally designated trails exist within the project boundaries. The land is currently privately owned and access is restricted.

The Auburn District Regional Park is located approximately ¼ mile west of the Highway 49 Bridge over Rock Creek. This 58 acre regional park is used by the various residents in the neighborhood, including a high school and a church adjacent to the Park, the mobile home park across the creek, the nearby low income housing units on Quartz Drive and Park Drive, and the Deer Creek Community (see Figure 15). Users from these areas comprise a diverse mix of residents that would potentially utilize a trail connecting the park to retail businesses in the vicinity of Highway 49 and Bell through the project site. Additional future expansion of the Regional Park onto a parcel to the west of the existing park as well as development of a senior facility southwest of the low income housing tract could provide additional users of the project site.

While Highway 49 is a designated bike route, conditions along the street are such that riding or walking is unpleasant. Traffic speeds are too high on Highway 49 for comfortable pedestrian/bike usage, and there is no physical separation between the bike lane and the road. During the site visit, pedestrians were using this route even under the current conditions, which become even more uncomfortable at the Rock Creek bridge structure. Pedestrians must either walk along the shoulder adjacent to the traffic or between the guard-rail and the edge of the bridge (Figure 14). Neither of these options provides a safe and pleasant experience. The east shoulder of Highway 49 is currently the only pedestrian or bike access from Locksley Lane to the corner of Highway 49 and Bell.

In addition to Highway 49, roads on-site include the private paved Rock Creek Road and a number of unpaved roads providing access to various private parcels. Two dirt roads cross the creek on the northern half of the site, between Rock Creek Road and Highway 49. The primary purpose of these roads is to provide access to properties on the east side of the creek. One of these roads crosses the creek via a large culvert, and the other utilizes an old wooden bridge structure (Figure 10).

Several dirt cross the site from southeast to northwest and are used by the County to maintain the sewerline. The Placer County Department of Facility Services plans to replace this sanitary sewer line, and the access roads for maintenance vehicles for this realigned sewer line provide an opportunity for conjunctive use with a north-south bicycle/pedestrian trail.

**Figure 14 — Highway 49 Bridge**

## Opportunities and Constraints

The single greatest opportunity for recreation on the site is conjunctive use between the sewer line access road and a pedestrian/bicycle trail. To function as a maintenance road for the sewer line, the path must be 12-feet wide with 1-foot shoulders, 3" AC on 8" AB. This conjunctive use trail will provide a pedestrian/bike route between Rock Creek Road and the Highway 49—Quartz Drive intersection. The existing signalized crossing at Highway 49 and Quartz appears to be sufficient to provide access to the project site from potential trail users to the west, including Auburn District Regional Park users seeking to use the commercial businesses on Highway 49.

Two possible routes connect the Highway 49 crossing at Quartz Drive to the Auburn District Regional Park. The first is on-street and would require only slight improvement to designate a bike lane following Quartz Drive to Park Drive and then to the park entrance. The second route would require constructing approximately 1200-feet of Class-I bikeway, following the Highway 49 west frontage for approximately 700 feet adjacent to the storage facility to a Park and Recreation District parcel along the west bank of Rock Creek downstream of the bridge. Both of these routes follow Park Drive for about 400 feet, and this section of Park Drive should be improved to provide a bike and pedestrian lane adjacent to the roadway. There appears to be sufficient space on Park Drive to accommodate a bike trail in addition to the existing travel and parking lanes, though a traffic/engineering study would be needed to confirm this. Of these two options, the second is preferred, because it creates an off-street connection between the project site and the regional park, improving both circulation and user experience.

Between the existing Target shopping center and Rock Creek Road, a proposed development may pay for the trail. The County will need to work with the developer (PacLand) to ensure that the desired connections are planned and constructed in locations recommended by this restoration Plan. As part of the development and the extension of Quartz Drive adjacent to Target to intersect with Highway 49, the opportunity may arise to close the section of Rock Creek Road from Highway 49 to just east of the creek crossing. This would simplify the trail crossing at Rock Creek Road and provide riparian vegetation connectivity. Some section of this abandoned road would need to be maintained for sewerline maintenance. Construction of the trail on the west bank of the creek on the PacLand parcel, between the proposed commercial buildings and the creek bank, will need to be sensitive of the existing wetlands in this area.

**Figure 15 — Potential Recreation Facility Users**

# Site Conditions

Rock Creek Restoration