Rose Creek Watershed Wetland, Riparian & Water Quality Restoration Opportunities Analysis

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FINAL REPORT

January, 2012

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Executive Summary

Work to develop a comprehensive plan to identify and model restoration opportunities in the Rose Creek Watershed (RCW) began in 2005 with the development of the Rose Creek Watershed Opportunities Assessment (KTU+A 2005). During this Assessment, it was determined that the existing hydrologic and hydraulic information available for the RCW was out of date, and the watershed had undergone significant urbanization since the Army Corps of Engineers (USACE) published the hydrologic and hydraulic reports in 1970 and 1978. It was recommended that an additional hydrologic and hydraulic assessment, as well as sediment transport and geomorphologic assessments, be updated and developed in order to identify and model wetland or floodplain restoration projects.

The project sponsor San Diego Earthworks was able to secure funding from the Coastal Conservancy to implement this update and assessment. A series of stakeholder meetings were conducted throughout the project to enable input, comments and feedback as the tools were developed.

The analytical tools were used to identify the specific fluvial processes (e.g., streambed erosion, streambank cutting, sedimentation) that dominate the morphology of the watershed stream network. The dominant processes were then utilized to establish the linkages between the causes and effects of significant morphologic features (e.g., channel migration and degradation). These results also established the historical context of the stream network for use in assessing future morphology associated with components of the watershed restoration opportunities identified.

The development of the hydraulic model allows for better design of floodplain restoration projects. Several past mitigation projects in the watershed were designed and implemented without adequate modeling to determine existing or proposed floodplain elevations or flow velocities, and appear to be struggling to reach dynamic equilibrium as a result. The hydraulic model was developed as a tool to test the feasibility of potential restoration sites within the RCW, with a primary focus from I-805 to the confluence of Rose and San Clemente Creeks. The model is intended to be used as a planning tool to aid in the concept level development of potential restoration alternatives and as a baseline tool for the future development of a final design of selected restoration alternatives.

One of the key issues that were assessed as part of this effort was the feasibility of concrete channel removal within the lower watershed. The existing conditions modeling validated that there is not adequate capacity within the concrete channels to allow modification or removal without potentially increasing flood risks, which is not acceptable. Therefore the only way concrete channel removal would be feasible is if sufficient flood detention/retention improvements could be made within the upper watershed (source control) to reduce flood elevations within the lower watershed to provide adequate capacity within the channels to either fully or partially remove the concrete without sacrificing adequate flood protection. The result of the model run indicated that even under a maximum flood detention/retention improvements scenario concrete removal was not possible.

The 2005 Opportunities Assessment identified a number of sites that appeared suitable for wetland/riparian habitat restoration based on landform, adjacency to the creeks, and non-native or lower quality existing habitats. The second and third restoration scenarios used hydraulic model simulations to evaluate and analyze specific riparian and wetland restoration and creation areas along Rose Creek and San Clemente Creek. The goal was to identify and analyze specific opportunities to restore wetland and riparian functions, including floodplain reconnection, improvement of wildlife habitat, and hydrology and water quality improvement. Details of the selected sites are included in this report.

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1. Introduction

1.1 - PROJECT LOCATION & PROJECT LIMITS

The Rose Creek Watershed (RCW) is approximately 37 square miles in size and includes portions of the City of San Diego and Poway (see Figure 1, Regional Map & Figure 2, Project Limits). The RCW includes two principal drainages: Rose Creek and San Clemente Creek. Watershed topography consists of steep foothills in the upper watershed, broad floodplains surrounded by hillsides in the central watershed, and steep, incised canyons in the lower watershed. Rose Canyon Open Space Park and Marian Bear Memorial Park are two significant open space areas within the watershed. Most of the focus of the project includes those areas of open space falling within Rose Canyon and San Clemente Canyon bottoms, particularly riparian areas, lying outside the bounds of the MCAS Miramar and outside the jurisdiction of the Coastal Commission.

1.2 - PROJECT BACKGROUND

The scope of this project builds upon previous efforts in the Rose Creek Watershed including the Rose Creek Watershed Opportunities Assessment (2005); technical studies on recreational Trails, Cultural Resources, and Hydrologic Modifications; the Rose Creek Watershed Biological Assessment (2009); and the Wet Weather Intermittent Stream Discharge Feasibility Study (RMC Water and Engineering, 2010). The Rose Creek Watershed Opportunities Assessment was a comprehensive analysis of opportunities and recommendations to enhance the natural, cultural, public safety, and recreation attributes of the RCW.

During the research and development of the Opportunities Assessment in 2005, specifically the Existing Conditions Report and the Hydrologic Modifications Technical Memorandum, it was determined that the existing hydrologic and hydraulic information available for the RCW was based on USACE reports published in 1970 and 1978. Based on aerial photography comparisons using GIS, the RCW has undergone significant urban development since then, with as much as 30 percent of the watershed's land area being converted from natural vegetation communities to various urban and suburban land uses. Based on this comparison, it was recommended that an additional hydrologic[1] and hydraulic[2] assessment, as well as sediment transport and geomorphologic assessments, incorporated as the tools of the project, be conducted prior to the development and implementation of wetland or floodplain restoration projects. These tools would ascertain the feasibility of project elements, appropriateness of the design of these elements and the potential downstream effects of the project elements. These tools, developed as part of this project, were then utilized by the team to develop and assess restoration opportunities in the watershed.

The project sponsor San Diego Earthworks was able to secure funding from the Coastal Conservancy to implement this assessment. A series of stakeholder meetings were conducted throughout the project to enable input, comments and feedback as the model developed. A list of participants can be found in the attached appendices.

1.3 – GOALS & OBJECTIVES

The goals of the project are as follows:

1. To develop and apply analytical tools to establish the hydrologic, hydraulic, sediment transport, and geomorphic conditions of the watershed to a level suitable to: (a) assess historical conditions for the purpose of identifying problems, causes, and potential solutions, and (b) predict the effects

1: Hydrology: the study of water at the watershed scale; starting from rainfall intensity to how that rain interacts with different soil types and land uses to produce a given volume of runoff for a particular storm event.

2: Hydraulics: the study of how water is conveyed after it has made its way to a stream or river. Velocity, flow depth, discharge, area of inundation and shear stress are the types of variables derived from a hydraulic analysis.

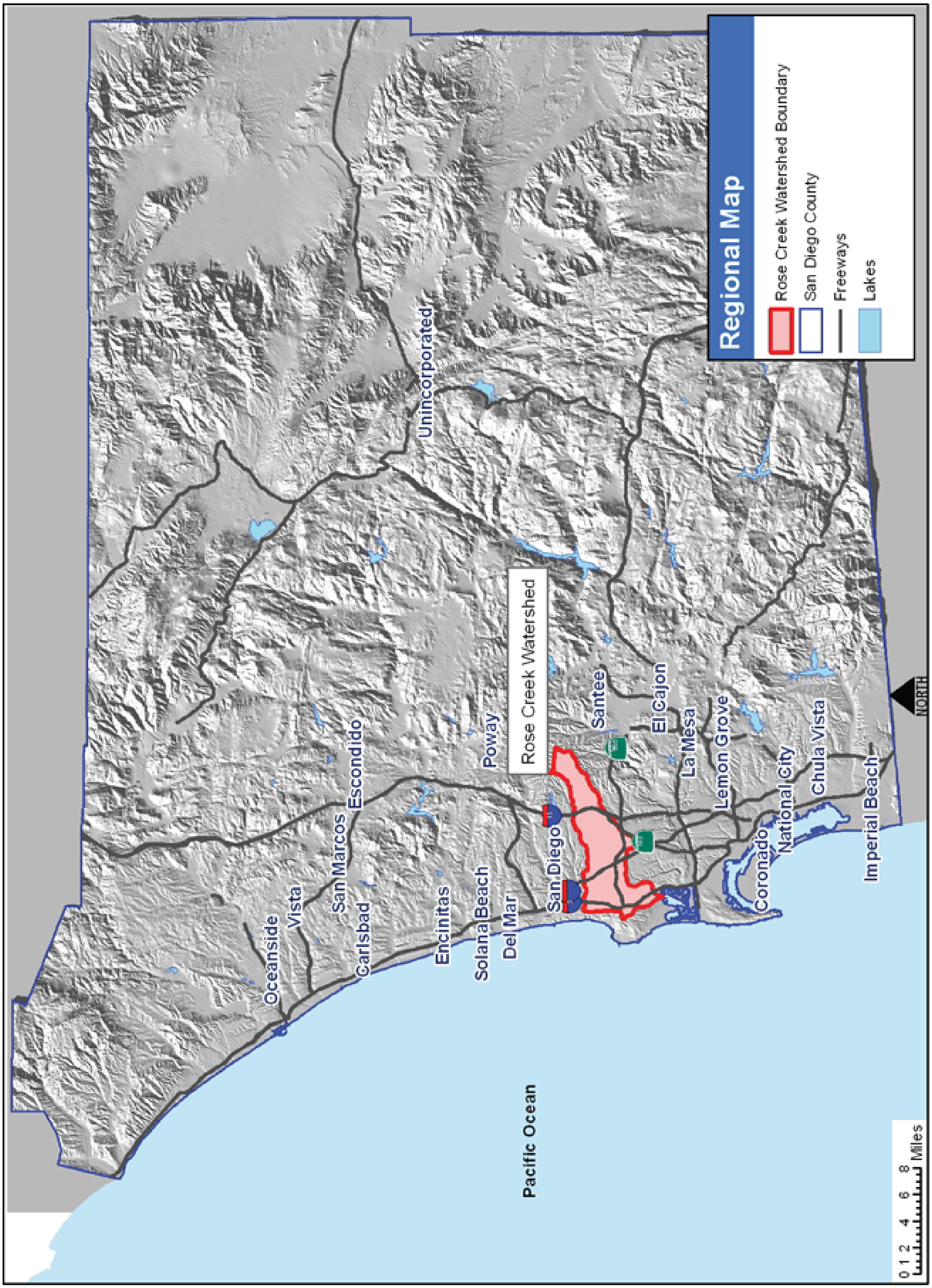
of changes in environmental forcing factors (e.g., precipitation and stream flows).

2. To identify suitable riparian and wetland restoration opportunities in the watershed for floodplain reconnection, improved water quality, and the creation/restoration of riverine or wetland habitat. In this context, relevant watershed restoration opportunities implies those activities that would involve direct modification (e.g., removal of concrete) or indirect manipulation of the watershed stream network.
3. To determine whether in-stream concrete structures can be removed, without creating hazardous conditions during peak storm events.

The following objectives were identified to achieve the goal of the determining riparian restoration/creation opportunities that supports the RCW Analysis for Hydrology.

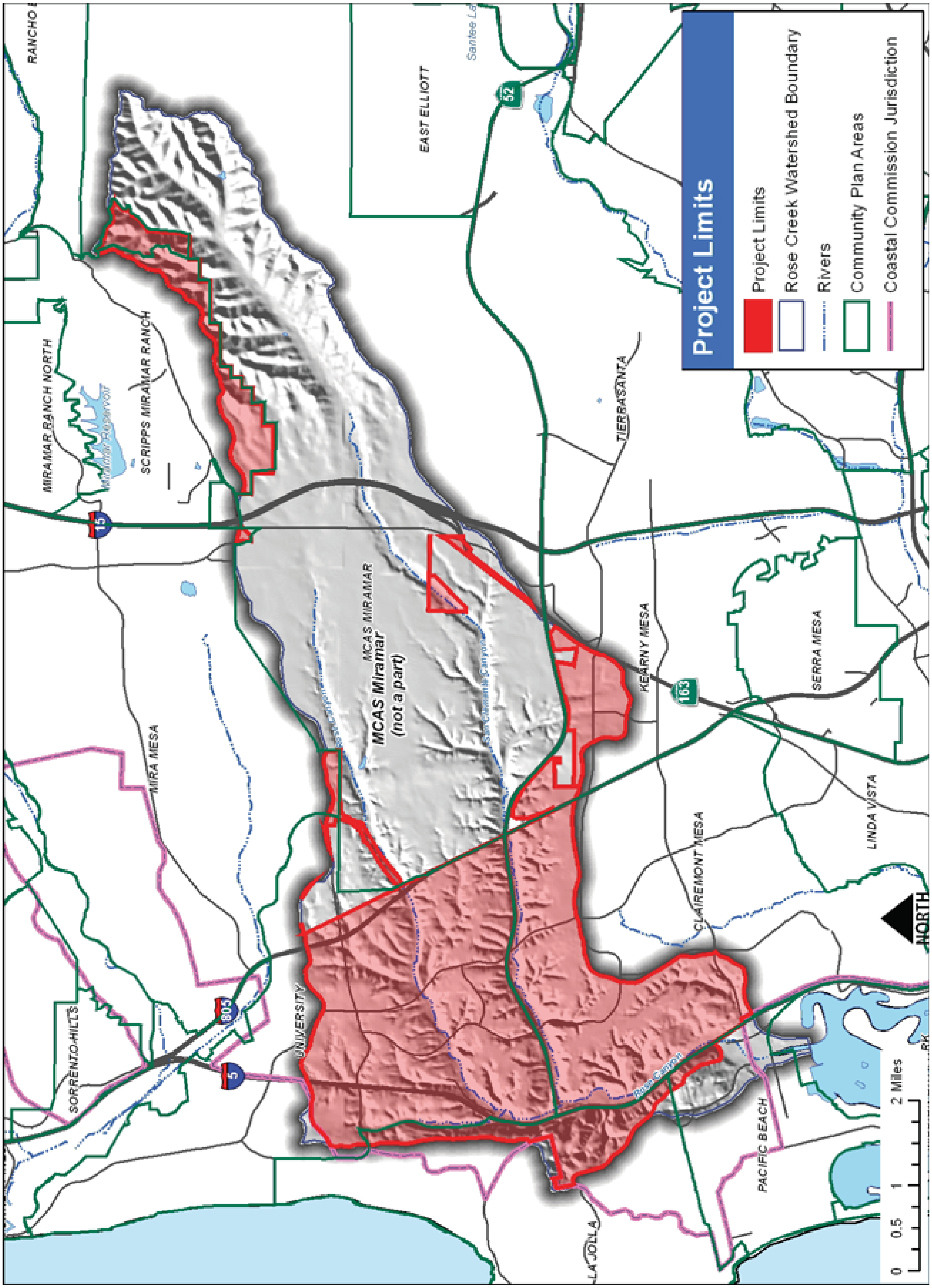
1. Establish the existing hydrologic conditions of the watershed.
2. Develop a hydrologic analysis tool that can be used to generate runoff flows to the watershed stream network.
3. Utilize the hydrologic analysis tool to establish runoff flows throughout the watershed for a range of environmental conditions (e.g., precipitation, soil moisture, and infiltration) and human disturbance conditions (e.g., impermeable surface area, lined channels, and slope modifications).
4. Utilize the hydraulic analysis tool to determine stream flows (e.g., 2-, 5-, 10-, 25-, 50- and 100-yr storm events) and map inundation areas for various stream flows ranging from base flows to extreme storm flood events (e.g., intermediate regional flood and standard project flood).
5. Develop a sediment transport analysis tool that can be used to analyze the sediment mobility of the corridor under existing and future restoration/creation conditions.
6. Develop watershed restoration alternatives that support floodplain reconnection, improved water quality, creation or restoration of riverine or wetland habitat, improvement of wildlife habitat and the restoration of wetland functions.
7. Estimate beneficial and adverse impacts of a range of watershed restoration alternatives on the stream network within the RCW.

Figure 1 – Regional Map



Source: SANDAG (2006), USGS

Figure 2 – Project Limits



1.4 - BIOLOGICAL, HYDROLOGICAL AND WATER QUALITY FUNCTIONS IN RIPARIAN AND WETLAND AREAS

1.4.1 - Wetland Values

Why restore or create wetland or riparian habitat in the Rose Creek Watershed?

In the beginning of this process, the team approached the participating stakeholders and asked the question of what was important about Rose and San Clemente Canyons to them. The value of the riparian areas lies in the benefits that it provides to both to the environment and the people. Wetland and riparian areas can have ecological, social and economic values. Social values are important to people, providing hiking, picnic grounds and places of solstice for people that use the area. Ecological values are what the area provides to native plant and animal life. Economic values can be applicable when habitat mitigation is needed for impacts to other wetlands or riparian areas, or other purposes such as railways, bridges or other human made structures that may be identified for use in the area. What is valuable and important to one person or group may not be valuable to another person or group.

The decision makers may choose among wetland values that benefit a small group or that are important to the maintenance or improvement of the wetland itself. With regard to the maintenance or improvement of wetland functions, along with many stakeholders comes conflicting views. Conflicts may exist between how the land is managed: status quo/“hands off” approach to the habitat, or a more active management approach for improvement of wetlands and their functions. Over time, the habitat without active management has seen environmental degradation, mild to severe channel incisioning, loss of floodplain habitat, erosion and sediment loss from the hillsides, increased peak flows, and the invasion of exotic species.

Thus it is our belief that to return the system to a healthy, sustainable state requires active management. For example, the degradation of the active channel has resulted in the inability of the flood flows to overbank during smaller storm events. Thus in San Clemente Canyon we see a long-term trend of sycamore woodland habitat being converted to non-native grassland and coastal sage scrub due to no new recruitment of sycamores, resulting in an overall net loss of riparian habitat. Over time these relic sycamores, being unable to reproduce, will die off and not be replaced by like-kind riparian habitat. We believe a hands-off approach would result in the loss of this important riparian habitat, as well as its associated functions.

The majority of participating stakeholders in this process have agreed that a more active management approach is appropriate to prevent long term wetland habitat loss, although consensus on all aspects of this report has not been met in its entirety.

1.4.2 - Wetland Functions

Wetland functions are the properties that the wetland naturally provides. These include functioning related to biology, hydrology and water quality. On a local scale wetlands affect adjacent or nearby ecosystems, for example, by reducing flooding in downstream communities or by removing pollutants from urban runoff. Natural functions of riparian areas and wetlands can be altered or impaired by human activity, such as the urbanization of the watershed. Although incremental changes in the landscape can lead to small changes in wetlands, the accumulation of these small changes can impair wetland functioning (Brinson, 1988).

Examining historical aerial photographs dating back to 1928 (Figures 3 and 4), we can find areas with both limited and significant changes in the Rose Creek Watershed. Figure 3 shows a portion of Rose Canyon near Interstate 805 (I-805) where the riparian corridor east of the highway appears today much the way it did in 1928 because most of the contributing watershed is still undeveloped. This reinforces that observed changes within the riparian corridors in the watershed are more directly related to urban

Figure 3 – Rose Canyon Comparison of 1928 and 2009 Aerial Photography

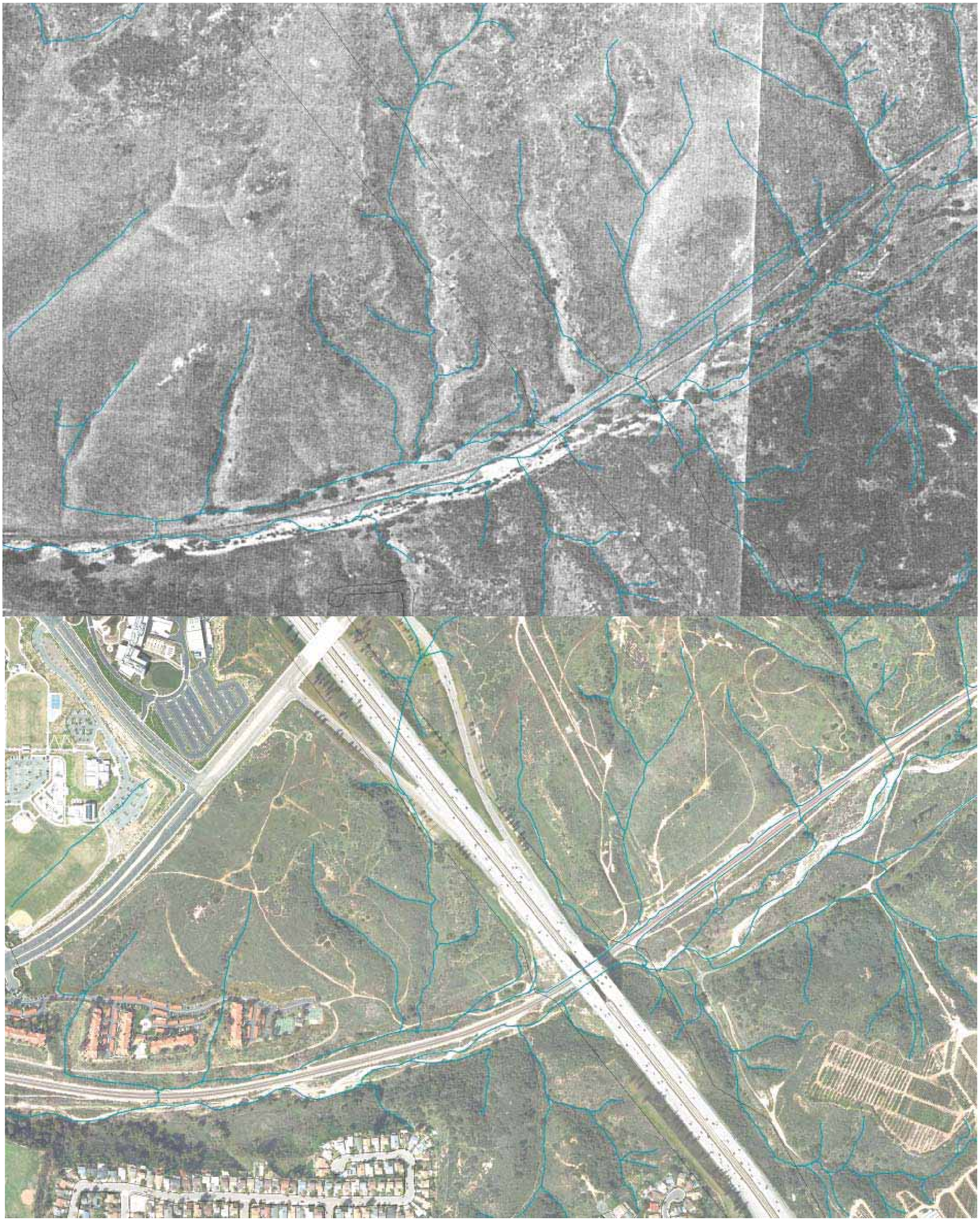


Figure 4 – San Clemente Canyon Comparison of 1928 and 2009 Aerial Photography

development, than natural climatic changes. Figure 4 shows a portion of San Clemente Canyon east of Genesee Avenue that has undergone more significant changes due to the influence of urban runoff and more substantial storm flows. In this area the riparian corridor appears to have improved in vegetative cover due to the availability of year round water, however the channel has incised several feet and most flood flows no longer connect with the floodplain, negatively affecting the ecological functions of the riparian habitat.

Urban development within the watershed has resulted in the reduction of open space, significant increases in impermeable surfaces, increased urban runoff, and thus the transformation of an ephemeral to intermittent stream system into an intermittent to perennial stream system that responds to rainfall events in a 'flashy' manner. All these changes have affected the riparian areas within the watershed in some fashion. Within both Rose and San Clemente Creek, the increases in urban runoff during dry weather and storm events have caused a two-fold change in the functioning of their floodplains and associated wetlands habitats.

First, the added urban runoff during storm events has increased the volume and velocity of water flowing in the creeks which has in turn caused streambank and streambed erosion resulting in less overbank flood flows and loss of floodplain connectivity. These changes have negatively impacted related habitats such as the Sycamore woodland by reducing the frequency of flood flows that disturb the floodplain surface and trigger seed germination. The reduced frequency of overbank flows onto the floodplain also reduces the amount of storm water temporarily stored within the floodplain soils that help support juvenile trees and riparian understory plants.

Second, the added urban runoff during dry weather has altered the types of riparian plant species supported from only sycamores and oaks to willows and cattails as well. These more water dependent species have colonized the streambeds and lower streambanks within the incised channels. With their more dense growth habits they cause additional turbulence during storm events often resulting in additional streambank erosion and further disconnection of the floodplain. So while there has been an overall increase in riparian vegetative cover within the creeks to date due to the increase of dry weather urban flow, the additional acreage is not providing the full suite of functions that wetlands are capable of providing and without the successful recruitment of floodplain species the current acreage will decline with time.

Riparian areas and wetlands are known best for the habitat functions they provide; functions that benefit wildlife. The habitat is defined as "the part of the physical environment in which plants and animals live" (Lapedes, 1976). Habitat functions to provide wildlife corridors, shelter, nesting grounds, foraging grounds, and water for wildlife including reptiles, amphibians, insects, birds, and mammals. Many endangered plant and animal species are dependent on wetland and riparian habitats for their survival in the RCW. The loss or conversion of habitat over time will signify a reduction in overall habitat quality for wildlife. Type conversion can eliminate some species' use while increasing others. Over time with the perennialization of the streams, increased cover has potentially benefited some species, such as the southwestern willow flycatcher and has improved the habitat potential to support species like the least Bell's vireo. However, with the degradation or loss of floodplain habitats, other species are potentially negatively affected, such as the Cooper's hawk that use the large sycamores for roosting and nesting.

Hydrologic functions are those related to the quantity of water that enters, is retained, and leaves a wetland. These functions include such factors as the flood storage and flow alteration as well as groundwater recharge and discharge. Wetlands and riparian areas under fully functioning conditions store floodwaters by spreading water out over the floodplain areas. These floodplain areas are accessed when overbank flow occurs. This temporary storage of water decreases runoff velocity, reduces flood peaks, and distributes storm flows over longer time periods, which in turn causes tributary and main channels to peak at different times. Wetlands with available floodplains store and release water over an extended period of time. When the floodplains become hydrologically isolated, as is the case with much of Rose and San Clemente Creeks, peak flows increase as well as runoff velocities, resulting in channel incision, erosion and further isolation from the alluvial deposits of the floodplain. This ultimately results in the impairment of the hydrological conditions within the watershed and the benefits the wetlands provides. Alluvial ground-water recharge and discharge are hydrologic processes that occur when water is stored on available floodplains. Alluvial ground-water discharge provides water necessary to the survival of juvenile riparian trees, other riparian plants and also provides water that leaves the riparian area as stream flow. Groundwater recharge to aquifers can also be an important hydrologic function. Recharge takes place through the bottoms of some streams, especially in the arid West. Some recharge also takes place when floodwater moves across the flood plain and seeps down into the water-table aquifer. So while alluvial ground-water processes have been impaired due to the disconnection of the floodplain (alluvial deposits) from the creeks flood flows, the over-all water-table within the urbanized portion of the watershed has been increased due to the perennial nature of urban runoff.

Major water quality functions of wetlands and riparian areas include: (1) nutrient transformation (2) sediment storage (3) retention of pollutants and nutrients, and (4) erosion reduction. Urban runoff transports nutrients, sediments, pollutants including trace metals, and organic materials. Wetland and riparian areas, particularly floodplains work to trap, transform and recycle many of these waterborne constituents. Water quality improvement can be significant as water leaves these riparian areas (Mitsch and Gosselink, 1993; Elder, 1987). Wetlands can maintain good water quality and improve degraded water. These areas are effective at removing sediments, suspended solids, phosphorous and nitrogen from the water profile, and store these nutrients and sediments within the floodplain. Nutrient transformation may include removing nitrates and transforming them into ammonia, a nutrient more readily available for plant absorption. The floodplains act as sinks for some materials. Pollutants attached to sediments are also retained as water spreads out on the floodplain and precipitates out of the water column. Wetlands are a major sink for heavy metals and for sulfur, which combines with metals to form relatively insoluble compounds. As flood flows overbank and are spread out across the floodplain, water velocities are reduced thus resulting in less erosion downstream as well. Without adequate access to the floodplain, water quality functions remain impaired. In addition to the wetlands which can serve to improve water quality, improvements to water quality should be directed at the source, by minimizing nutrient and toxic materials from entering the streams, as well as treating them before they are incorporated into natural waterways.

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2. Approach

2.1 – DEVELOPMENT OF ANALYTICAL TOOLS

As part of this project a set of analytical tools were developed (numerical computer models and empirical methodology) to analyze the hydrology, hydraulics, sediment transport, and geomorphology of the RCW in order to identify wetland and riparian restoration opportunities that would reconnect floodplains and restore habitat, hydrology and water quality functions. The analytical tools were developed to a level suitable for planning-level analyses utilizing methodologies that are understandable and acceptable to the relevant stakeholders (e.g., resource agencies, land owners, regulatory agencies, non-profits and interested public). The analytical tools allow for informed decision-making by the relevant stakeholders. The tools developed are readily transferable for use during the environmental review process and possibly future engineering and design.

The analytical tools used identify the specific fluvial processes (e.g., streambed erosion, streambank cutting, sedimentation) that dominate the morphology of the watershed stream network. The dominant processes were then utilized to establish the linkages between the causes and effects of significant morphologic features (e.g., channel migration and degradation). These results also established the historical context of the stream network for use in assessing future morphology associated with components of the watershed restoration opportunities.

Prior to the initiation of the project, cbec eco engineering (cbec) reviewed relevant existing data and information pertaining to the RCW that were used in development of the analytical tools. Relevant data included measurements of precipitation, stream flows, and water levels as well as topographic maps, photographs, geologic maps, anecdotal accounts, and soils maps. Relevant information consisted of prior reports summarizing hydrologic, hydraulic, sediment transport, and geomorphic analyses and studies. Some of the information reviewed included:

- Urban Runoff Management Program Storm Water Best Management Practices, City of San Diego, February 21, 2001.
- Mission Bay and Coastal La Jolla Watersheds Urban Runoff Management Program – Fiscal Year 2003 Annual Report, City of San Diego, 2003.
- Mission Bay and Coastal La Jolla Watersheds Urban Runoff Management Program: Stormwater Pollution Protection Program, City of San Diego, January 2003.
- Rose and Tecolote Creeks Water Quality Improvement Project, City of San Diego, February 2003.
- Constructed Wetlands in the Rose Creek Watershed, City of San Diego Water Department, August 2001.
- Rose Creek Canyon Enhancement Plan. Report to The Nature School, KTU+A, June 2000.
- Rose Creek Watershed Opportunities Assessment, Prepared for San Diego Earthworks, KTU+A, April 2005.
- Rose Creek Biological Habitat Assessment, Prepared for San Diego Earthworks, Trestles Environmental Corporation, 2009.
- Flood Hazard Information, Rose Canyon and San Clemente Canyon, Report to the County of San Diego, USACE 1970.
- Watershed Erosion / Sedimentation Study – Rose and San Clemente Canyons. Report to the City of San Diego, Woodward-Clyde Consultants, 1986.
- Planning Level Delineation of Aquatic Resources, Floodplain Mapping, and Functional Assessment of Riparian Ecosystems at Marine Corps Air Station, Miramar. Report to MCAS Miramar, ERDC WES and CRREL, July 2001.

- Final Technical Memorandum #3 – City of San Diego Public Utilities Department, Wet Weather Intermittent Stream Discharge Feasibility Study. Report to City of San Diego Public Utilities Department, February 2010 by Everest International Consultants.

2.2 - BASELINE DATA COLLECTION

Cbec performed a stream network field assessment and collected additional baseline data to observe and document the conditions of the watershed stream network. The field assessment encompassed the Rose Canyon main stem drainage as well as the San Clemente main stem from I-805 to Mission Bay. The field assessment included photographic documentation at key observation points, hydraulic field surveys, stream bed sediment characterization, and water level monitoring. Additional details of the baseline data collection are provided in the Appendices. A summary of the procedures used to collect these data are provided below.

Information and data collected during the baseline surveys included the establishment of base flows, flood flows, flood levels (inundation maps), sediment yield, and sediment delivery under existing conditions. These results established the baseline conditions for comparison with the results of the same analytical tools applied to the habitat restoration alternatives.

2.2.1 - Hydraulic Field Surveys

Cbec conducted a hydraulic field survey as a part of the baseline data collection effort and was used primarily in the development of the hydraulic model. This effort involved the collection of cross sectional topographic data of the low flow channel and the adjacent floodplain as well as other key features such as bridges and culverts, as shown in Figure 5. These data were prepared in California State Plane (CASP) 1983 Zone 6 (feet) and NAVD 88 vertical datum (feet). The relative densities in vegetative cover and channel bedforms that affect the efficiency of flow conveyance (hydraulic roughness) were also observed as a part of this effort.

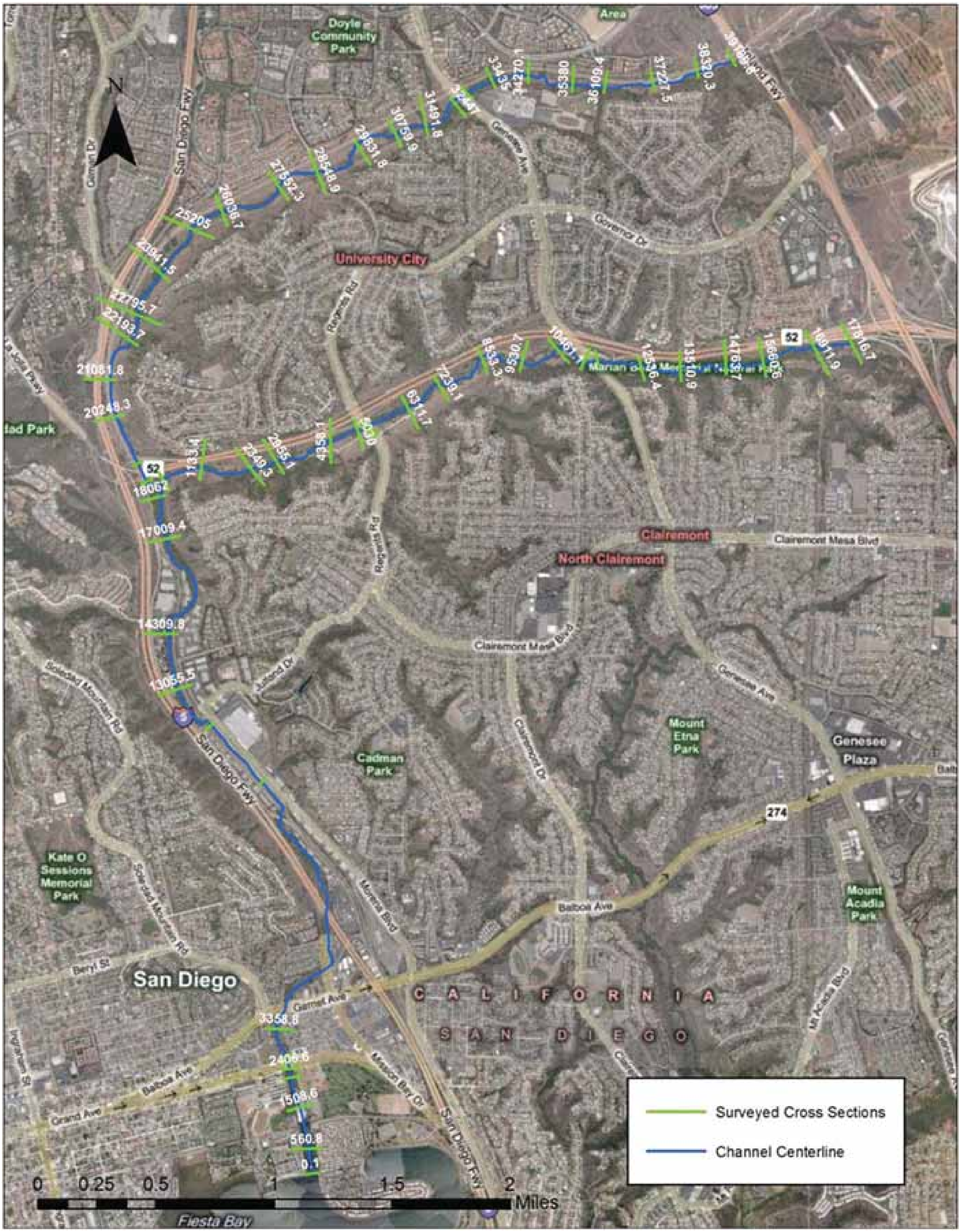
Photo 1: GPS Total Station used to survey cross sections

Photo 2: Stadia rod used to survey cross sections

2.2.2 – Streambed Sediment Characterization

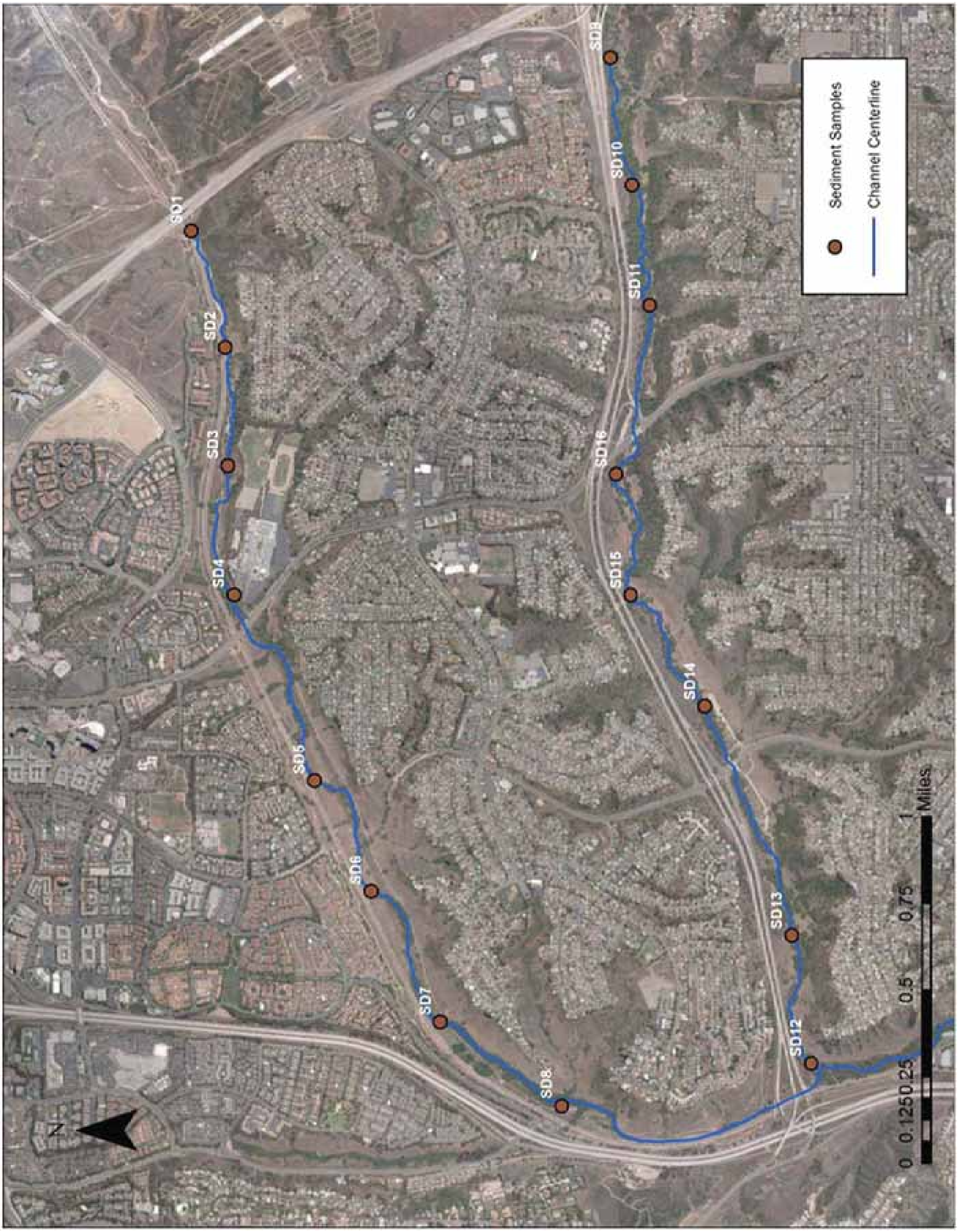
Cbec characterized the size of the streambed sediments within the project reach in an effort to analyze the sediment mobility of the corridor under existing and future rehabilitation conditions. The location of sediment sampling is shown in Figure 6. At each location a sediment grab sample was collected. The sediment samples were analyzed for particle sized distribution (PSD) at a laboratory (See Technical Appendices for analysis results) The sediment size data (PSD) were compared to velocity data derived from the hydraulic model, in conjunction with

Figure 5 – Locations of Surveyed Cross Sections



Notes: Image depicts location of surveyed cross sections used in hydraulic model development. Aerial image from Bing maps.

Figure 6 – Locations of Sediment Samples



Notes: Streambed sediment samples collected at these locations were analyzed for particle size distribution (PSD) and used as baseline data for sediment transport analysis. Aerial image from Bing maps.

published maximum incipient velocity to initiate sediment transport, to determine sediment mobility thresholds for Rose Creek and San Clemente Creek. For example, according to published literature, the velocity required to transport a 1-inch diameter gravel particle is 5 feet per second (ft/s) (Fischenich, 2001). Velocity results from the hydraulic model will be compared to this threshold value (5 ft/s) to determine if that gravel particle (representing the streambed) will be mobilized during a specific storm event.

Photo 3: Samples were collected to characterize the size of the streambed sediments within Rose and San Clemente Creek. These data were used to help determine the mobility of these sediments during specific flow events.

2.2.3 – Water Level Data Collection

Continuous water level (stage) data was also collected at six key locations, as shown by Figure 7, within the project reach beginning in mid January 2010. These data are referenced to the NAVD 88 vertical datum and were used to help validate results derived from the hydraulic model.

2.3 - MODEL DEVELOPMENT

A HEC-RAS (RAS) 1-dimensional hydraulic model was developed for approximately 11 miles of Rose and San Clemente Creeks within the RCW from I-805 to Mission Bay. Model development was facilitated by using HEC-GeoRAS, which is a GIS interface for pre-processing model inputs (i.e., cross sections) and post-processing model outputs (i.e., inundation maps). Modeled flows include the 2-, 5-, 10-, 25-, 50-, and 100-year storm events. Further details of the hydraulic model are provided in the Technical Appendices. A summary of the data and procedures used to construct this model is provided below.

2.3.1 - Topography

Topography used in the hydraulic model was developed using cross sectional surveys of the low flow channel and adjacent floodplains, collected as described in Section 2.2. Measured cross sections were taken at approximately 500 to 1,000 feet intervals as shown in Figure 5. These data were

Photo 4: Water level data logger components and protective housing

Photo 5: Field installation of water level data logger

Figure 7 – Locations of water level data loggers

Notes: Aerial imagery from Bing maps.

supplemented with a 1999 topographic dataset developed by the City and County of San Diego (SANGIS). This dataset was collected and processed to an accuracy suitable to develop 2-foot contours. All were prepared in California State Plane (CASP) 1983 Zone 6 (feet) and NAVD 88 vertical datum (feet).

2.3.2 - Hydraulic Structures

Bridges and culverts that were incorporated into the model geometry include Genesee Avenue and Regents Road. Other hydraulic features associated with the concrete lined flood control channel downstream of the confluence were also incorporated. This process involves characterizing the area in which water is conveyed through the certain structures. For example, to quantify the flow area under a bridge one would need to characterize height of the deck, the topography of the stream as well as the location of the bridge piers and abutments.

2.3.3 – Hydraulic Roughness

Hydraulic roughness (Manning's roughness) values that correspond to the density of vegetative cover and channel bed forms (boulders, cobbles and undulations in the bed), which describe the efficiency of flow conveyance in the channel and floodplain, were estimated during the hydraulic field survey using published guidelines (Chow, 1959). These values ranged from 0.02 to 0.1. As an example, the hydraulic roughness of a coarse gravel bed stream with minimal obstructions is approximately 0.035; whereas a dense area of coastal sage scrub could have a roughness as high as 0.08.

2.3.4 – Model Boundary Conditions

An HSPF hydrologic model of the RCW developed for the City of San Diego by Everest International Consultants (Everest, 2010) was utilized to derive unsteady flow boundary conditions for the hydraulic model. This model utilized historic rainfall data (hourly, 1970-2006), soils permeability data, land use data and topographic data to produce unsteady flow hydrographs (hourly) for each of the sub-watersheds within the RCW for the 2-, 5-, 10-, and 25-year return interval storm events. The boundary conditions for the 50- and 100-year return interval storm events were modeled in steady state according to FEMA prescribed flows.

The hydraulic model includes a total of 14 boundary conditions for 2- to 25-year return interval events as shown in Figure 8. Of these 14 boundary conditions, 13 were unsteady flow inputs derived from the HSPF hydrologic model. The hydraulic model includes two unsteady flow inputs immediately downstream of I-805. The remaining 11 flow inputs were modeled as lateral inflows along Rose and San Clemente Creeks. The downstream boundary is a water surface elevation that represents an average tide condition (6.0 ft) according to FEMA guidelines. The location of the boundary positions are as shown in Figure 6.

2.3.5 - Inundation mapping

HEC-GeoRAS was utilized to map the maximum inundation extents for the 2-, 5-, 10-, 25-, 50-, 100-year return interval flow events. These results were used to determine the frequency of inundation for portions of the floodplain under existing and proposed project conditions. These frequency data were used to determine the appropriate extent of grading and plant community type for proposed restoration sites.

2.3.6 – Sediment Mobility Analysis

The sediment size data (PSD) were compared to velocity data derived from the hydraulic model, in conjunction with published maximum incipient velocity to initiate sediment transport, to determine sediment mobility thresholds for Rose Creek and San Clemente Creek under existing and proposed conditions. Sections 2.2.2 and 3.8 contain addition information on the sediment mobility analysis.

2.3.7 - Model Limitations

The hydraulic model was developed as a tool to test the restoration feasibility of potential sites within the RCW, with a primary focus from I-805 to the confluence. The model is intended to be used as a planning tool to aid in the concept level development of future potential restoration alternatives and as a

Figure 8 – Model boundary conditions

Notes: Uniform later inflow boundaries are distributed along the entire channel length within the subwatershed to allow for gradual flow increase. Aerial image from Bing maps.

baseline tool for the development of a final design of selected restoration sites.

However, the hydraulic model was constructed at the watershed scale. The topographic data used to construct the model was collected at 500 to 1,000-foot intervals and not at a scale appropriate for analyzing the *final design* of particular restoration scenarios. Additional topographic and hydraulic roughness data should be incorporated into the project reach when the selected restoration projects are to be implemented. Alternatively, hydrologic data could be extracted from the existing model to serve as the boundary conditions for a separate hydraulic model that needs to be developed for analysis of the final design of a particular restoration site.

The hydraulic model in its current state is not intended to be used for flood prediction / mapping purposes, according to FEMA guidelines. Several updates to the lower portion of the model should be implemented in order for it to be used as a flood prediction / mapping tool. These additional updates may include a denser network of topographic cross sectional data and the implementation of certain hydraulic structures that exist within the flood control channel downstream of the confluence.

2.4 SELECTION OF FLOODPLAIN RECONNECTION SITES

The Opportunities Assessment identified a number of sites that appeared suitable for wetland/riparian habitat restoration based on landform, adjacency to the creeks, and non-native or lower quality existing habitats. As part of this effort, both Rose and San Clemente Canyons were traveled via bicycle or on foot to re-assess each of the sites identified within the Opportunities Assessment, as well as look for additional potential sites suitable for further investigation and restoration planning. The sites included in Section 5 are those sites along the main stems of Rose and San Clemente Creeks that could be modeled by the tools developed for this effort. Additional sites along some of the tributary canyons are still viable, but could not be modeled within the limitations of the tools developed for this effort.

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3. Existing Conditions

3.1 - WATERSHED CHARACTERISTICS / REGIONAL SETTING

The RCW contains two main drainages – Rose Creek and San Clemente Creek, as well as steep canyons and broad mesas. The headwaters of Rose and San Clemente Creeks develop on the MCAS Miramar and flows to the west. The confluence of these two creeks joins near the intersection of Interstate 5 and State Route 52 and turns to flow south, eventually emptying into Mission Bay. Relatively steep foothills and canyons in the upper and lower watershed, and broad mesas in the middle watershed characterize the RCW. MCAS Miramar occupies the upper watershed while residential and commercial development dominates the watershed's land use from I-805 to Mission Bay.

3.2 - SOILS

Approximately 20 different soil series are found within the project limits. Four of those series represent more than 80 percent of the project limits, including the Redding series, Chesterson series, urban land complexes, and loamy alluvial lands. Redding soils are found primarily on the MCAS Miramar outside the project limits. Riverwash soils are found within canyon bottoms and drainages. Upland soils include the Carlsbad, Chesterston, Cieneba, Corralitos, Gaviota, Huerhuero, Olivehain, Redding, and Salinas series, in addition to area defined as Terrace escarpment, gravel pit and unclassified soil types. See Figure 9 for a map of the soils within the project limits.

3.3 - VEGETATION COMMUNITIES/ FLORA

The project limits support three principal habitat groups, including urbanized lands, upland habitats, and wetlands and other drainages. Table 1 and Figure 10 present a detailed breakdown of the specific plant communities within the project. Plant communities are identified and classified according to the Holland/Oberbauer Terrestrial Vegetation Classification System adapted for San Diego County (February 1996). Regional vegetation mapping was made available from SANDAG and augmented by field surveys and aerial mapping during the 2005 Opportunities Assessment. Southern coast live oak riparian forest, southern cottonwood willow riparian forest, southern maritime chaparral, southern riparian forest, southern riparian scrub, San Diego mesa hardpan vernal pool, valley and foothill needlegrass grassland are all listed as California Department of Fish and Game sensitive communities documented within the project limits. Southern willow scrub vegetation is found principally within Rose and San Clemente Canyons. Southern sycamore riparian woodland is found principally in San Clemente Canyon.

For the purpose of this report, the focus is on the riparian areas, and more specifically the natural sustainment of the sycamore woodlands which are a significant character defining element of these canyons. Further refinement of the vegetation mapping has been made to clarify the vegetation communities in these areas.

A Manual of California Vegetation (Sawyer, 2009) describes California Sycamore (*Platanus racemosa*) as typically co-dominant with Coast Live Oak (*Quercus agrifolia*), Black Willow (*Salix goodingii*), Arroyo Willow (*Salix lasiolepis*), and several other tree species within riparian woodlands from inland drainages in northern California south through coastal San Diego county and beyond into Baja California. It describes the Sycamore's typical habitat as being along gullies, intermittent streams, stream banks, and terraces adjacent to floodplains that are subject to high-intensity flooding. Soils are typically rocky or cobbly alluvium with permanent moisture at depth. Trees produce plumed, wind-dispersed achenes annually. Fresh seeds germinate on moist, clayey sediments.

It also mentions that Sycamores appear to have specific germination requirements that limit their

Figure 9 – Soils

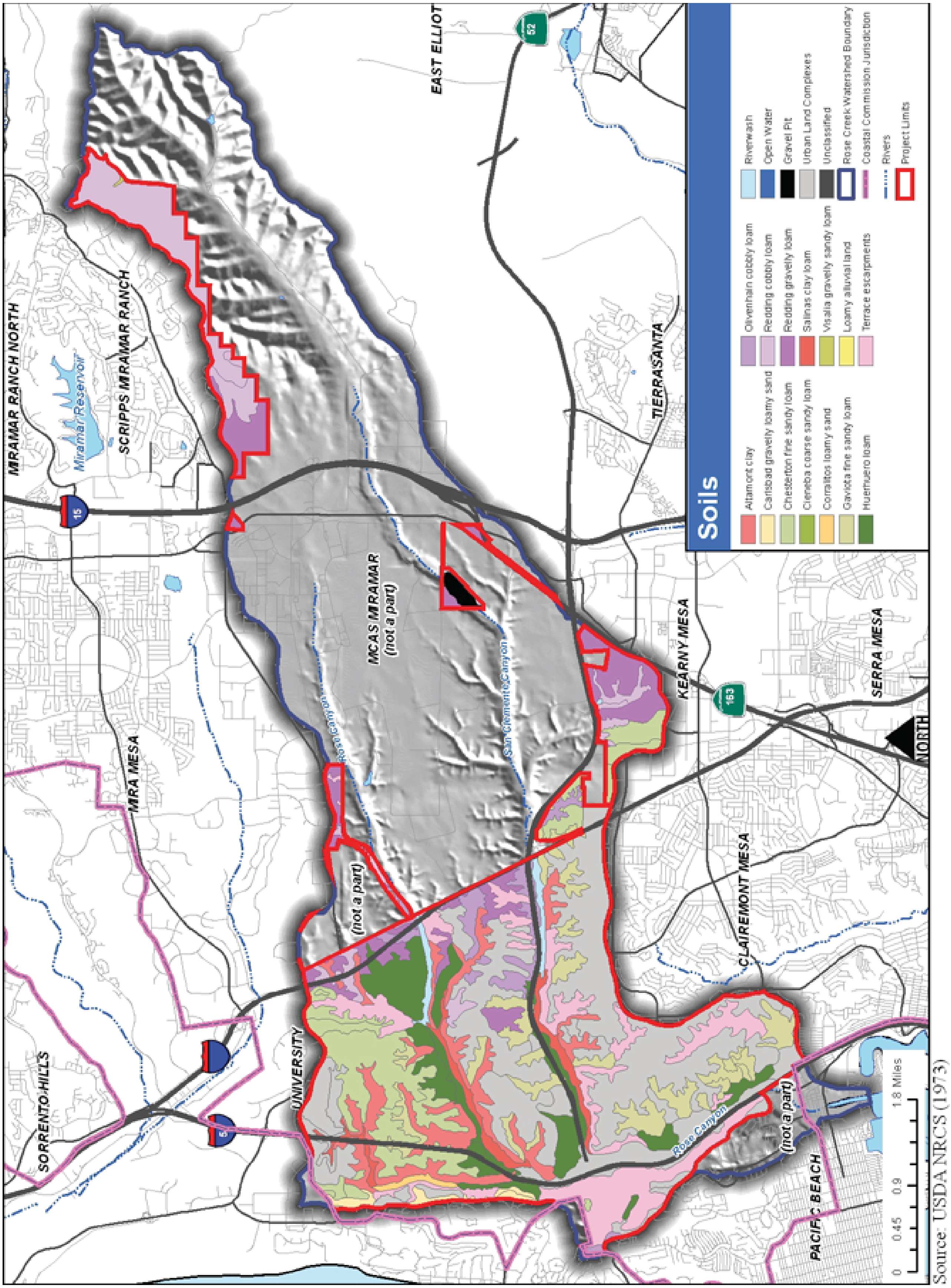
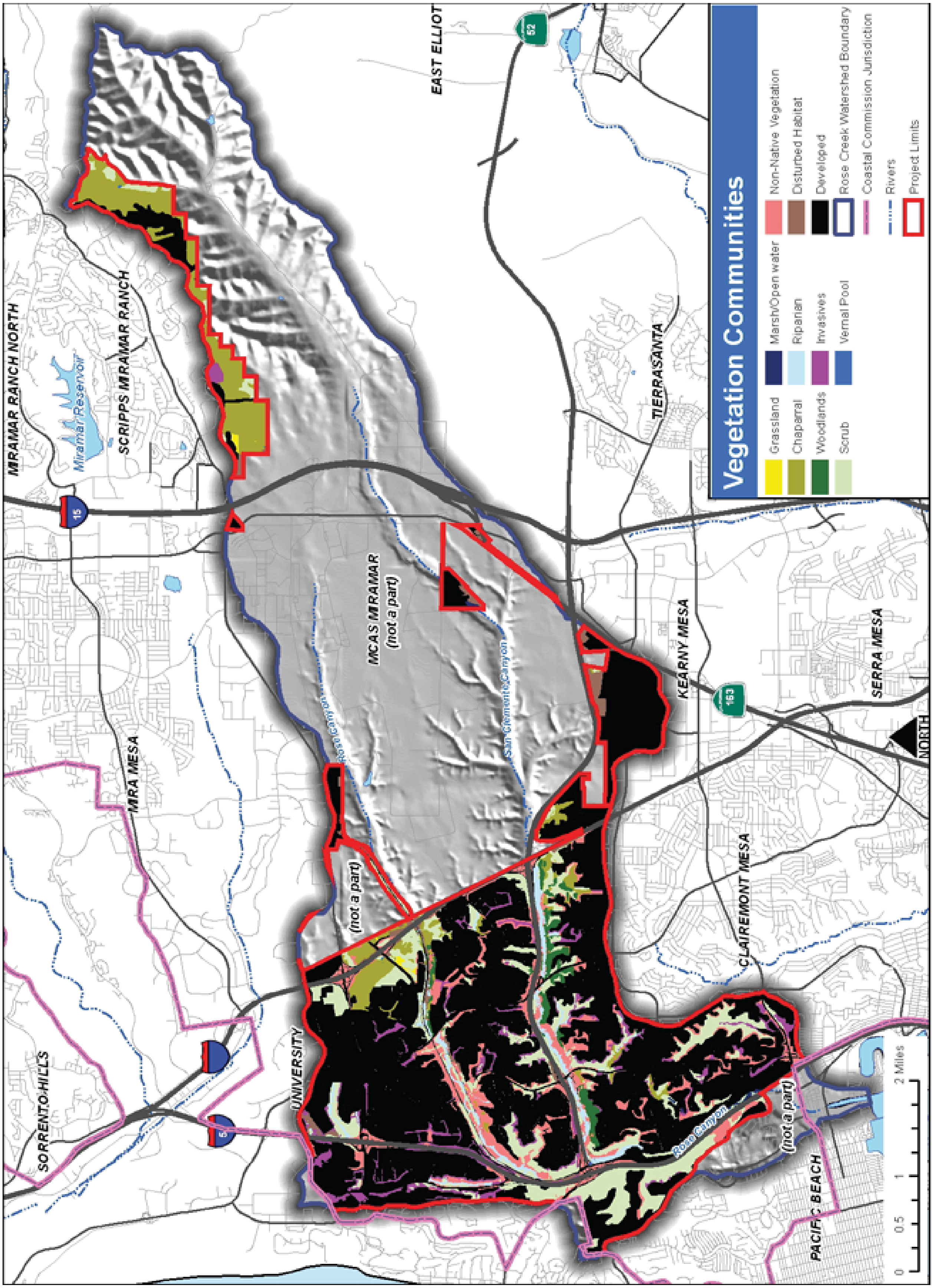


Figure 10 – Vegetation Communities



Source: SANDAG (1995) and field work by Merkel & Associates (2004)

Table 1 - Vegetation Communities within the Rose Creek Watershed Project Limits

Holland/Ober. Classification	Vegetation Communities	Equivalent SD City Vegetation Classification	Acreage Within Project Limits
12000	Developed/Roads	Disturbed (Tier IV)	6,639
11100	Eucalyptus Woodlands	Eucalyptus (Tier IV)	339
11300	Non-Native Vegetation/Disturbed	Disturbed (Tier IV)	1,023
42000	Valley and Foothill Grassland	Native grassland (Tier I)	15.4
32500	Diegan Coastal Sage Scrub	CSS (Tier II)	1110
37K00	Coastal Sage-Chaparral Scrub	CSS/Chaparral (Tier II)	26
37000	Chaparral Scrub	Chaparral (Tier IIIA)	399
37C30	Southern Maritime Chaparral	Chaparral (Tier I)	180
37200	Chamise Chaparral	Chaparral (Tier IIIA)	127
37120	Southern Mixed Chaparral	Chaparral (Tier IIIA)	48
37900	Scrub Oak Chaparral	Chaparral (Tier IIIA)	6.5
71160	Coast Live Oak Woodland	Oak Woodland (Tier I)	146
44321	San Diego Mesa Hardpan Vernal Pool	Vernal Pools	2.7
63310	Mule Fat Scrub	Riparian Scrub	1.5
63320	Southern Willow Scrub	Riparian Scrub	28
61320	Southern Arroyo Willow Riparian Forest	Riparian Forest	7
61330	Southern Cottonwood-Willow Riparian Forest	Riparian Forest	173
62000	Southern Sycamore Riparian Woodland	Riparian Woodland	1
61310	Southern Coast Live Oak Riparian Forest	Oak Riparian Forest	9.5
13200	Non-Vegetated Channel	Natural Flood Channel	2
13100	Open Water	Natural Flood Channel	8.2
52440	Emergent Wetland	Freshwater March	7
52400	Freshwater Marsh	Freshwater Marsh	1.2
Total			**10,297**

ability to colonize areas that are not scoured often by natural flooding events.

It goes on to describe more characteristics of the species: winter deciduous tree; seeds are short lived and transient, distributed by wind and water, and requires winter stratification to germinate; recruitment is typically episodic; and individual plants live between 25 and 400 years.

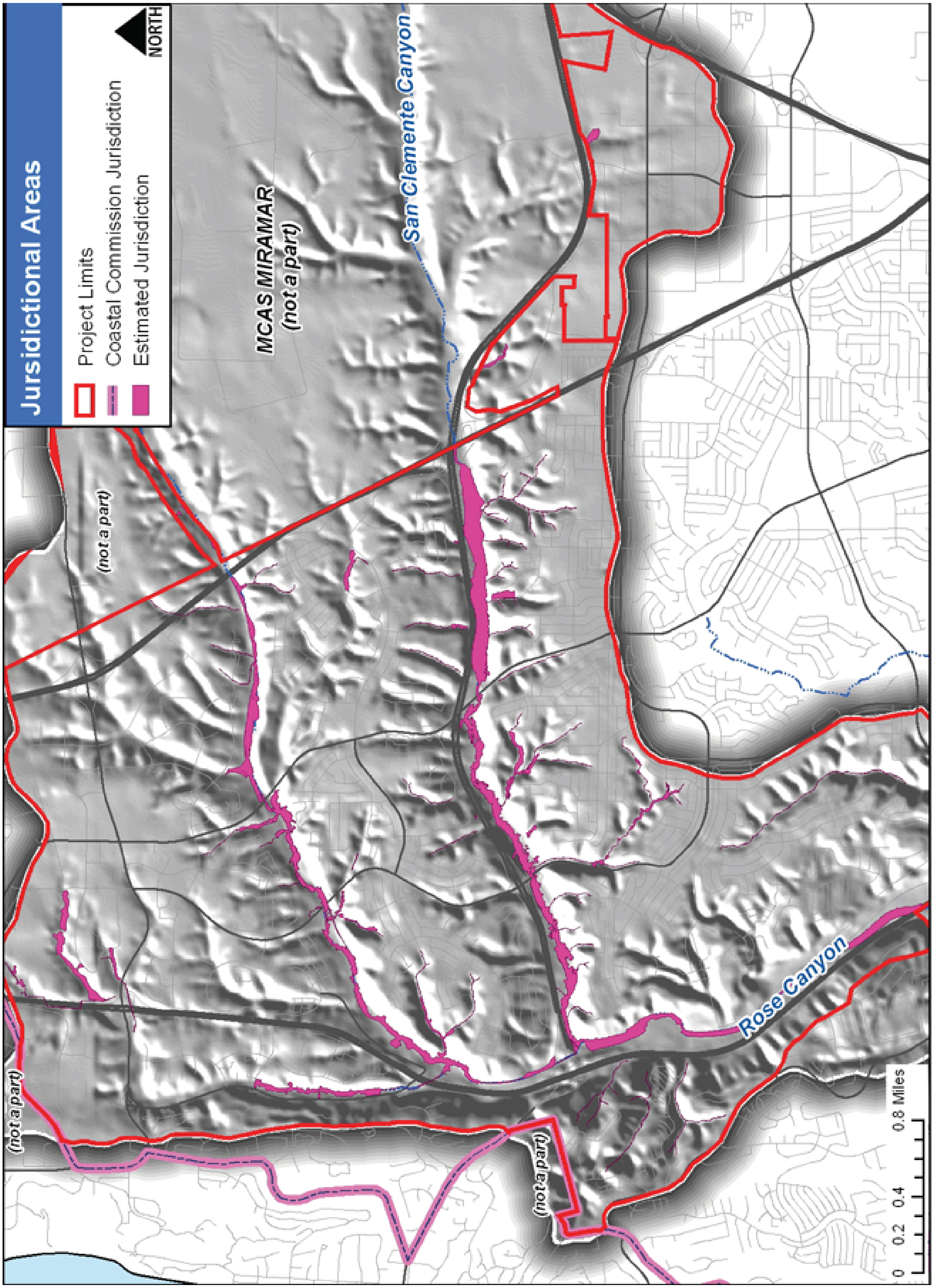
3.4 – WETLANDS & WATER RESOURCES

The RCW contains wetlands and jurisdictional waters resources including Rose Creek and San Clemente Creek. An estimate of total riparian and wetland habitat has been generated based upon known soil, topographic and vegetation mapping information provided by SANDAG and the NRCS. Limits of riparian vegetation have been overlaid with the soils and topographic information to provide an estimate of the maximum riparian jurisdiction within the project limits under existing conditions. Approximately 293 acres of jurisdictional riparian habitat is estimated within the project boundaries, as well as several vernal pools. Figure 11 depicts the limits of estimated jurisdiction.

3.5 – HYDROLOGY & HISTORIC CHANGES TO THE WATERSHED

The existing conditions hydrology of the RCW is heavily influenced by its land use. To date, the majority of the RCW, excluding MCAS Miramar, is considered to be in a full build-out condition, denoting that the majority of the watershed has been developed by residential or commercial properties. This development has led to a significant increase in the impervious surfaces (>35% impervious for subwatersheds west of I-805) within the RCW and has significantly altered its hydrologic regime (hydromodification). Hydromodification has caused significant increases in the magnitude and frequency of peak flows for a given storm event compared to historic conditions. Because the majority of the watershed was fully developed by the mid 1980's, few, if any best management practices (BMPs) were implemented to help mitigate for the increase in impervious surfaces. The lack of BMPs has allowed for not only increases in flows, but has also caused

Figure 11 – Wetland Habitats



Source: SANDAG 1995, SANDAG and USDA-NRCS (2000), USGS a substantial increase in the pollutants entering Rose and San Clemente Creeks compared to historic conditions.

A more subtle effect of urbanization within the RCW is the increased summer “nuisance flows”. These are flows that result from summer irrigation runoff within the watershed and have lead to a significant increase water supply and nutrients (from urban fertilizer use) for vegetative communities along the margins of Rose and San Clemente Creeks. When compared to the 1928 aerial photographs there is a discernible increase in the vegetation density along the creek corridor proceeding downstream from I-805 towards Mission Bay. This increase in vegetation density has likely contributed to a decreased efficiency of flow conveyance and consequently has resulted in increased flood levels for a given storm event compared to historic conditions.

A hydrological model of the RCW (HSPF) was developed in 2010 for the City of San Diego by Everest International Consultants as a subconsultant to RMC Water and Environment (RMC, 2010). This model utilized hourly rainfall data, soils permeability data, existing conditions land use data and topographic data to simulate historic flows for Rose and San Clemente Creek for a 36 year period of record (1970-2006). Cbec performed a statistical analysis (flood frequency – USGS Bulletin 17b) using the annual peak discharges output from this model to calculate the flow magnitude (recurrence interval) for a given storm event. These flows are listed in Table 2 below. Due to the limited period of record and the lack of extreme hydrologic events that occurred within the simulated period, the FEMA prescribed flows were selected for the 50 and 100 year flood events.

Table 2: Results of Flood Frequency Analysis using HSPF Model Output for the 2- to 25-Year Return Interval Events

Annual Exceedance Probability	Flood Event	Peak Discharge (cfs)
0.5	2	2,406
0.2	5	3,264
0.1	10	3,817
0.04	25	4,501
0.02	50[1]	8,100
0.01	100[1]	12,000

[1] FEMA prescribed flow were selected for the 50- and 100-year return interval flood events.

3.6 – RIVER MORPHOLOGY & URBANIZATION

The effects of urbanization and subsequent hydromodification within the RCW have had profound impacts on the morphology of the channels of Rose and San Clemente Creeks. The increase in the magnitude and frequency of high flow events has led to an increase in erosive forces compared to historic conditions. The 1928 aerial photographs depict an ephemeral to intermittent braided channel that contained sparse vegetation and little to no channel incision. As storm events occurred the active channel likely meandered across the floodplain without obstruction. Additionally, there has been a significant reduction in sediment supply as open space has been converted to developed land, which in turn, has disrupted a natural balance that existed between sediment supply and sediment transport. This imbalance has also led to an increase in erosive processes.

These increases have caused Rose and San Clemente creeks to deepen and widen into the canyon valley bottom. This deepening and widening process has hydrologically disconnected the channel from its floodplain, which has reduced or eliminated the frequency of floodplain inundation.

The influence of hydromodification progressively increases downstream through the RCW with the proportional increase of urbanized runoff. The effects of this are especially evident from I-805 to Mission Bay on both San Clemente and Rose Creeks. The channels become progressively incised with the increasing erosive forces moving downstream.

As hydromodification has impacted the morphology of the stream channels within the RCW for many years, it is likely that the channels have reached a state of vertical equilibrium; meaning that they will likely not continue to deepen into the valley bottom. However, observations made during the data collection phase suggest that in many locations, the stream channel is still actively widening, which is causing accelerated bank erosion. This erosion is likely to continue and the delivery of this eroded sediment will continue to impact water quality in lower Rose Creek and Mission Bay.

3.7 – FLOODING UNDER EXISTING CONDITIONS

The maximum water surface elevation was output from the hydraulic model for the 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals flows in an effort to examine the inundation extents within the RCW under existing conditions. This process involved utilizing the SANGIS topographic dataset and model results to map the maximum inundation footprint produced by these flow events. Figures 12 and 13 provide an example of the results produced by this exercise at floodplain restoration sites (mitigation for City of San Diego utility projects) that were previously constructed on Rose and San Clemente Creeks for the 2-, 10-, 25-, and 100-year recurrence interval flows. Figure 12 shows that the restoration site on Rose Creek is inundated at flows equal to or greater than the 2-year recurrence interval event and are completely inundated at flows equal or greater than the 10-year recurrence interval event. Figure 13 indicates that the restoration site on San Clemente are inundated at flows equal to or greater than the 10-year recurrence interval event. Water surface elevations for each recurrence interval at each modeled cross section are provided in the Technical Appendices.

3.8 – SEDIMENT MOBILITY UNDER EXISTING CONDITIONS

Cbec characterized the particle size distribution of the streambed sediments within the project reach in an effort to analyze the sediment mobility of the corridor under existing conditions. Generally, the sediments in Rose Creek and San Clemente Creek are non-cohesive, medium to coarse (1-2") gravels (see Technical Appendices PSD results). To accomplish this task, the sediment grain sizes of each sample were compared to published velocity thresholds with which these sediments would become mobilized (Fischenich, 2001). Table 3 shows these typical velocity thresholds for a range of sediment types. These thresholds were then compared to velocity output from the various model runs to determine at which storm events and what velocities mobilization of streambed sediments occurs.

Table 3: Typical Sediment Mobility Thresholds

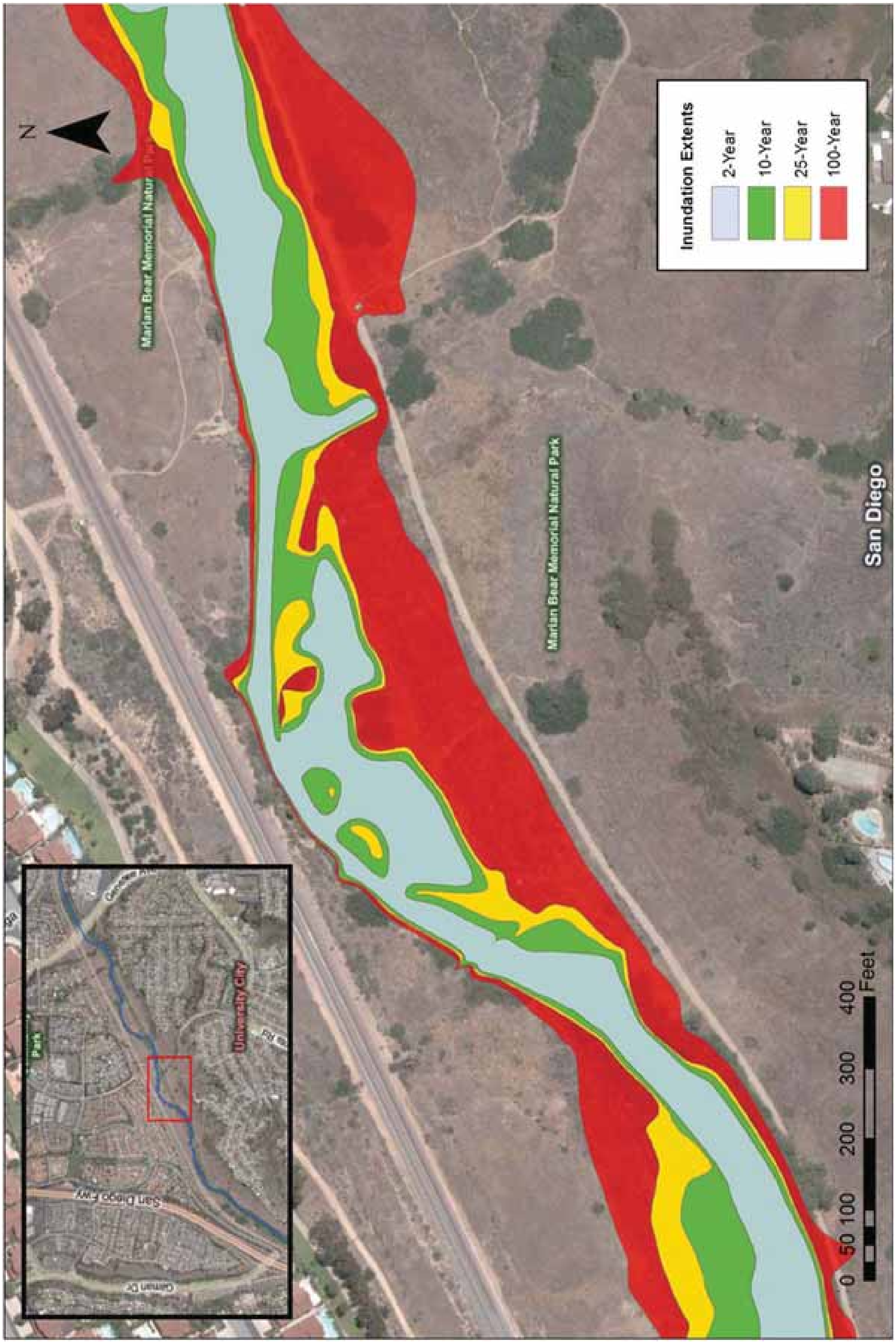
Sediment Type	Permissible Shear Stress (lb/sq ft)	Permissible Velocity (ft/sec)
Fine Collodial Sand	0.02-0.03	1.5
Sandy Loam (noncollodial)	0.03-0.04	1.75
Alluvial Silt (noncollodial)	0.045-0.05	2
Silty Loam	0.045-0.05	1.75-2.25
Alluvial Silt (collodial)	0.26	3.75
Gravel (1-in.)	0.33	2.5 – 5
Gravel (2-in.)	0.67	3 – 6
Gravel (6-in.)	2	4 – 7.5
Gravel (12-in.)	4	5.5 – 12

(Fishenich, 2001)

The results are of these analysis are displayed in Figures 14 and 15. In these graphs, data points that fall above the mobility threshold line indicate that bed sediments will be mobilized during a specific storm event. Figure 14 indicates that under existing conditions on Rose Creek, streambed sediments ranging in size from 1" to 2" become mobilized near the 10-year recurrence interval flow in the upper and in middle reaches, whereas sediment in the lower reach ranging in size from 1" to 2" is mobilized at flow events greater than the 2-year recurrence interval. Figure 15 indicates that the streambed sediment on San Clemente Creek is generally more resistant to erosion when compared to Rose Creek. On San Clemente, streambed sediment ranging in size from 1" to 2" is mobilized at flows near the 25-year recurrence interval in majority of the upper and middle reaches where as sediments ranging in size from 1" to 2" within the lower reaches are generally mobilized at flows near the 10-year recurrence interval.

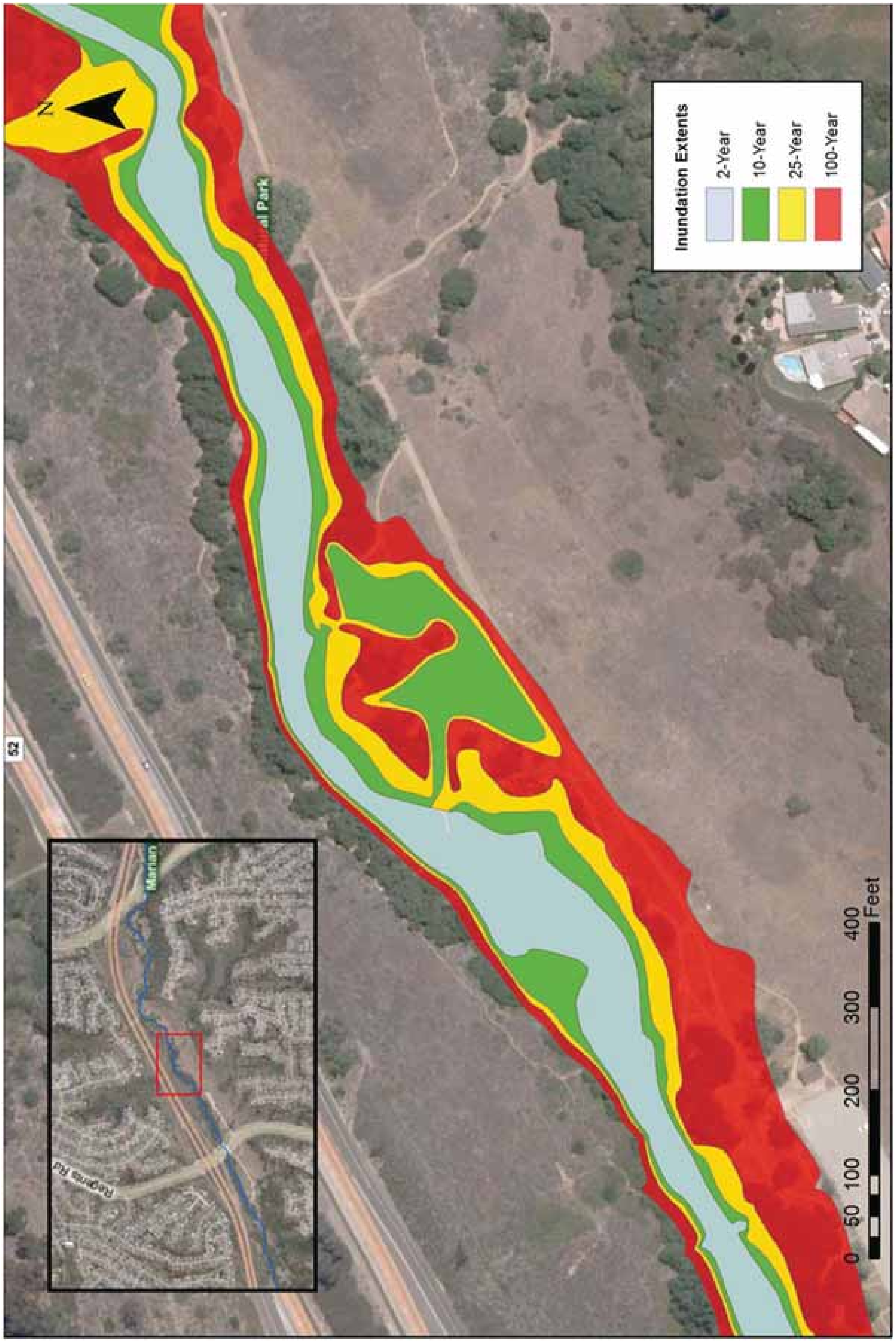
In watersheds similar to the RCW that have not been impacted by hydromodification, streambed sediments are typically mobilized at flows near the 10-year recurrence interval and are simultaneously replenished from sediment supplied from the upstream reaches as part of the natural equilibrium that exists between sediment supply and transport (Wolman and Miller, 1960). Because

Figure 12 – Existing Hydrologic Conditions - Rose Canyon



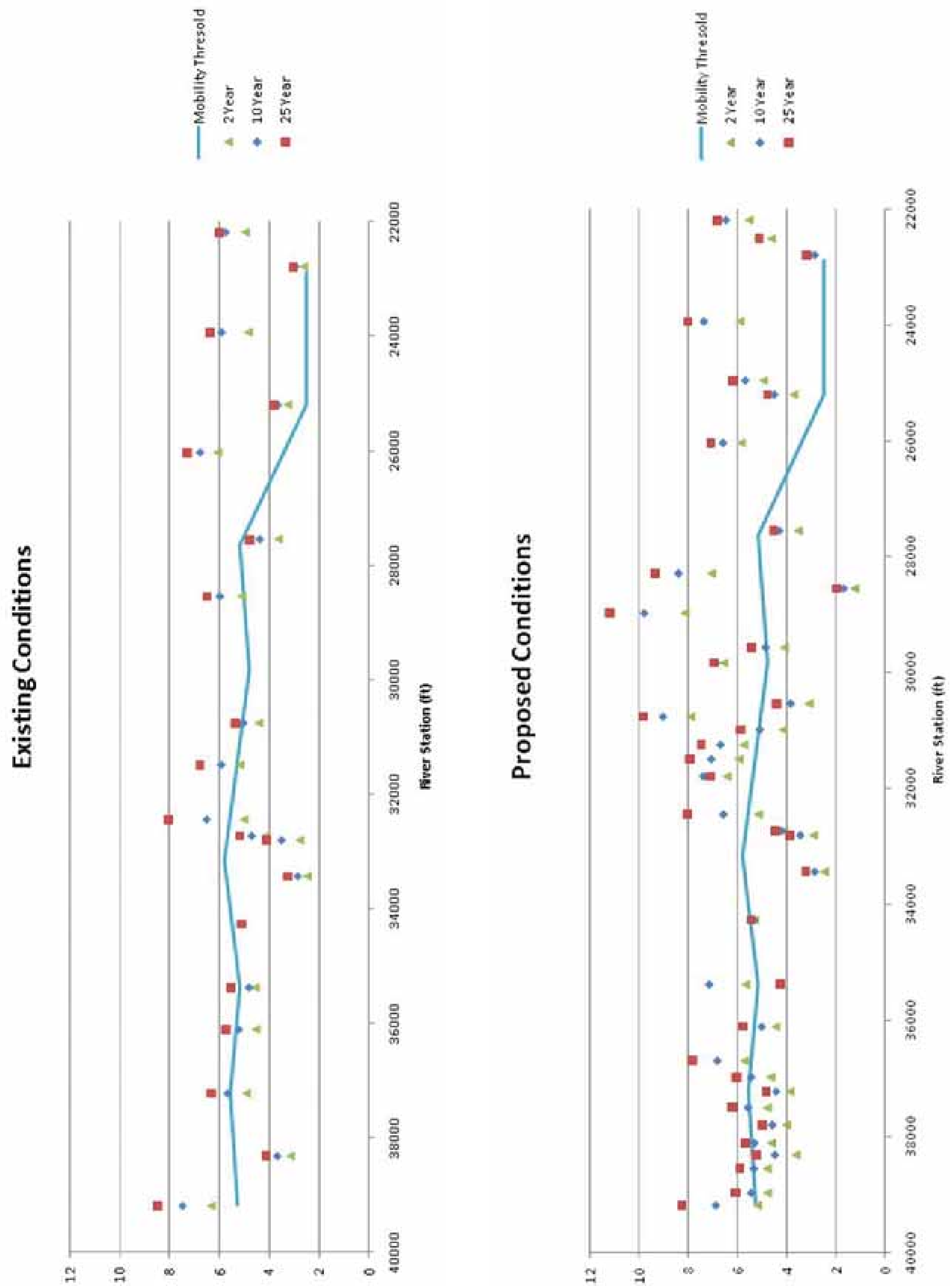
Notes: Inundation extents for the 2-, 10-, 25-, and 100-year recurrence interval flows on Rose Creek approximately 4500' downstream of Genesee Avenue. Aerial image from Bing maps.

Figure 13 – Existing Hydrologic Conditions - San Clemente Canyon



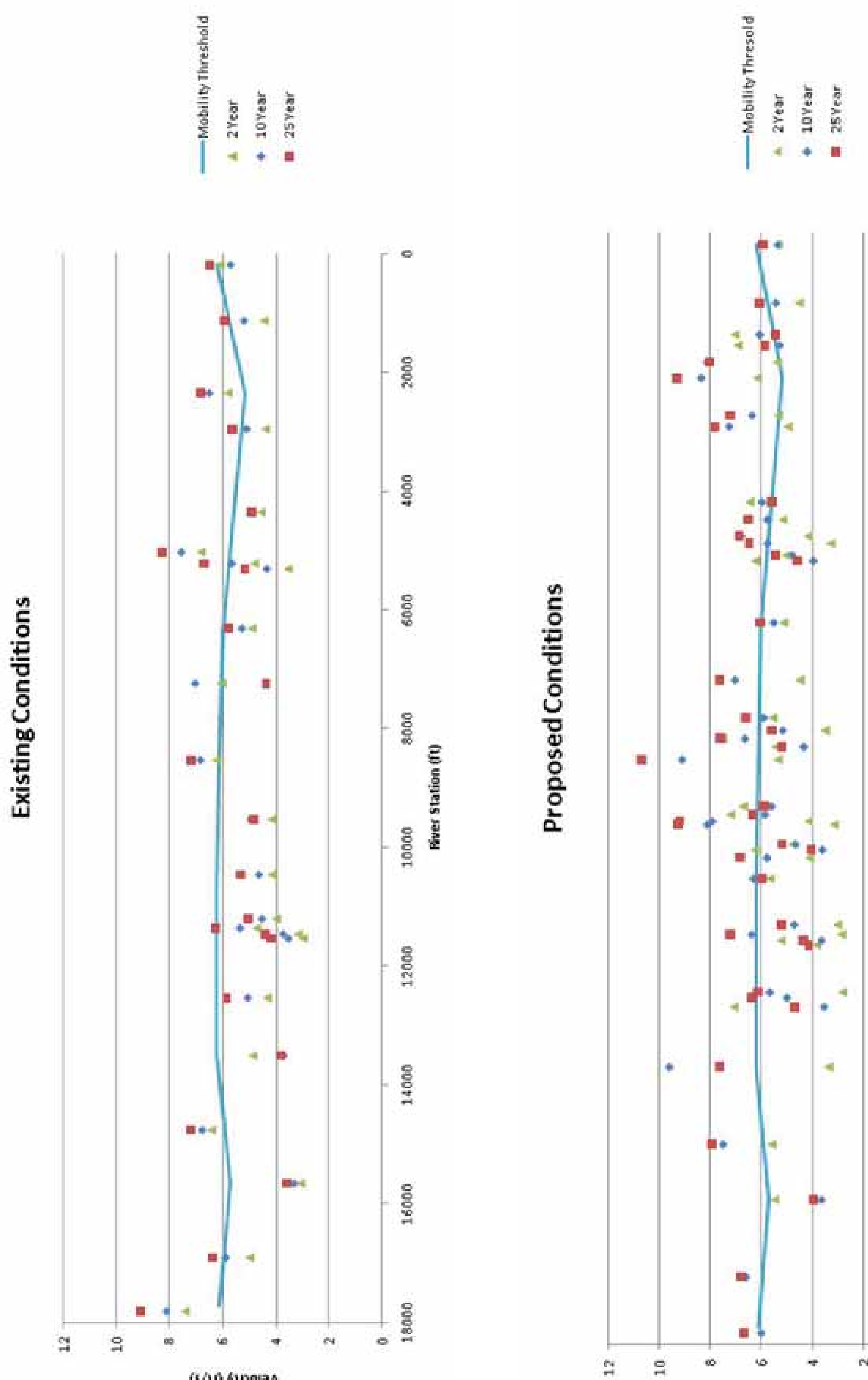
Notes: Inundation extents for the 2-, 10-, 25-, and 100-year recurrence interval flows on San Clemente Creek approximately 1800' upstream of Regents Road. Aerial image from Bing maps.

Figure 14 – Sediment Transport Analysis - Rose Canyon



Notes: Data points that fall above the mobility threshold line indicate that bed sediments would be mobilized during the specified storm event. See section 2.2.2 and 3.8 for additional information regarding bed sediment mobility.

Figure 15 – Sediment Transport Analysis - San Clemente Canyon



Notes: Data points that fall above the mobility threshold line indicate that bed sediments would be mobilized during the specified storm event. See section 3.8 for additional information regarding bed sediment mobility.

hydromodification has reduced the sediment supply and increased the flow magnitude, much of the smaller sediment particles, fine sands up to fine gravels ranging in size from 0.005” to 1” have been transported downstream and have not been replenished, which has led to a coarsening (armoring) in the size of the streambed sediments overtime. The results of this analysis support this theory as the mobility threshold for San Clemente Creek (which receives a higher proportion of urbanized runoff) is near the 25-year recurrence interval flow. Also, the PDS data suggest an overt lack of fine material within the sediment matrix. The results also support the assumption that both Rose and San Clemente Creek have reached a state of vertical equilibrium as the armored streambed sediments are likely inhibiting vertical incision.

3.9 – RESTORATION CONSTRAINTS

Habitat restoration in an urbanized watershed can be challenging due to existing physical and environmental constraints. In the Rose Creek Watershed these challenges are pervasive.

Physical constraints found within the valley bottom of Rose and San Clemente Canyons include:

- Sewerlines and high pressure gas lines within the valley bottoms
- Overhead powerlines
- Concrete lined channels found in several reaches of Lower Rose Creek
- Existing structures – parking areas, bathrooms, hiking trails, picnic areas, etc.
- Railway lines & freeways
- Historic structures

Environmental constraints found within the valley bottom of Rose and San Clemente Canyons include:

- Sensitive habitat – sycamore, oak, and willow woodland, coastal sage scrub, etc.
- Incised channels ranging in severity

Other constraints include potential future uses of the identified areas including the construction of additional railways, overhead bridges, and freeway expansion that cannot be ignored.

In identifying potential floodplain restoration and creation areas, the various constraints were considered, some proving to be unalterable, and others possible to overcome such as the relocation of certain structures. Where constraints were present, the team carefully considered the pros and cons of eliminating the constraint in terms of net environmental benefit. Economic considerations, although important, in this course-planning level document did not result in elimination of the identified area.

4. Is In-stream Concrete Removal Possible?

As discussed in Section 1.2, during the development of the Opportunities Assessment it was determined that there was not adequate accurate hydrologic and hydraulic information to fully assess if removal of the concrete channels within the lower watershed was feasible. To determine the feasibility of concrete channel removal, this hydrologic/hydraulic study was recommended as a follow action to the Opportunities Assessment. As such, one of the key issues that needed to be assessed as part of this effort was the feasibility of concrete channel removal within the lower watershed.

The existing conditions modeling validated that there is not adequate capacity within the concrete channels to allow modification or removal without potentially increasing flood risks, which is not acceptable. Therefore the only way concrete channel removal would be feasible is if sufficient flood detention/retention improvements and source control can be made within the upper watershed to reduce flood elevations within the lower watershed to provide adequate capacity within the channels to either fully or partially remove the concrete without sacrificing adequate flood protection.

Concrete structures line the in-stream channels in several areas of the watershed. The prime areas include along Lower Rose Creek at the Highway 5 and 52 intersection, and along Lower Rose Creek before the creek flows under Highway 5; and near the In and Out Burger. See Figure 16 for a location of the in-stream concrete structures. The presence of a hard structure produces significant environmental impediments for wildlife movement along a corridor; limits wildlife use including cover, foraging and nesting grounds; provides no water quality improvement benefits or water storage; and typically results in a net increase in water velocities downstream, which may result in channel incision or further degradation of wetland functions.

In an urbanized watershed, removal of these hard structures can provide increased habitat, water quality and floodplain functions. The question asked was: ***Is it possible to remove in stream structures in the Rose Creek Watershed and maintain safe hydrologic conditions during peak storm events?***

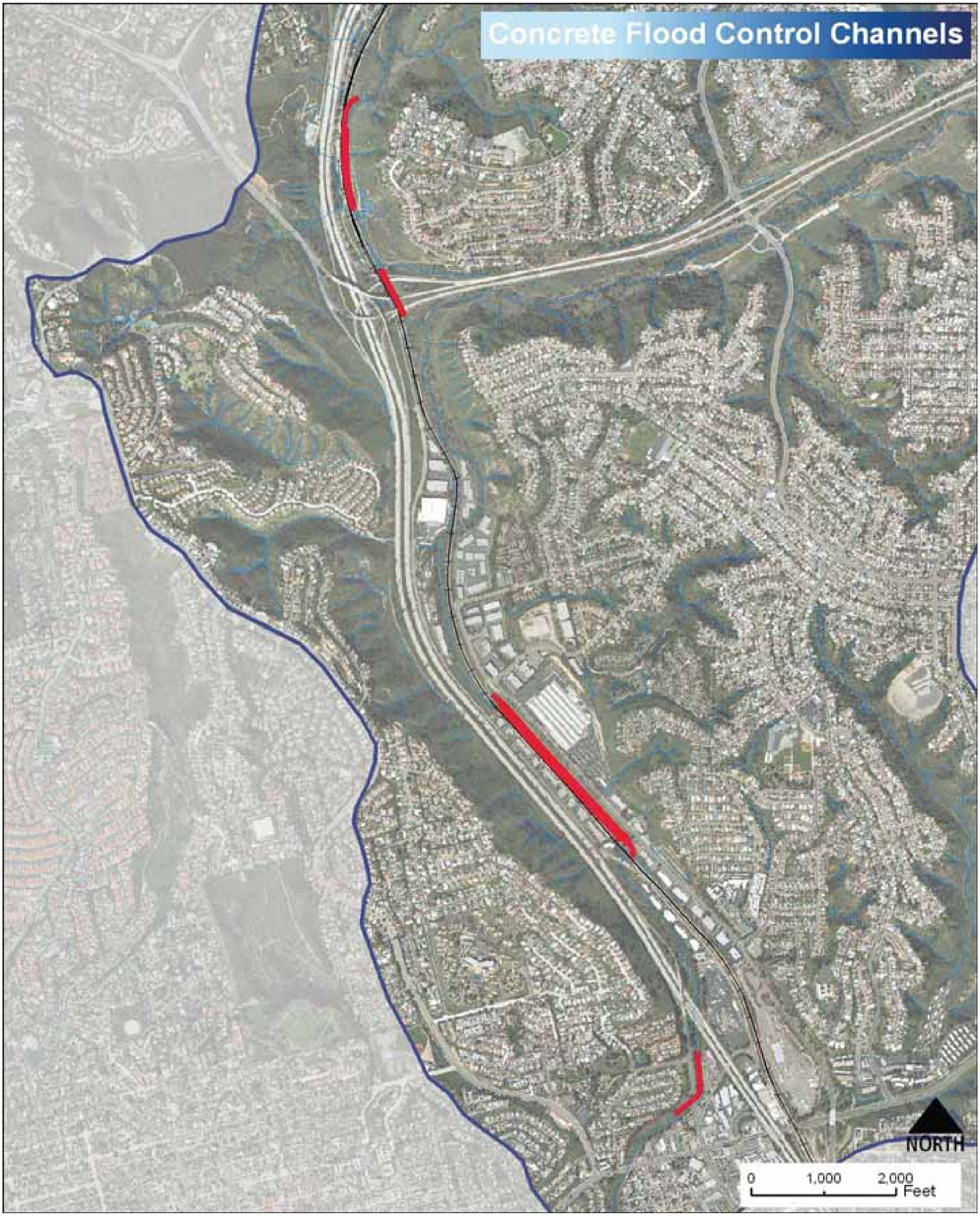
This restoration scenario was the first to be assessed within the hydrologic model that was developed to answer whether concrete removal is possible under any hydrologic alterations.

4.1 - ASSUMPTIONS

The "no constraints" restoration scenario was developed and modeled ignoring any and all environmental and physical constraints to floodplain restoration. The scenario assumed that habitats would be expanded where possible and adjacent areas graded down to capture the 10 year flood event. Floodplain grading or terracing would not encroach into areas greater than 15 feet above the existing stream bed. Where underground utilities such as sewer or gas pipelines were present, it was assumed that these lines would be relocated.

This scenario was conceived with the theory that by restoring hydraulic connectively of the main channel through floodplain terracing, flood flows would be attenuated or slowed in the created floodplain depressional areas enough to reduce peak discharges within concrete lined channels. If a significant reduction in peak water surface elevations could be achieved for the extreme flood event (100-year return interval), then it is plausible that modifications could be made, e.g., concrete removed, from the channels. If concrete removal was not possible under even the most extreme restoration measures, then it was not necessary to manipulate the model for less extreme conditions and thus this possibility would be eliminated.

Figure 16 – Locations of Existing In-stream Concrete Structures



4.2 - MODEL DEVELOPMENT

Under this scenario, modifications were implemented to the existing conditions hydraulic model to incorporate the "no constraints" floodplain grading plan. These changes primarily included the lowering of topographic cross sections within the selected floodplain areas (Figure 17) and the development of unsteady flow boundary conditions for the 100-year return interval flood event.

Under the existing conditions modeling scenario, steady state flow boundary conditions were implemented for the 50- and 100–year return interval flood events according to FEMA guidelines, while unsteady flow boundary conditions for the 2-, 5-, 10-, and 25-year return interval events were derived from the hydrologic model. Under this alternative, modeling the 100-year return interval event using unsteady boundary conditions was necessary to examine the potential of the floodplain terracing to attenuate flood flows and potentially decrease water levels in the concrete lined flood control channels. To accomplish this, the unsteady 25-year return interval flood boundary conditions were scaled to match the FEMA prescribed 100 year peak flood flows for the RCW. Hydraulic roughness values assigned to the proposed grading plan were consistent with the proposed vegetative palettes as prescribed by (Chow, 1959).

4.3 - RESULTS & DISCUSSION

Model results indicate a minor reduction in peak discharge and water surface elevation within the concrete lined flood control channels in the lower RCW. Figure 18 displays a longitudinal profile of the maximum water surface elevation within the flood control channel for existing conditions and the no-constraints scenario. The water surface elevation was reduced an average of 0.1 foot while peak discharges were reduced by approximately 186 cubic feet per second (cfs).

One possible reason why floodplain terracing had such a minimal effect in attenuating flood flows is because the storage volume provided by the terraces were relatively small when compared to the overall volume of water produced by such an extreme flood event (100-year). During the course of a flood event of this magnitude, floodplain terraces are rapidly filled during initial stages of the storm and by the time the peak flows are conveyed through the system, the floodplain terraces were filled and provided little or no additional storage to reduce the peak flows. Also, the relatively steep valley gradient of the RCW contributes for the lack of storage volume provided by the floodplain terraces.

While there are other off-channel detention alternatives that can provide more effective storage and attenuation, these alternatives are likely not consistent with the goal of restoring natural channel processes to the RCW. Additionally, the scale at which these off-channel detention facilities would need to be implemented to provide enough attenuation to allow for removal of portions of the flood control channel is likely not feasible st this time. Based on this model run, it was determined that a more holistic watershed scale approach of slowing the flow at the source would provide the best opportunity to reduce flood levels in lower Rose Creek.

Figure 17 – Typical Cross Section configuration used within the No Constraints Model

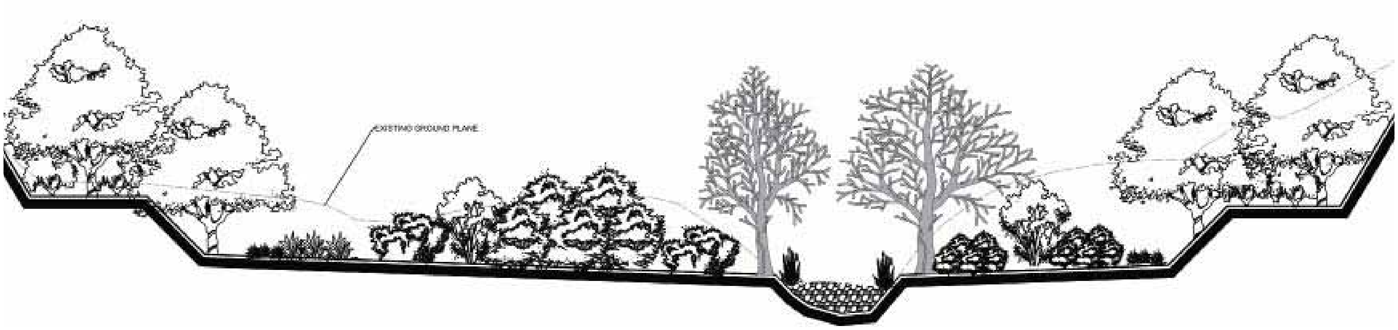
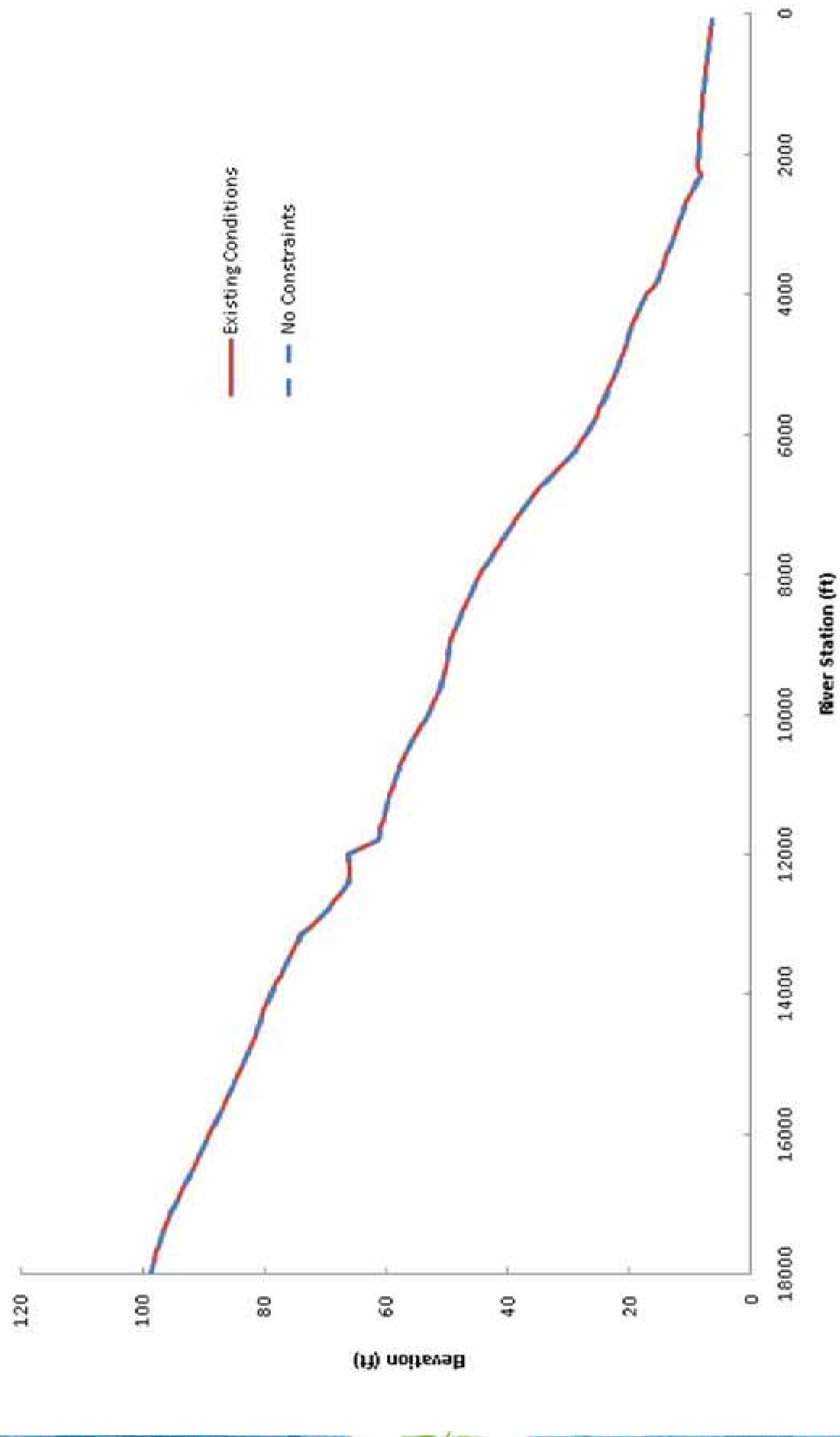


Figure 18 – Overview on In-Stream Concrete Removal Model



Notes: Water surface elevation data derived from hydraulic model for lower Rose Creek downstream of confluence for the 100-year recurrence interval flow. Results indicate minor reductions in flood levels associated with the "no constraints" alternative. Vertical datum references NAVD 88.

5. Restoration of Biological, Hydrologic & Water Quality Functions

To restore floodplain habitat and its associated functions, the incised creek must be able to overbank and flow into its floodplains during storm events. For much of the study area, under current conditions, the creek is too incised and remains within the channel during storm flows. Implementation recommendations include the construction of in-stream step pools (see Figure 19) to build the channel elevation back up and to grade adjacent habitat, if sediment transport studies determine that there is sufficient sediment in the system to allow for accumulation behind the structures. This less intrusive technique, should be implemented first in several of the locations. This would capture sediment being transported from upstream sources, and deposit the sediments slowly behind the steps. However, with the urbanization of the watershed, the runoff from impervious areas is typically sediment starved. Sediment input currently comes from adjacent eroding hillsides, as well as the headwater areas within MCAS Miramar. Thus step pools in themselves may prove a very long term solution. Step pools in combination with site grading will likely provide faster results to a healthier and functioning system.

Photo 6: Example of step pools within a creek restoration

Figure 19 – Typical Step Pool Construction Section and Profile

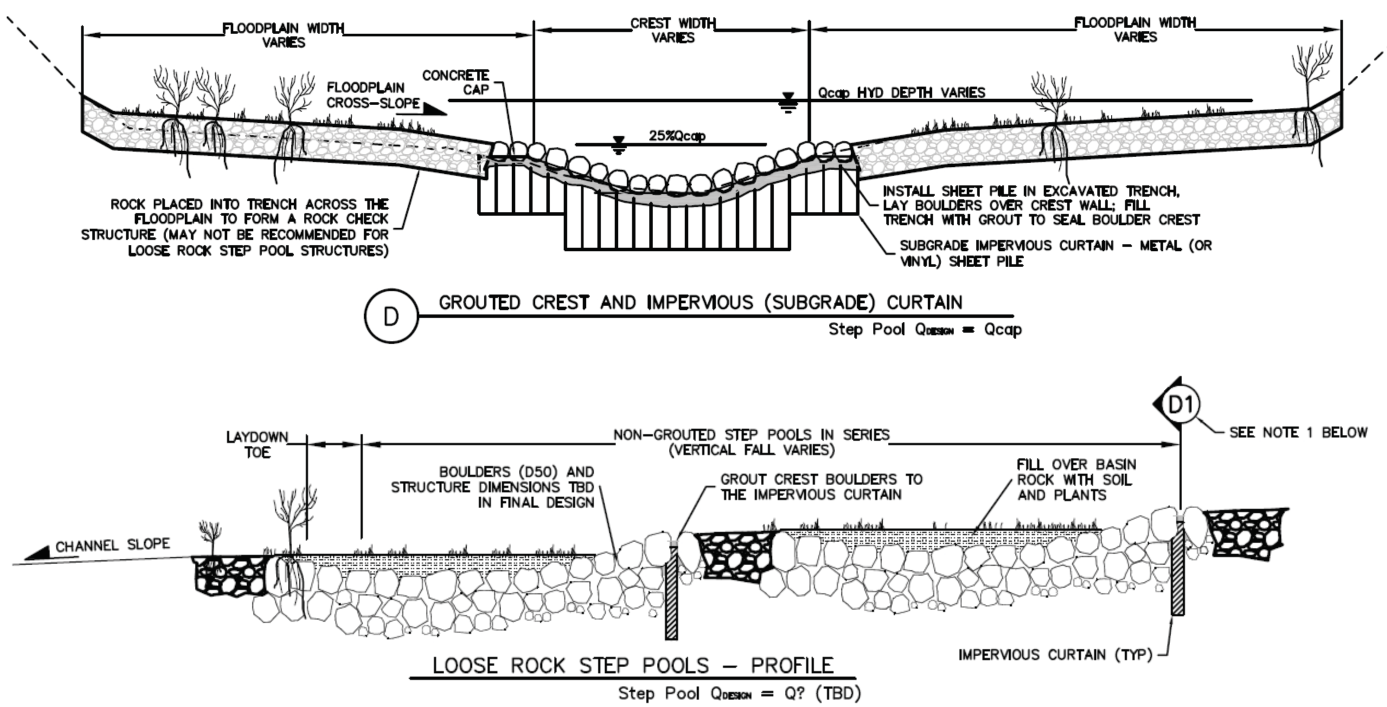
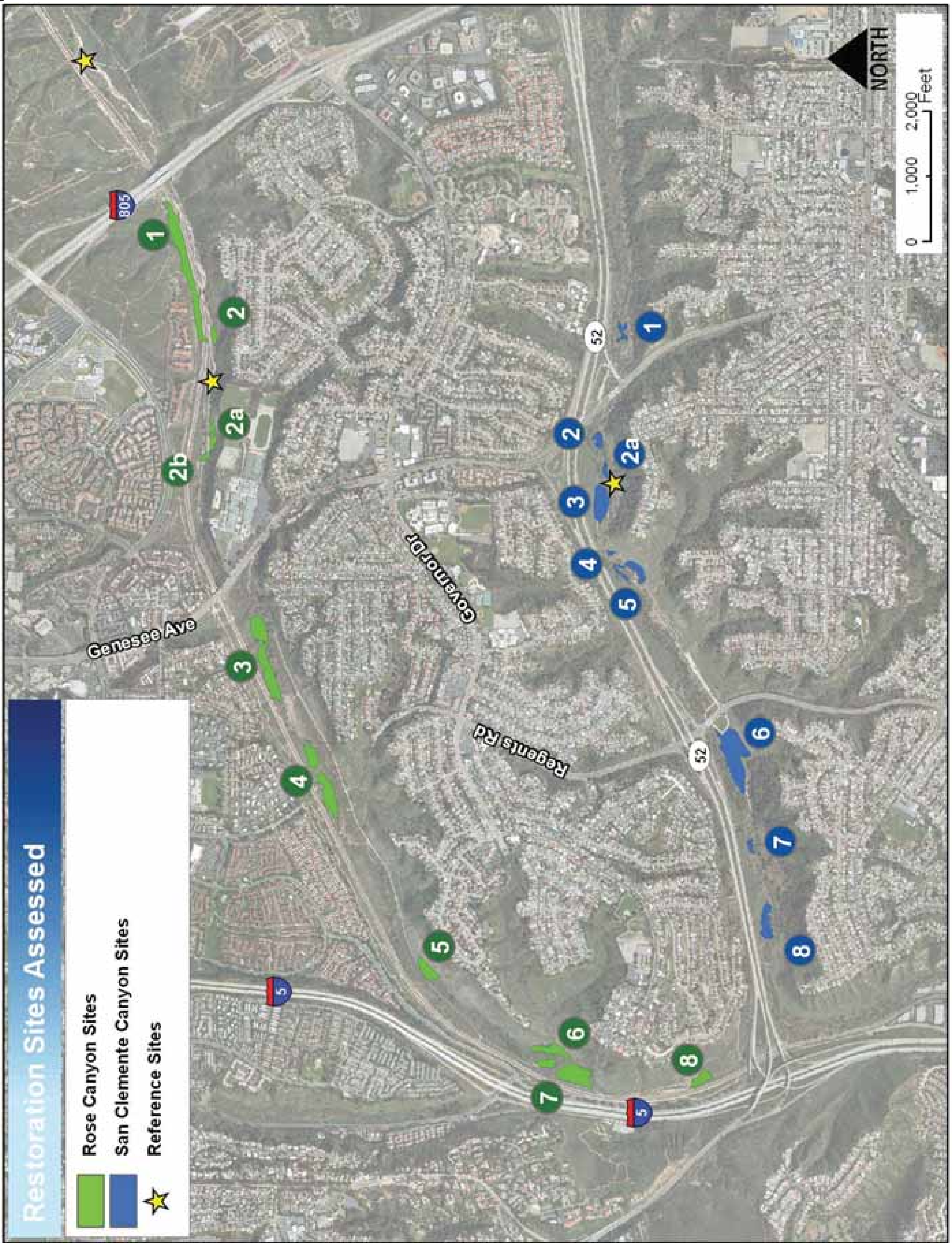


Figure 20 – Locations of Modeled Restoration Sites



The second and third restoration scenarios used hydraulic model simulations to evaluate and analyze specific riparian and wetland restoration and creation areas along Rose Creek and San Clemente Creek. The targeted areas were identified based upon previous efforts and professional knowledge of the watershed by the project team as shown in Figure 20.

The scope of the restoration areas was then refined following the first simulation of the hydraulic model to try to maximize environmental benefits and address stakeholder concerns. Early stakeholder meetings identified restoration of wetland functions as a priority for the watershed, including the restoration of biological, hydrologic and water qualify functions. Thus the focused effort included the identification of areas where floodplain restoration and water quality improvement could be achieved. The reconnection or creation of 5- and 10-year floodplains were targeted not as a means to try and turn back time to a pre-development condition, but instead as a mechanism to provide a range of physical and environmental conditions suitable for establishing and sustaining riparian habitats, as well as, water quality improvements.

Channel incision is found throughout the watershed, as a result of hydromodification due to urbanization, thus floodplain restoration was analyzed either through the gradual elimination and restoration of the channel incision using in-stream step pool structures to re-build the incised channel, or the lowering of adjacent areas to reconnect the floodplain (terracing). Both these options are discussed in the text below. Where possible, additional water quality improvements within the two canyons was examined. Targeted areas for water quality specific improvements were identified, and preliminary proposals are set forth in this report. No hydrologic analysis was conducted on these water quality improvement areas, since they were beyond the limits of the hydrologic model developed.

5.1 - ASSUMPTIONS

In the selection of potentially suitable sites that would restore biological, hydrologic and water quality functions within Rose Canyon and San Clemente Canyon, the team, together with the support of the participating stakeholders, have made the following assumptions to move forward with the assessment, hydrologic model simulations, and preliminary conceptual design of the sites:

1. Permission is granted by the property owner(s) to undertake the recommended improvements.
2. Both in-stream structures to raise the elevation of the incised channel, and adjacent upland grading are considered in order to either create new floodplain habitat or restore isolated floodplain habitat.
3. Preferred method of channel reconnection would be the less ground-disturbing option of installing in-stream step pool structures to re-build the stream bed and eliminate/reduce the channel incision.
4. Adjacent upland grading to create hydraulically connected floodplain terraces shall be no more than 15 feet above the present channel.
5. Restoration of the 5 and 10 year return interval is the priority to restore and/or created adjacent floodplain habitat.
6. No ponding shall be incorporated into the site designs to avoid any vector controls issues.
7. Limited temporary impacts on adjacent riparian or coastal sage scrub habitat are acceptable, given that these habitats are either replaced in other nearby places, or restored following floodplain restoration/creation.
8. Conversion of non-native grassland to restore riparian habitat is preferred and shall be targeted over other habitat type conversions.
9. The sites will not encroach into railway easements, nor propose to move major roads or overpasses.
10. The localized relocation of sewer lines and power lines presently situated either in the active floodplain or in adjacent valley bottom is acceptable. The economic constraints of moving

these utilities have not been fully considered at this time.

11. Relocation of hiking trails, parking lots, bathrooms, and picnic areas are acceptable, as long as they remain in the relative area and the relocation does not negatively impact existing recreational uses.

5.2 – MODEL DEVELOPMENT

Under this modeling scenario, modifications were implemented to the existing conditions hydraulic model to incorporate the proposed floodplain restoration plans. These changes primarily included increasing the density and redefining the topographic cross sections to match the elevations of the proposed restoration plans. A detailed discussion on the existing conditions model develop can be found in Section 2.3.

Hydraulic roughness values assigned to the proposed restoration plans were consistent with the proposed vegetative palettes as prescribed by published values (Chow, 1959).

5.3 – SEDIMENT MOBILITY UNDER PROPOSED CONDITIONS

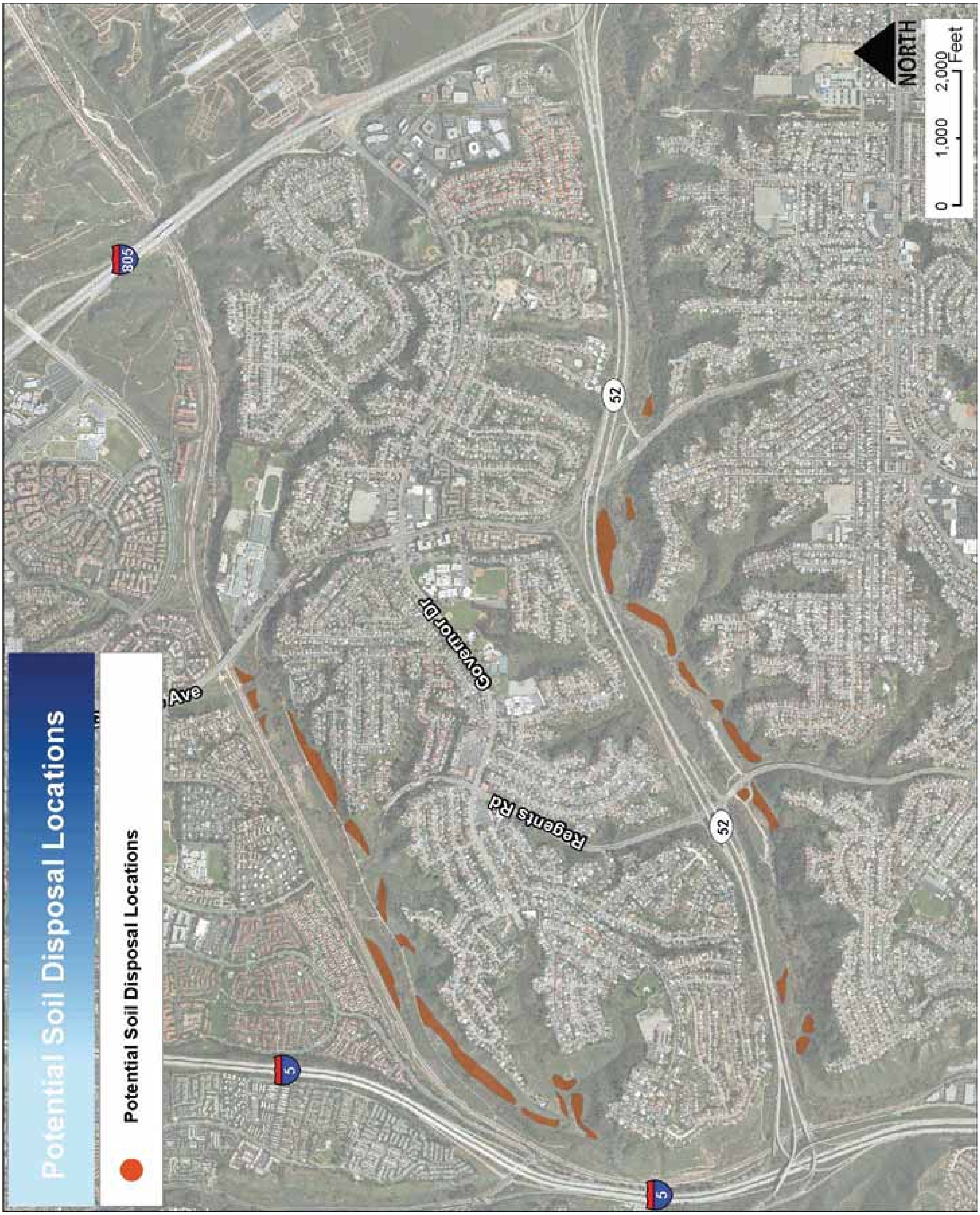
Cbec characterized the particle size distribution (PSD) of the streambed sediments within the project reach in an effort to analyze the sediment mobility of the corridor under proposed conditions. The results of the PSD analysis can be found in the Technical Appendices and a detailed discussion on the methodology and existing conditions results is presented in Sections 2.2.2 and 3.8.

Figure 14 and 15 compare the sediment mobility between the existing and proposed condition for Rose and San Clemente Creeks. This analysis indicates that there are not significant changes in bed mobility for the proposed condition. The increase in density of data points is a function of a denser network of topographic cross sections that were incorporated into the hydraulic model to provide greater detail within the proposed restoration sites. There are some local changes in the frequency in which sediment is mobilized (both increases and decreases) that result from changes in the local hydraulic regime associated with the proposed grading plans. When conducting the final design analysis, care should be taken to examine these in detail as it may be necessary to implement certain features in the design to mitigate for these changes.

5.4 – SOIL DISPOSAL OPTIONS

With the excavation of the existing disconnected floodplains or other adjacent uplands being a potentially major component of the recommendations contained in this report, soil disposal and management will be a significant cost associated with the successful implementation of these efforts. Fortunately, both Rose and San Clemente canyons offer opportunities for upland disposal of excavated material within non-native grassland habitats that can then be restored to coastal sage scrub, chaparral or oak woodland communities. Figure 21 shows areas within Rose and San Clemente canyons that appear suitable for varying amounts of upland soil disposal and revegetation with native communities. These areas should be further assessed during final design to determine actual disposal capacity and appropriate revegetation communities.

Figure 21 – Potential Soil Disposal Locations



5.5 – RESULTS & DISCUSSION: SITES TO RESTORE BIOLOGICAL AND HYDROLOGIC FUNCTIONING

Preliminary site plans were developed for each of sites and modeled as part of scenario two. The preliminary site plans, potential impacts, proposed habitats, and modeling results were presented to the stakeholders for comment. Based on comments received, the site plans were modified to minimize impacts to existing sycamores, oaks, and coastal sage scrub, as well as maximizing in-stream step pools to reduce channel incision, and minimize grading to provide floodplain connectivity primarily for the 5- and 10-year storm events. The adjusted site plans were then modeled as scenario three. The results of this modeling effort are presented for each site in the following sections. Recommendations for additional site plan modifications are made for sites where the modeling results still do not quite align with the stated objectives for a given site. These adjustments, as well as further site plan refinements would be made during final design and implementation for each site.

The first priority of the restoration of each of these sites is to reduce or eliminate the channel incision to allow for floodplain reconnection without extensive grade changes. The first action in all areas would be to determine if sufficient sediment is being transported within the watershed to allow for the successful installation of in-stream step pools, which would capture the sediment and raise the elevation of the active incised channel. The locations of proposed in-stream step pools for Rose Creek and San Clemente Creek are presented in Figure 22. Without adequate sediment volumes being transported, however, in-stream step pools would be ineffective. Minimal sediment transport would also prolong the functional recovery of the ecosystem. If sediment transport studies conclude that sediment transport is minimal or insufficient, then adjacent site grading would be considered, as is included in the following sections. This would allow for the reparation of wetland and riparian functions in a timeframe acceptable to those funding and implementing the restoration activities.

The intent of these actions is not to provide a quick fix of creating additional habitat via targeting the habitat de jour to meet some mitigation need or through tree planting programs where the underlying ecological issue is not fixed, but rather to restore the functional processes which create these riparian habitats. The reconnection of the floodplain would allow natural processes, such as sycamore recruitment, to occur and sustain themselves over time.

Figure 22 – Potential Locations of in-stream Step Pool Structures

5.5.1 - Rose Canyon – Reference Site

A reference site provides important information pertaining to the physical and biological conditions of a relatively undisturbed site. The reference site is used as the template when restoring or creating other like habitats or conditions. To the east of Interstate 805 within the bounds of Miramar Air Base, is a glance of what some of Rose Creek may have looked like prior to development. Examination of the 1928 aerial photographs of the watershed show similar conditions to this reference site (Figure X). A video of the site can be viewed at: http://bit.ly/RCReferenceSite. Most of the substrate is cobble to gravel with very little sands, silts or clay. The active channel meanders throughout the unconstrained floodplain and the location of main channel changes over time due to deposition of material after storm flows. Most of the vegetation is scrubby, however mature sycamore and oaks are found on the edges of the active floodplain. Channel incision is minimal. This reference site is primarily applicable to Rose Canyon Sites 1, 2, 2a, 2b, which are minimally affected by runoff from urban development. The majority of the upper watershed flowing into this reference site is not developed and the flow is ephemeral, thus making it difficult to use this as a reference site for the lower reaches of Rose Canyon, where flow is perennial due to urban runoff.

Photo 7: Reference Site east of Interstate 805 in Rose Canyon, Source Bing Maps

Photo 8: Overbank secondary channel at the Reference Site

Photo 9: Looking upstream at the Reference Site

5.5.2 - Rose Canyon – Reference Site near Site 2

The Rose Canyon Reference Site near Site 2 is a good example of sycamore woodland terrace floodplain habitats. A video of the reference site near Site 2 can be viewed at: http://bit.ly/RCRefNear2. This habitat is only slighter higher than the active channel and is inundated during the larger storm events, presumably 2-5 year storm events and larger. Nearest the active channel in the dryer systems coyote brush and mule fat are the dominant plants, whereas in wetter systems willows and mule fat would dominate. Slightly higher elevations and outside the active channel the terrace floodplain contains mature sycamores with an understory of grasses and forbes that can withstand periodic inundation. Sycamores are water dependent species that are typically inundated during larger storm events. Higher still, the oaks emerge. Coastal sage scrub habitat may also occur on the canyon side, beyond the limits of inundation. This reference site provides a good example of the structure of the floodplain habitat that is targeted for creation/restoration along Rose and San Clemente Creeks.

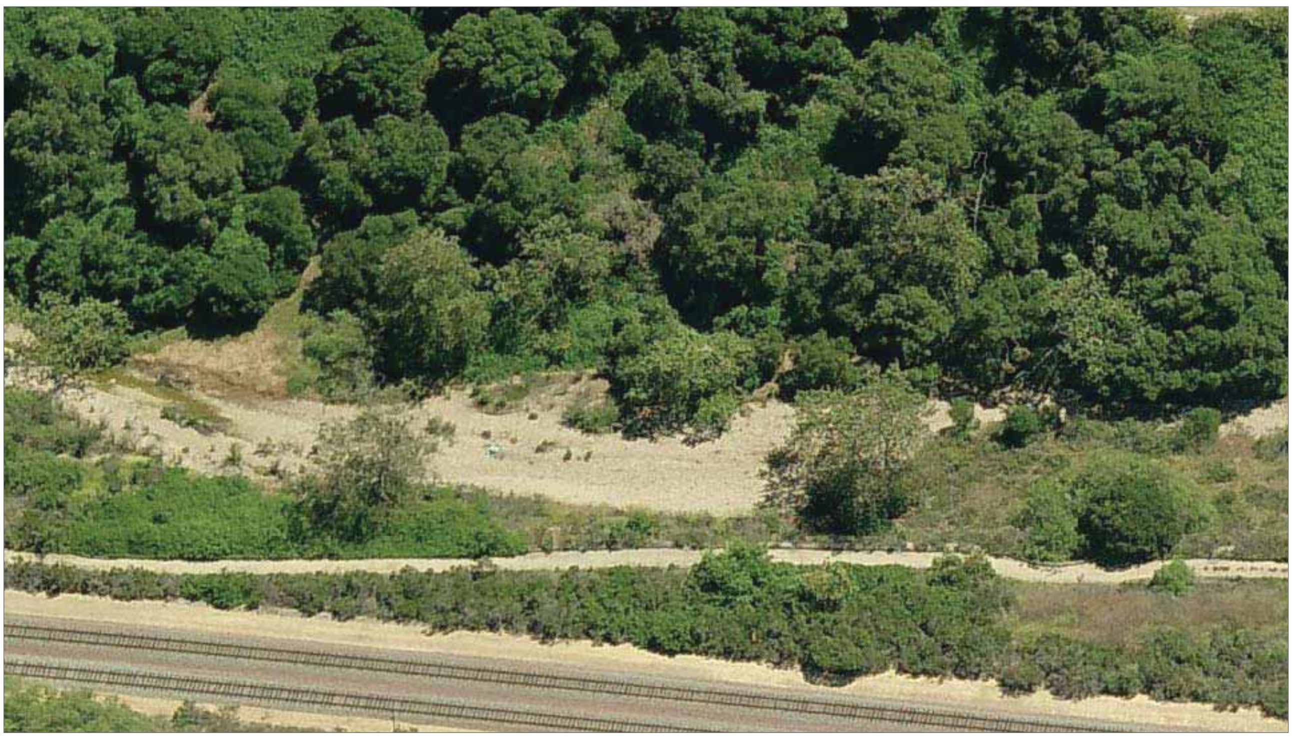


Photo 10: Reference Site west of Interstate 805 in Rose Canyon, Source Bing Maps

Photo 11: Looking upstream at the Reference Site

Photo 12: Looking downstream at the Reference Site

5.5.3 - Rose Canyon – Site 1

Rose Canyon Site 1 is situated directly west of I-805 overpass and encompasses approximately 5.8 acres of habitat restoration. A video of the site can be viewed at: http://bit.ly/RCSite1. The railroad bisects this site. To the north of the railroad is the historic floodplain that is now hydrologically isolated from the main flow of Rose Creek. The north area habitat received some water input both from the freeway and the adjacent residential development to the north. The main stem is to the south side of the railroad tracks. As a result of the main flow wanting to meander within the floodplain, the rail bed has been armored with concrete and gunnite. Undermining of this armoring is evident in the field. The sewer line is also situated in the active floodplain of this site. The substrate is primarily cobble and gravel. The flow is ephemeral. Dominant vegetation is coyote bush and mule fat in the active channel, and sycamore and oaks on the edges of the active floodplain as shown in Figure 23.

Floodplain reconnection is the primary goal of this restoration site. The main action in the restoration effort would be to create three separate culverts cutting under (400 cy of soil removal at each culvert) the rail bed that would allow the water to flow under the rail bed to reconnect the north side with the south side of Rose Creek. The upstream- most culvert would allow water to flow from the south side into the isolated north side. The middle culvert would allow flow in both directions, and the lower culvert would allow flow back into the main drainage. These structures would need to be engineered to allow a 5-year flood events and larger to pass through it, while maintaining the structural integrity of the rail bed. The sewerline would not be relocated from its present location. Figure 24 depicts the proposed design of Rose Canyon – Site 1. Figure 25 shows the modeled floodplain analysis.

During final design, the elevations of the culvert connections should be lowered 12-18 inches to provide the targeted 5-yr storm event connectivity.

Table 4: Functional Improvements Rose Canyon - Site 1

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 5: Existing / Proposed Vegetation Rose Canyon - Site 1

Vegetation	Existing acres	Proposed acres
Willow Scrub	0.048	
Oak / Sycamore Woodland	1.298	5.601
Coastal Sage Scrub	3.667	
Non-native Grassland		
Disturbed Habitat	0.132	
Roads / Trails	0.693	0.237
Total Acres	5.838	5.838

Photo 13: Looking southeast over Site 1

Figure 23 – RC-01 Existing Vegetation and Floodplain Modeling

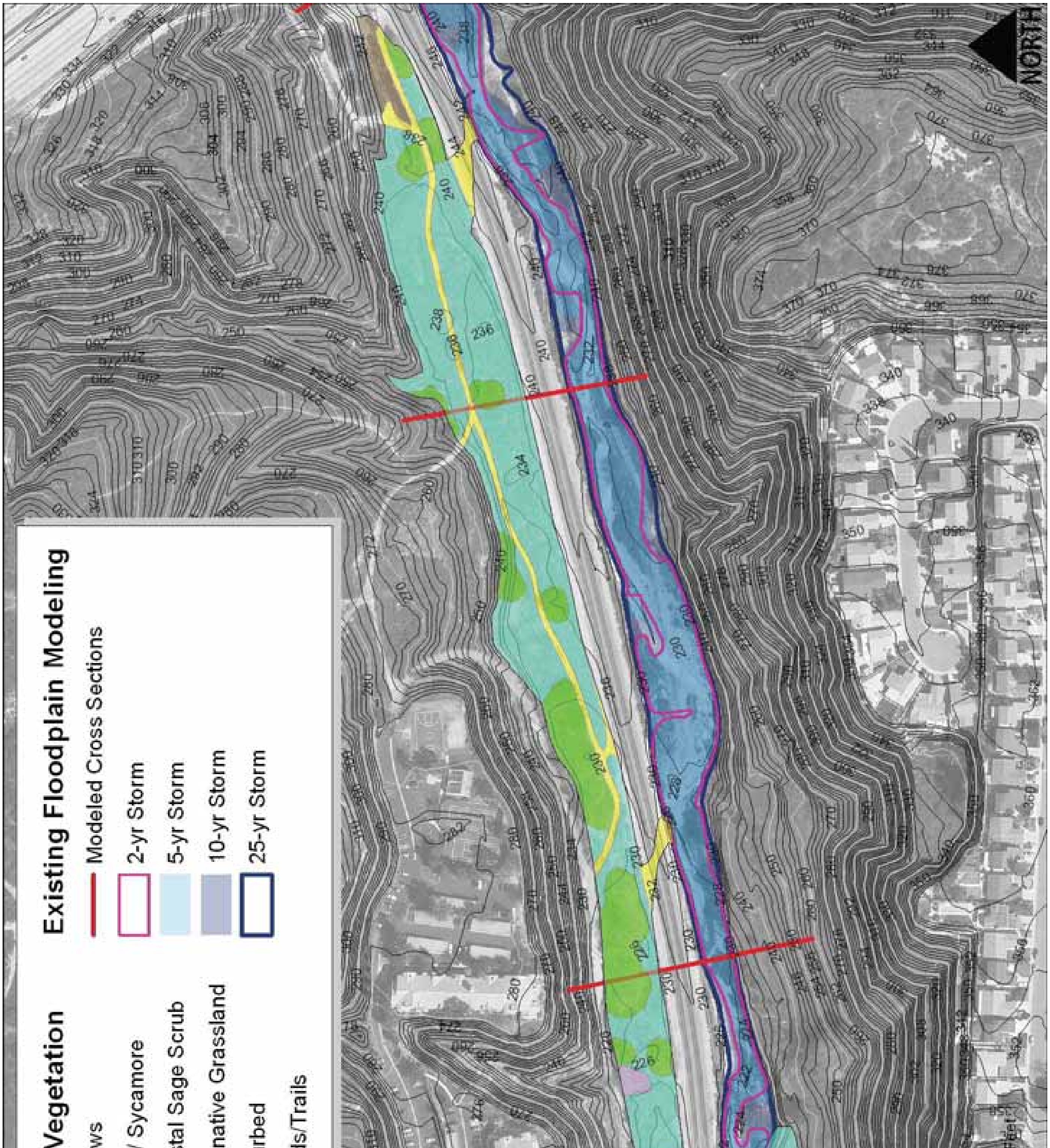
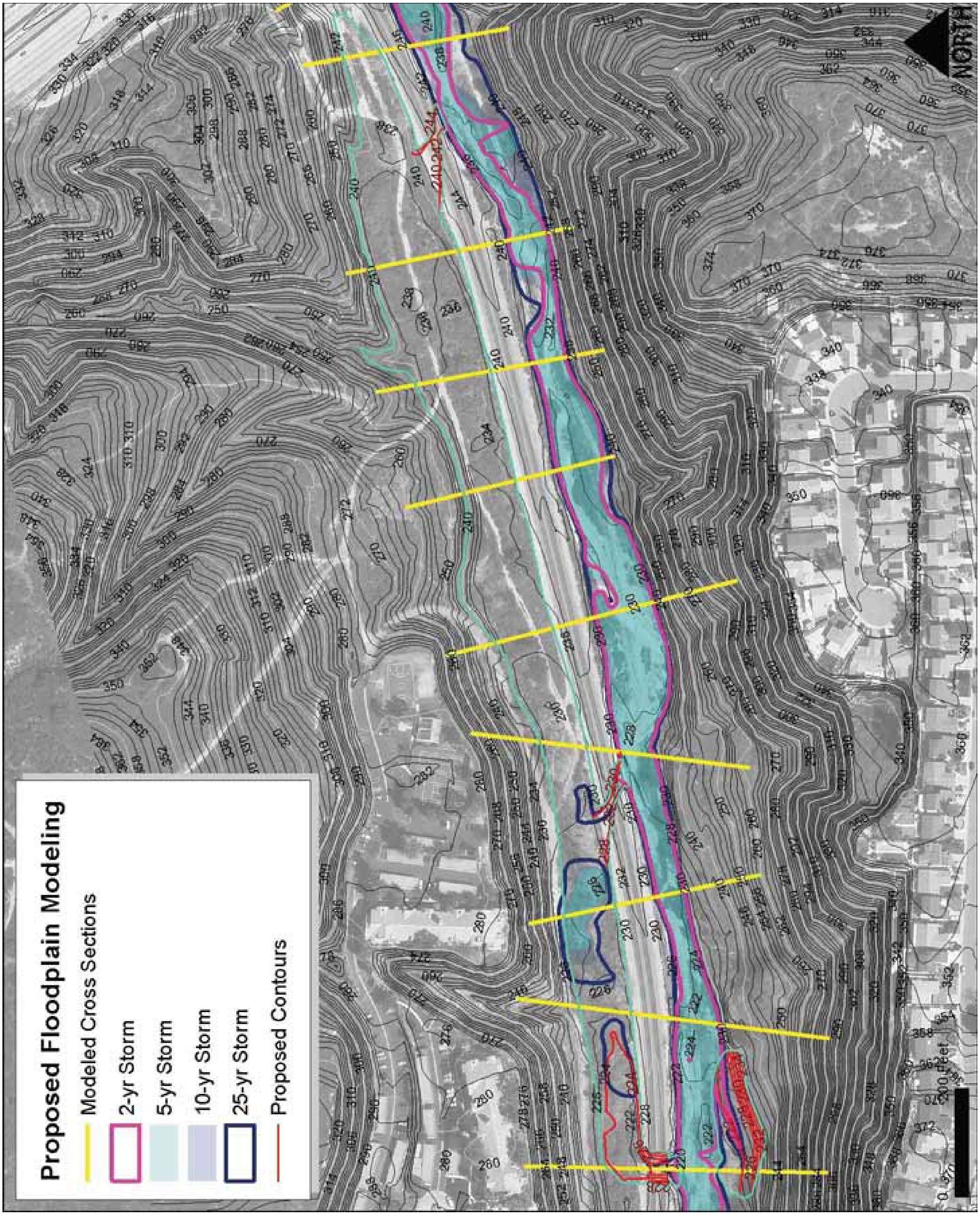


Figure 24 – RC-01 Proposed Vegetation

Figure 25 – RC-01 Floodplain Modeling Results



5.5.4 - Rose Canyon – Site 2

Rose Canyon Site 2 is situated west of I-805 overpass and downstream of Site 1. It encompasses approximately 0.4 acres of floodplain restoration. A video of the site can be viewed at: http://bit.ly/RCSite2. The intent of this site is to relieve the floodplain constriction caused as a result of the railway situated within the floodplain by expanding the active floodplain into adjacent upland habitats. The site contains primarily non-native vegetation but some sycamore and mule fat individuals are present as shown in Figure 26. Minor channel incision is present in the active channel. The sewer line cuts through the active channel as well.

Recommended actions at this site would be to expand the floodplain through site grading (~1,600 cy of soil removal), thus allowing flood flows to enter the area in the 5- and 10-year storm events. This would result in the active floodplain expansion of approximately 0.3 acres, including the creation of 0.3 acres of Oak / Sycamore Woodland. These habitats would replace the non-native vegetation that has established in this area. The sewerline would not be relocated from its present location. Figure 27 depicts the proposed design of Rose Canyon – Site 2. Figure 28 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain should be lowered 12-18 inches to provide the targeted 5- and 10-yr storm event connectivity.

Table 6: Functional Improvements Rose Canyon - Site 2

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 7: Existing / Proposed Vegetation Rose Canyon - Site 2

Vegetation	Existing acres	Proposed acres
Willow Scrub		
Oak / Sycamore Woodland	0.081	0.303
Coastal Sage Scrub	0.342	0.120
Non-native Grassland		
Disturbed Habitat		
Roads / Trails		
Total Acres	0.423	0.423

Photo 14: Looking east over Site 2

Figure 26 – RC-02 Existing Vegetation and Floodplain Modeling

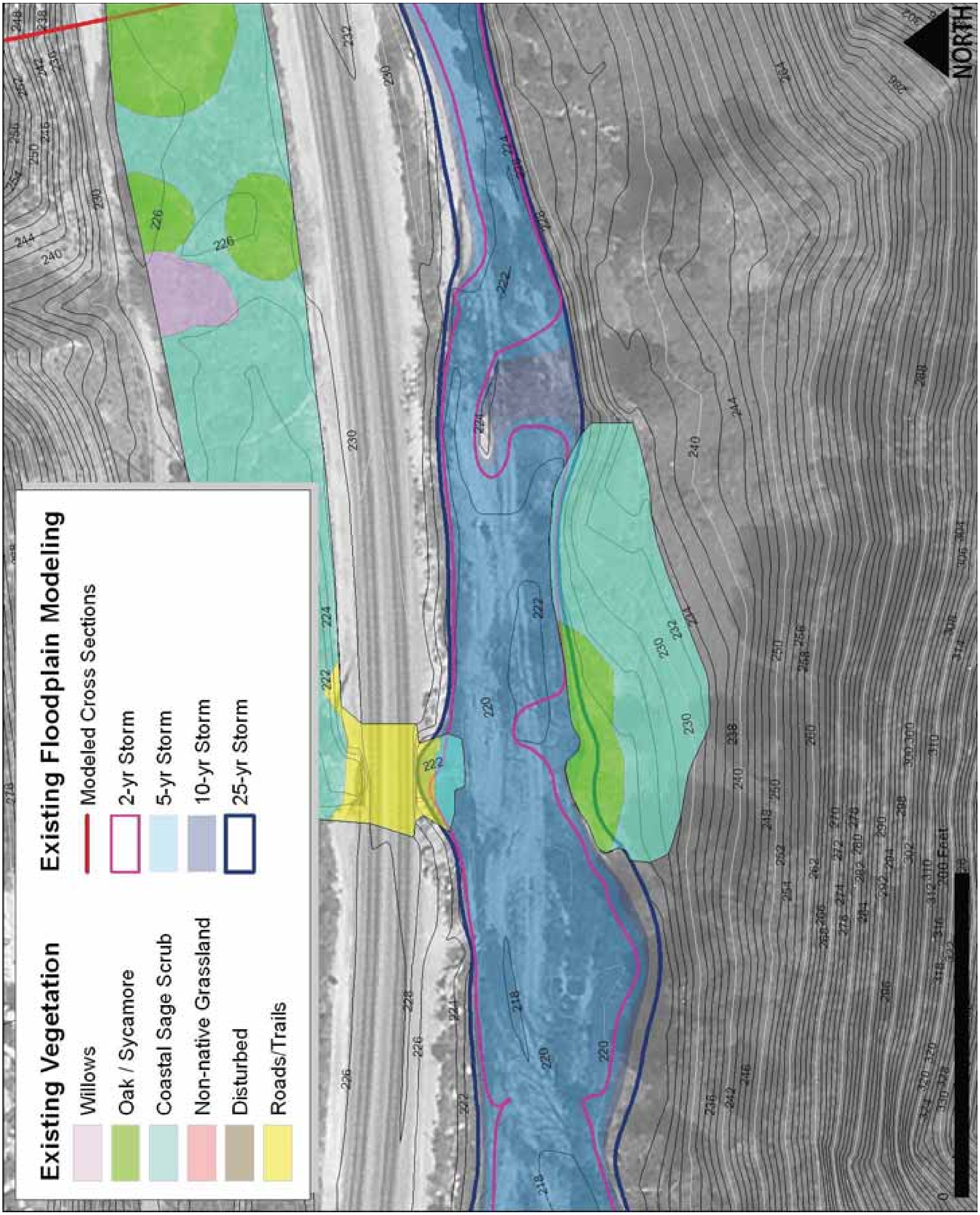


Figure 27 – RC-02 Proposed Vegetation

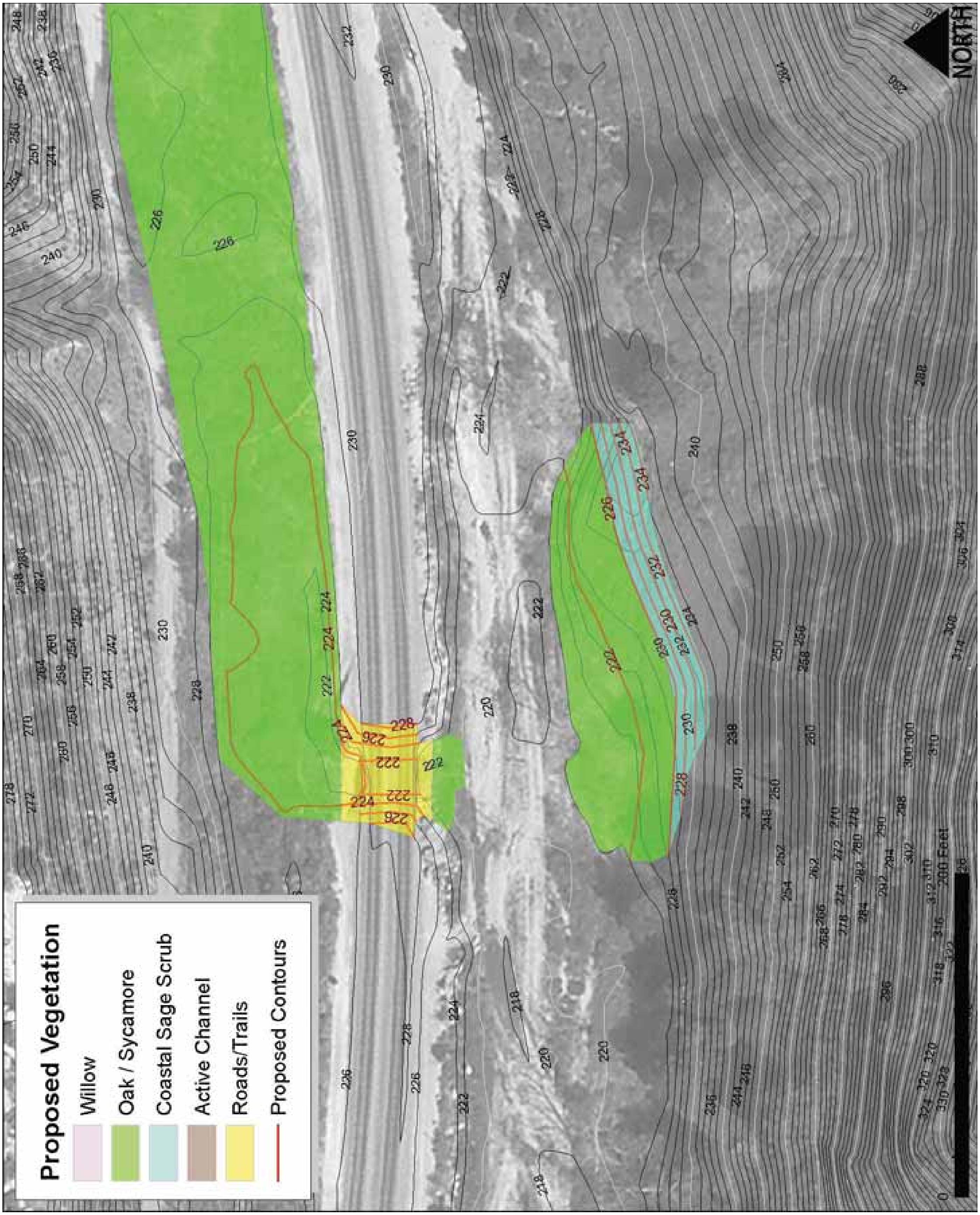
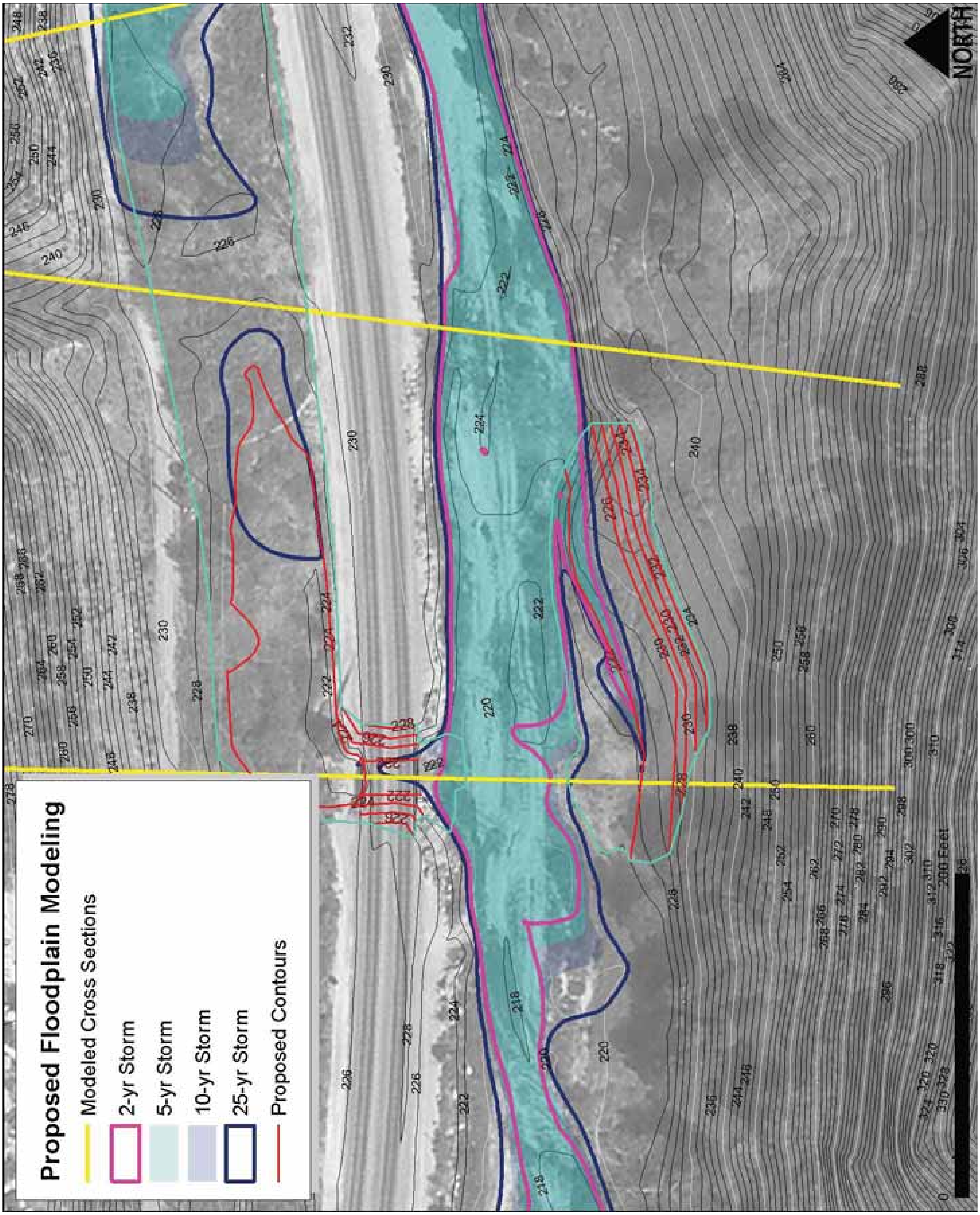


Figure 28 – RC-02 Floodplain Modeling Results



5.5.5 - Rose Canyon – Site 2a

Rose Canyon Site 2a is situated west of Interstate 805 overpass and downstream of Site 2. It encompasses approximately 0.75 acres of floodplain creation. A video of the site can be viewed at: http://bit.ly/RCSite2a. The site is situated above the active floodplain, and contains primarily non-native vegetation, however some sycamore and mule fat individuals are present (Figure 29). The sewer line and railway are situated on the north side of the site, to the north of the active floodplain. Like Site 2, this area poses an opportunity to expand the active floodplain, allowing for increased water and sediment storage, reduced velocities, and improved habitat.

Recommended actions at this site would be to expand the floodplain through site grading (~1,600 cy of soil removal), thus allowing flood flows to enter the area in the 5- and 10-year storm events. This would result in the active floodplain expansion of approximately 0.6 acres, including the creation of 0.685 acres of Oak / Sycamore Woodland. These habitats would replace the non-native vegetation that has established in this area. The sewerline would not be relocated from its present location. Figure 30 depicts the proposed design of Rose Canyon – Site 2a. Figure 31 shows the modeled floodplain analysis.

During final design, the toe of the slope at the back of the new floodplain should be lowered 12-18 inches to provide the targeted 5- and 10-yr storm event connectivity across the entire floodplain.

Table 8: Functional Improvements Rose Canyon - Site 2a

Floodplain Restoration Functional Improvements		
Habitat	**Yes**	**No**
Increase in riparian habitat	x	
Nesting grounds	x	
Foraging grounds	x	
Shelter	x	
Improved wildlife corridor	x	
Hydrology		
Flood storage	x	
Flood alteration	x	
Groundwater discharge		x
Groundwater recharge	x	
Water Quality		
Nutrient transformation	x	
Sediment storage	x	
Retention of pollutants	x	
Retention of nutrients	x	
Erosion reduction	x	

Table 9: Existing / Proposed Vegetation Rose Canyon - Site 2a

Vegetation	Existing acres	Proposed acres
Willow Scrub		
Oak / Sycamore Woodland		0.685
Coastal Sage Scrub	0.307	0.053
Non-native Grassland	0.431	
Disturbed Habitat		
Roads / Trails		
Total Acres	0.738	0.738

Photo 16: Looking southeast over Site 2a

Figure 29 – RC-02a Existing Vegetation and Floodplain Modeling

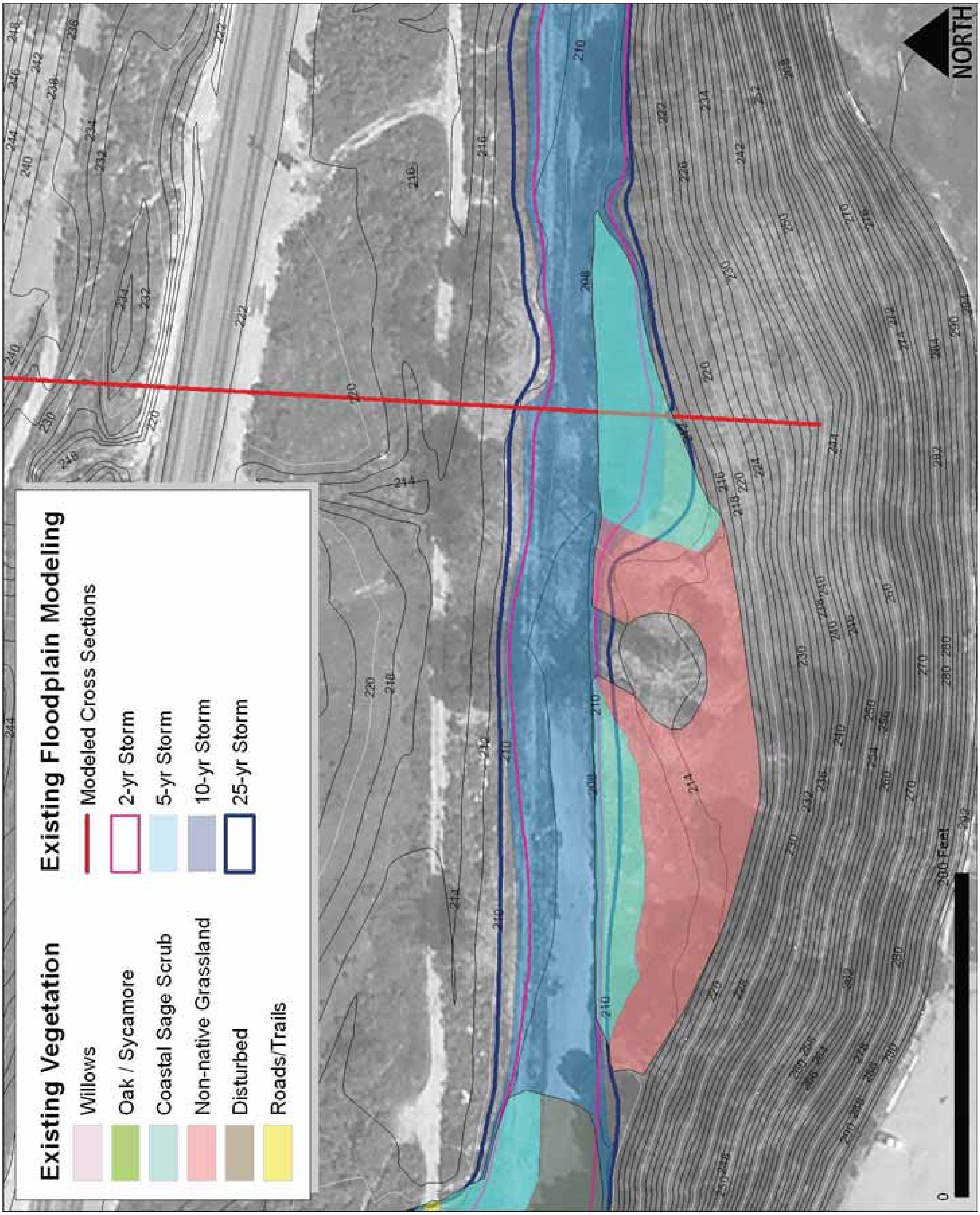
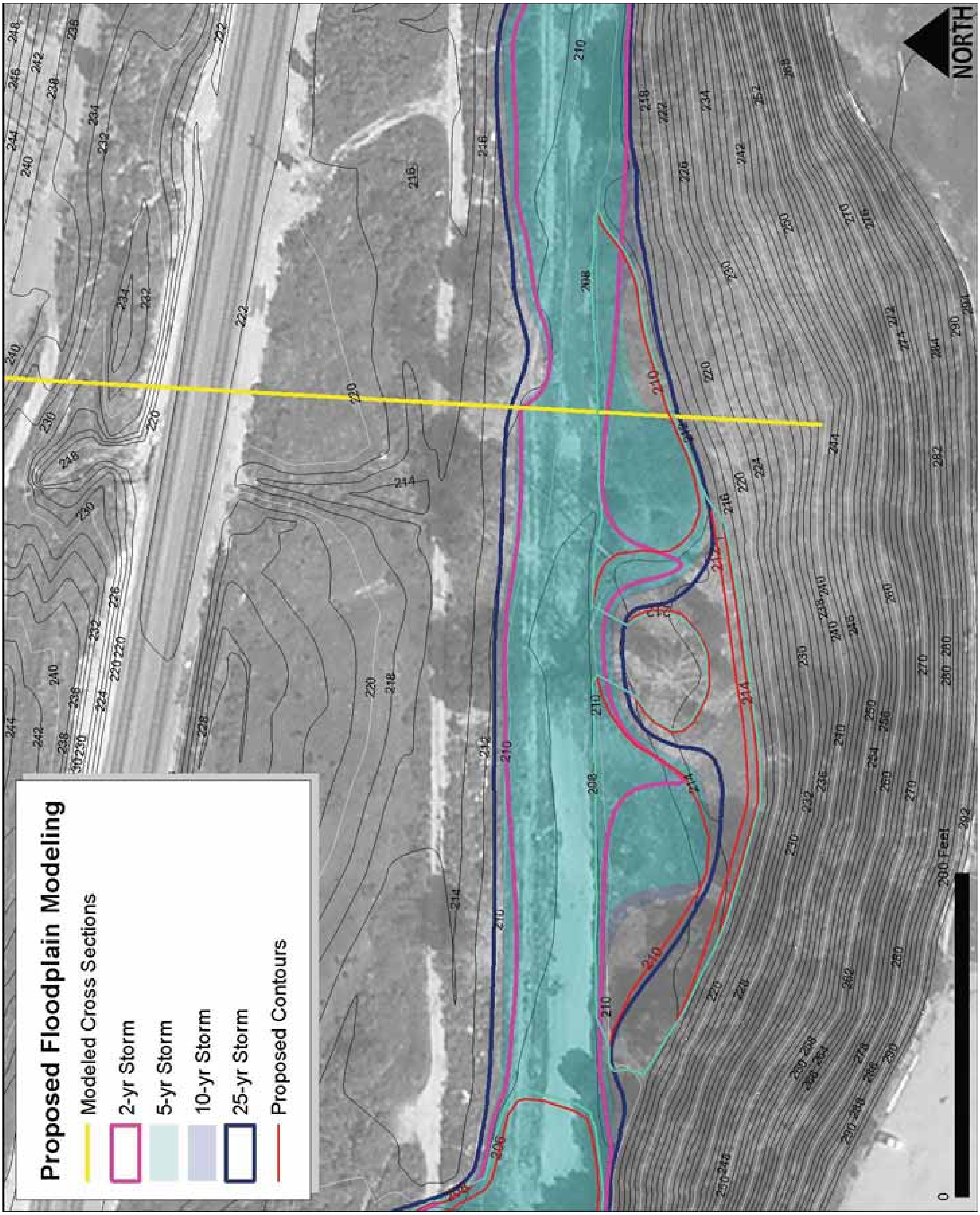


Figure 30 – RC-02a Proposed Vegetation

Figure 31 – RC-02a Floodplain Modeling Results



5.5.6 - Rose Canyon – Site 2b

Rose Canyon Site 2b is directly downstream of Site 2a. A video of the site can be viewed at: http://bit.ly/RCSite2b. The primary area for floodplain restoration is situated along the abandoned rail bed. The existing active channel in this area has to take a 90 degree turn and go under the abandoned rail bed via a multi-spanned bridge. As a result, the area to the north of the rail bed has been hydrologically isolated, and the natural meandering of the active channel has been eliminated. A sewer line runs through this area as well. The hydrologically isolated area to the north of the abandoned rail bed is now occupied by coyote bush scrub as shown in Figure 32.

Recommended actions would be to remove sediments under the eastern portion of the old railroad bridge, as well as immediately up- and down-stream to restore floodplain functionality. This would allow a more natural meandering of the creek, eliminate the 90 degree turn that is causing erosion and periodic maintenance problems, and increase wetland functioning. The railroad bridge is now used by the public for walking, mountain biking, and utility access. Implementing Site 2b would result in the restoration of approximately 0.2 acres of floodplain habitat. Confirmation that the sewerline is deep enough following fill removal must be confirmed. The sewerline would not be relocated. Figure 33 depicts the proposed design of Rose Canyon – Site 2b. Figure 34 shows the modeled floodplain analysis.

During final design, the integrity of the old railroad bridge structure and footing depth will need to be assessed. Coyote bush habitat replacement would be implemented in nearby non-native grassland.

Table 10: Functional Improvements Rose Canyon - Site 2b

Floodplain Restoration Functional Improvements		Yes	No
Habitat			
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 11: Existing / Proposed Vegetation Rose Canyon - Site 2b

Vegetation	Existing acres	Proposed acres
Willow Scrub		
Oak / Sycamore Woodland		0.082
Coastal Sage Scrub	0.138	
Active Channel		0.195
Non-native Grassland		
Disturbed Habitat	0.139	
Roads / Trails	0.022	0.022
Total Acres	0.299	0.292

Photo 16: Looking south under eastern end of old railroad bridge

Figure 32 – RC-02b Existing Vegetation and Floodplain Modeling

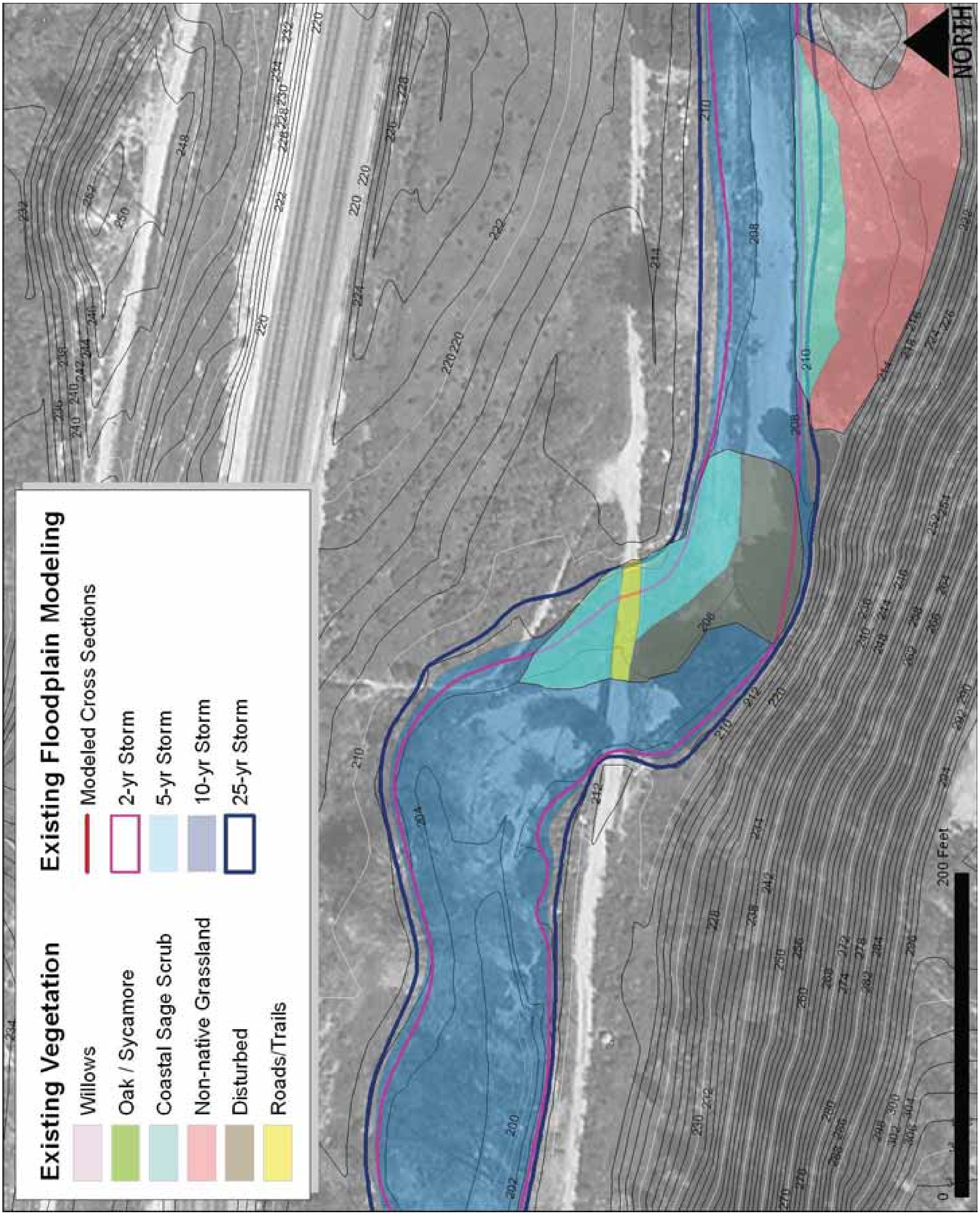


Figure 33 – RC-02b Proposed Vegetation

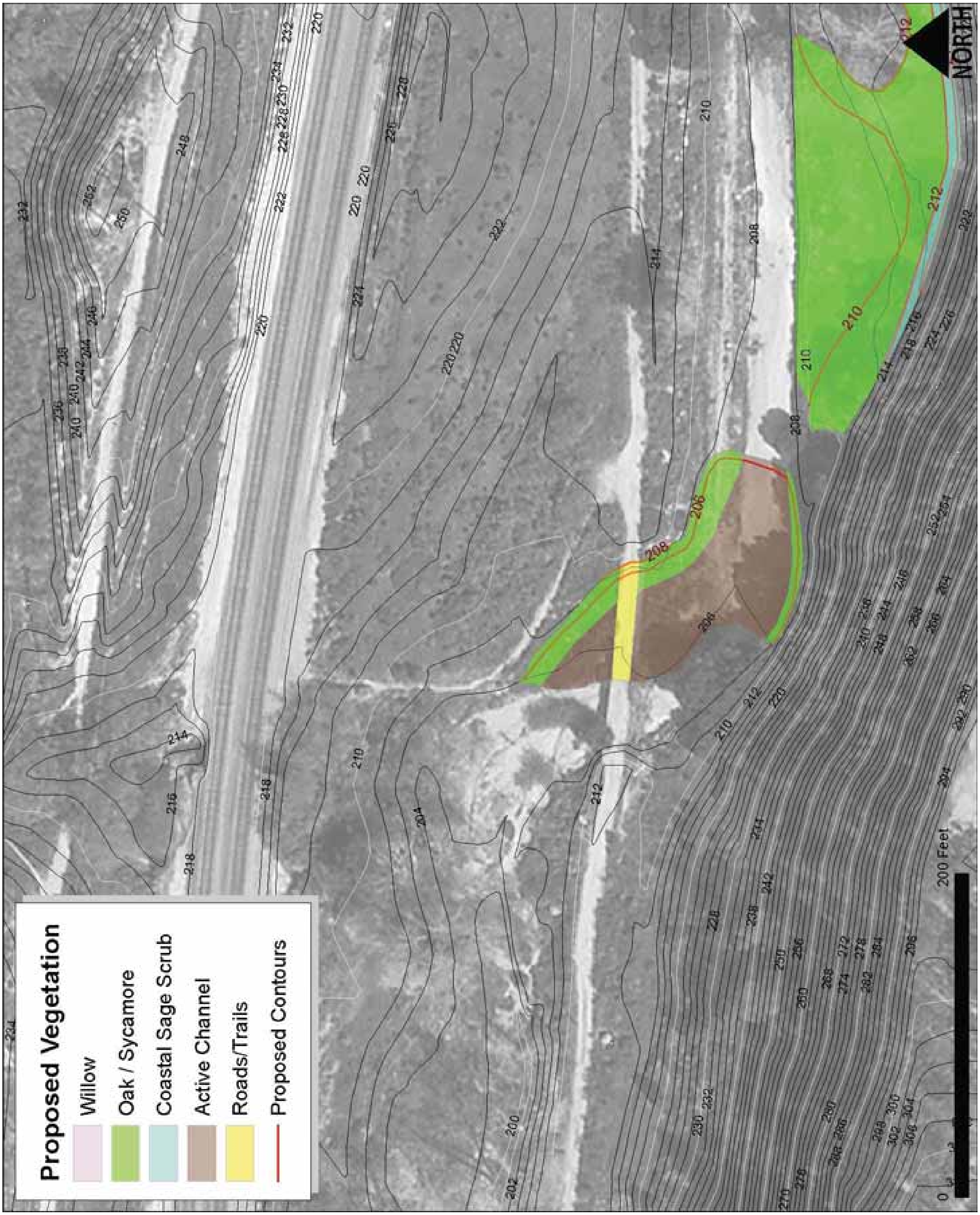
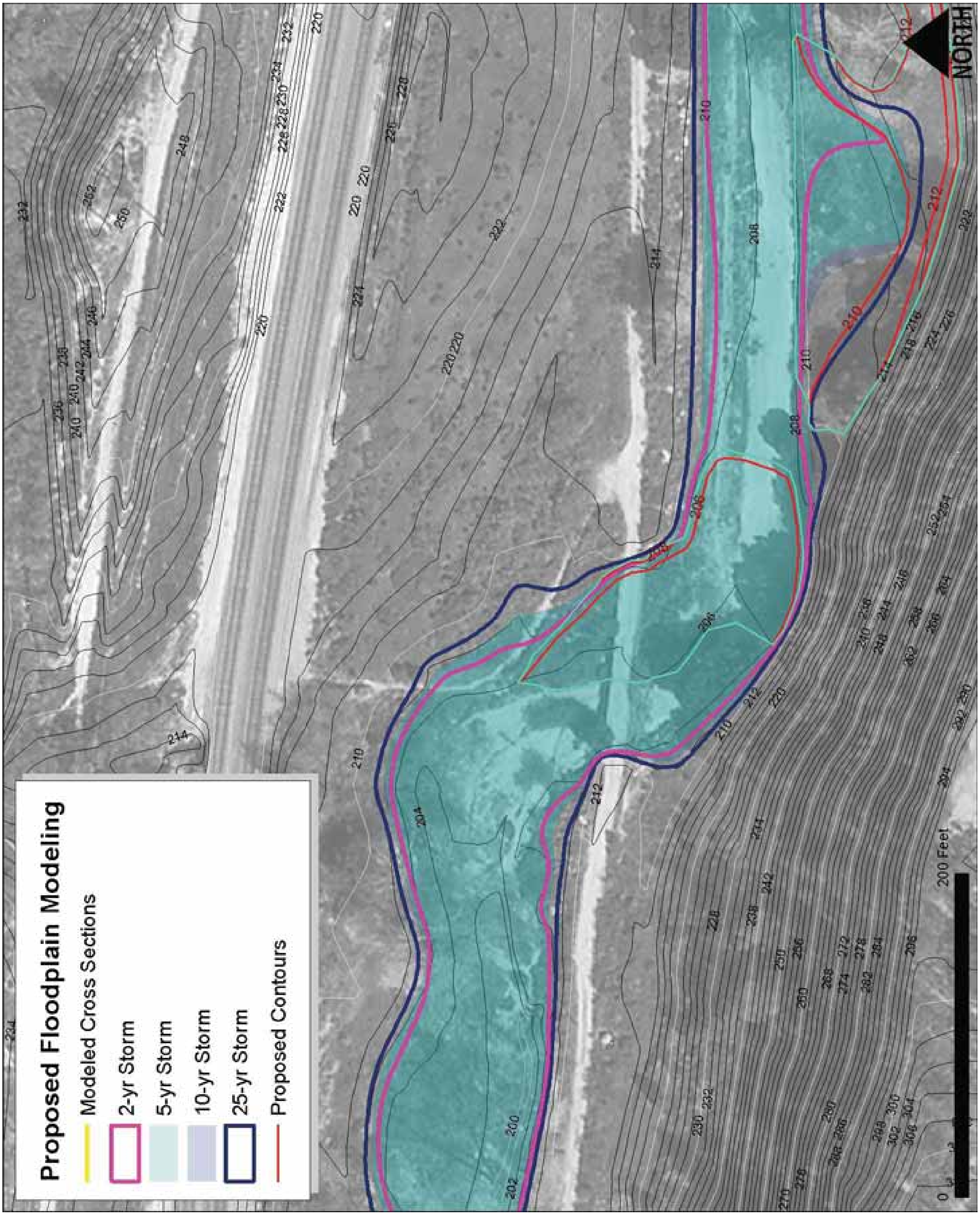


Figure 34 – RC-02b Floodplain Modeling Results



5.5.7 - Rose Canyon – Site 3

Rose Canyon Site 3 is situated to the north of the active channel. Rose Creek is severely incised in this area, and has no access to a floodplain where water can be captured and stored. The targeted area to created floodplain habitat is to the north of the active channel and would involve first the installation of step-pool structures to reduce channel incision. If ineffective, then extensive site grading (~40,000 cy of soil removal) to lower the adjacent topography would be instituted. A video of the site can be viewed at: http://bit.ly/RCSite3. The area is currently occupied primarily by non-native grasses; however some transitional coyote bush scrub is situated on the upslope of the channel as shown in Figure 35. The site itself is approximately 10-12 feet above the low flow channel. Grading would occur to lower the elevation to capture a 5- to 10-year storm event. Due to the extensive excavation necessary to implement this process, current topsoil would need to be saved during grading, and the site overexcavated 3-5 feet, since subsurface soils may not be suitable for initial plant establishment. Details of the extent of over-excavation necessary, as well as soil condition, would be determined at the time of implementation. All subsurface soils would need to be deep ripped before topsoil is placed. These and other restoration measures would be specified during specific site design. Where site grading occurs on other restoration areas identified in this report, the same conditions apply.

Two sewer mains traverse the eastern portion of Site 3 and are proposed to remain in place. Some minor grading is proposed over the sewer mains and additional coordination with City of San Diego Public Utilities Department will be required. The Coastal Sage Scrub that occurs over the sewer mains is a mitigation area, so any damage will either be repaired or replaced elsewhere through negotiations with the resource agencies. Any loss of coastal sage scrub or coyote bush scrub would be replaced in nearby areas as part of the overall project to ensure no loss of this valuable habitat.

Implementation of Site 3 would result in the active floodplain expansion of approximately 2.2 acres, including the creation of over 2 acres of Oak / Sycamore Woodland. Figure 36 depicts the proposed design of Rose Canyon – Site 3. Figure 37 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain in the middle of the site should be lowered 12-18 inches to provide the targeted 5- and 10-yr storm event connectivity.

Table 12: Functional Improvements Rose Canyon - Site 3

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 13: Existing / Proposed Vegetation Rose Canyon - Site 3

Vegetation	Existing acres	Proposed acres
Willow Scrub	0.111	0.192
Oak / Sycamore Woodland	0.755	2.961
Coastal Sage Scrub	1.556	1.503
Non-native Grassland	1.799	
Disturbed Habitat	0.435	
Total Acres	4.656	4.656

Photo 17: Looking southeast across eastern portion of Site 3

Figure 35 – RC-03 Existing Vegetation and Floodplain Modeling

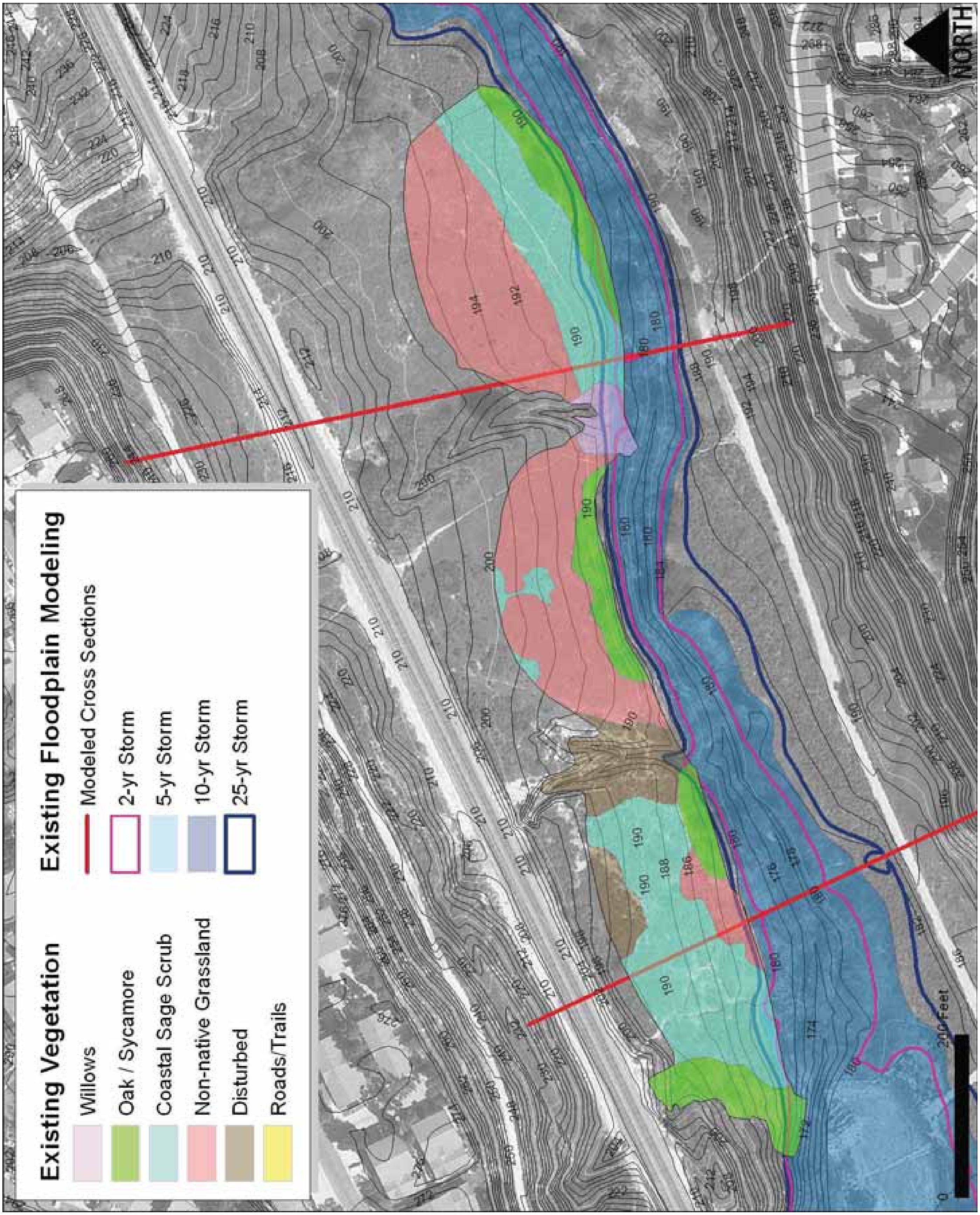


Figure 36 – RC-03 Proposed Vegetation

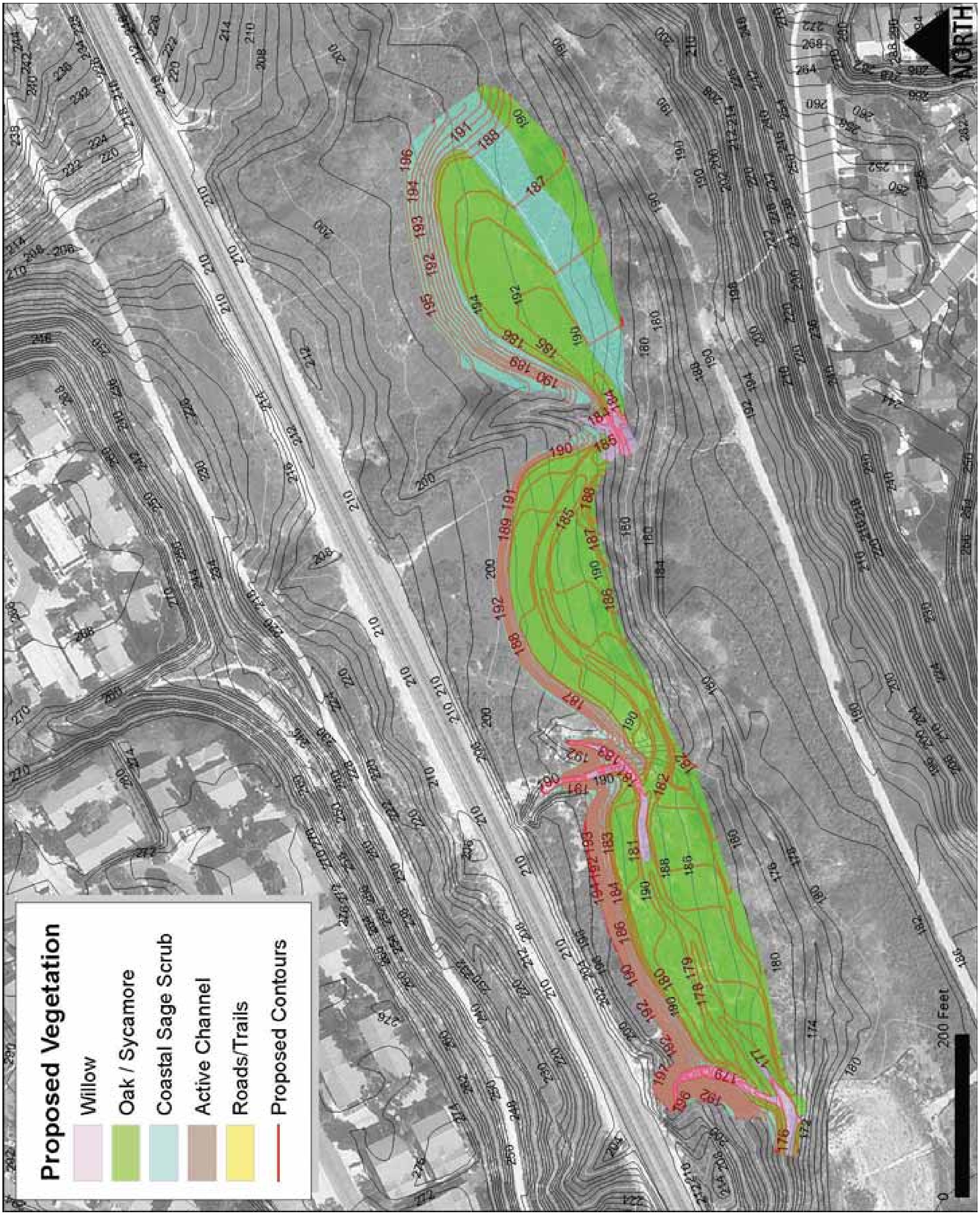
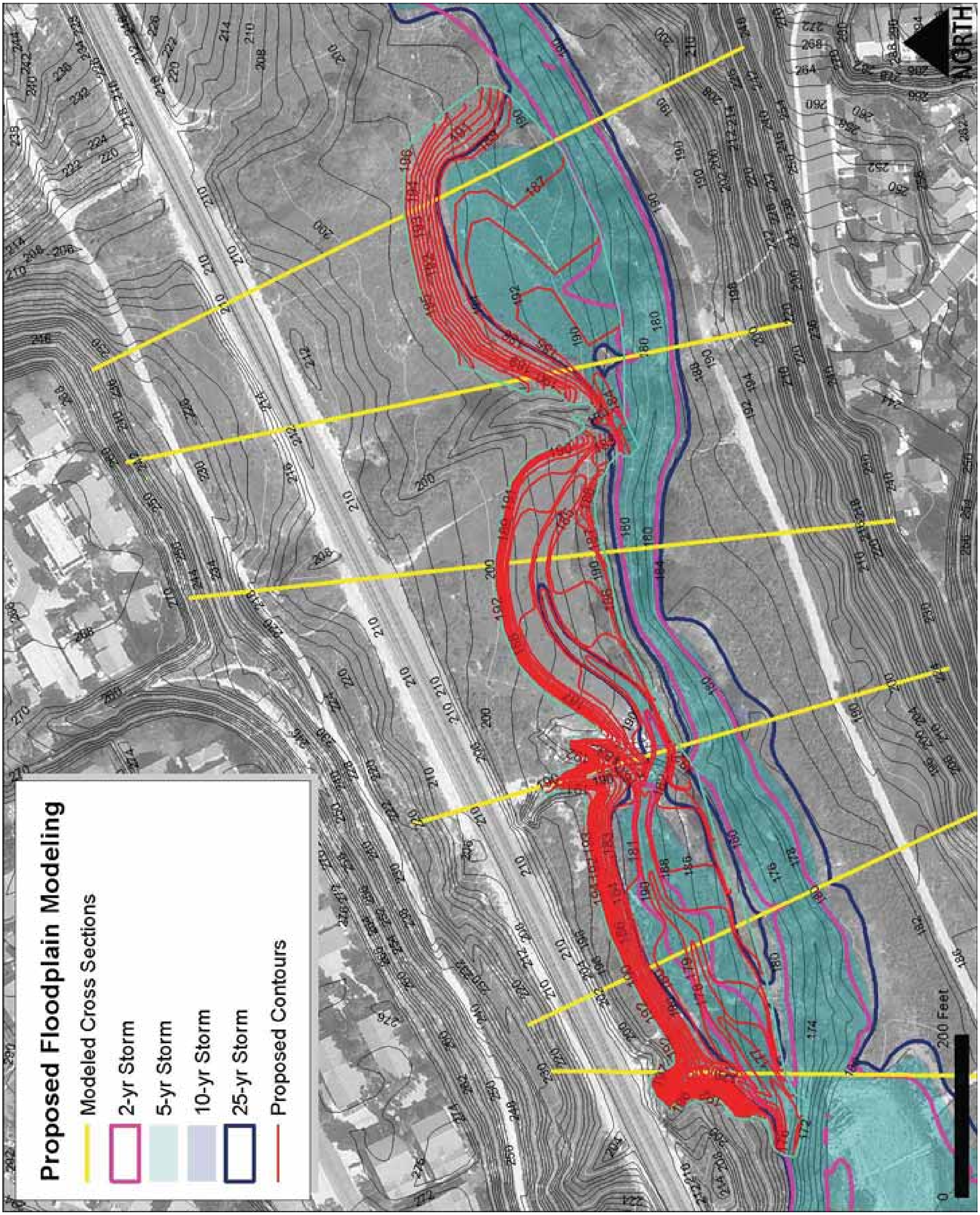


Figure 37 – RC-03 Floodplain Modeling Results



5.5.8 - Rose Canyon – Site 4

Rose Canyon – Site 4 recommendations are similar to Site 3. These two areas are situated adjacent to each other. A video of the site can be viewed at: http://bit.ly/RCSite4. Rose Creek is severely incised in this area and has no opportunity for significant overbank flow. As a result, velocities speed up and result in further downcutting and isolation of the flow from the rest of the system. In-stream step pool structures would first be installed and monitored to determine if this technique would reduce channel incision and raise the bed to allow for sufficient overbank flow. If grading is necessary, the target area for floodplain reconnection and creation is to the north of the channel, and is primarily occupied by non-native grasses as shown in Figure 38. Coyote bush scrub is the transitional habitat on the upslopes of the creek between the riparian habitat and the upland non-native grassland. This habitat type would be replaced upslope following implementation activities.

Like Site 3, significant grading (~45,000 cy of soil removal) would be necessary to create the floodplain terraces. Stockpiling of topsoil, over-excavation, and deep ripping during grading would be required. Implementation of Site 4 would result in the active floodplain expansion of approximately 2.0 acres, including the creation of 0.2 acres of Willow Scrub and 1.75 acres of Oak / Sycamore Woodland. Figure 39 depicts the proposed design of Rose Canyon – Site 4. Figure 40 shows the modeled floodplain analysis.

During final design, flows from the storm drain that discharges into the site will need to be modeled to determine appropriate channel design and erosion controls. Additionally, the elevation of the new floodplains could be raised by approximately 12 inches to keep more of the 2-yr storm event in the channel.

Table 14: Functional Improvements Rose Canyon - Site 4

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 15: Existing / Proposed Vegetation Rose Canyon - Site 4

Vegetation	Existing acres	Proposed acres
Willow Scrub	0.193	0.405
Oak / Sycamore Woodland	0.167	1.948
Coastal Sage Scrub	0.301	1.240
Non-native Grassland	2.699	
Disturbed Habitat	0.233	
Roads / Trails		
Total Acres	3.593	3.593

Photo 18: Looking northeast across Site 4

Figure 38 – RC-04 Existing Vegetation and Floodplain Modeling

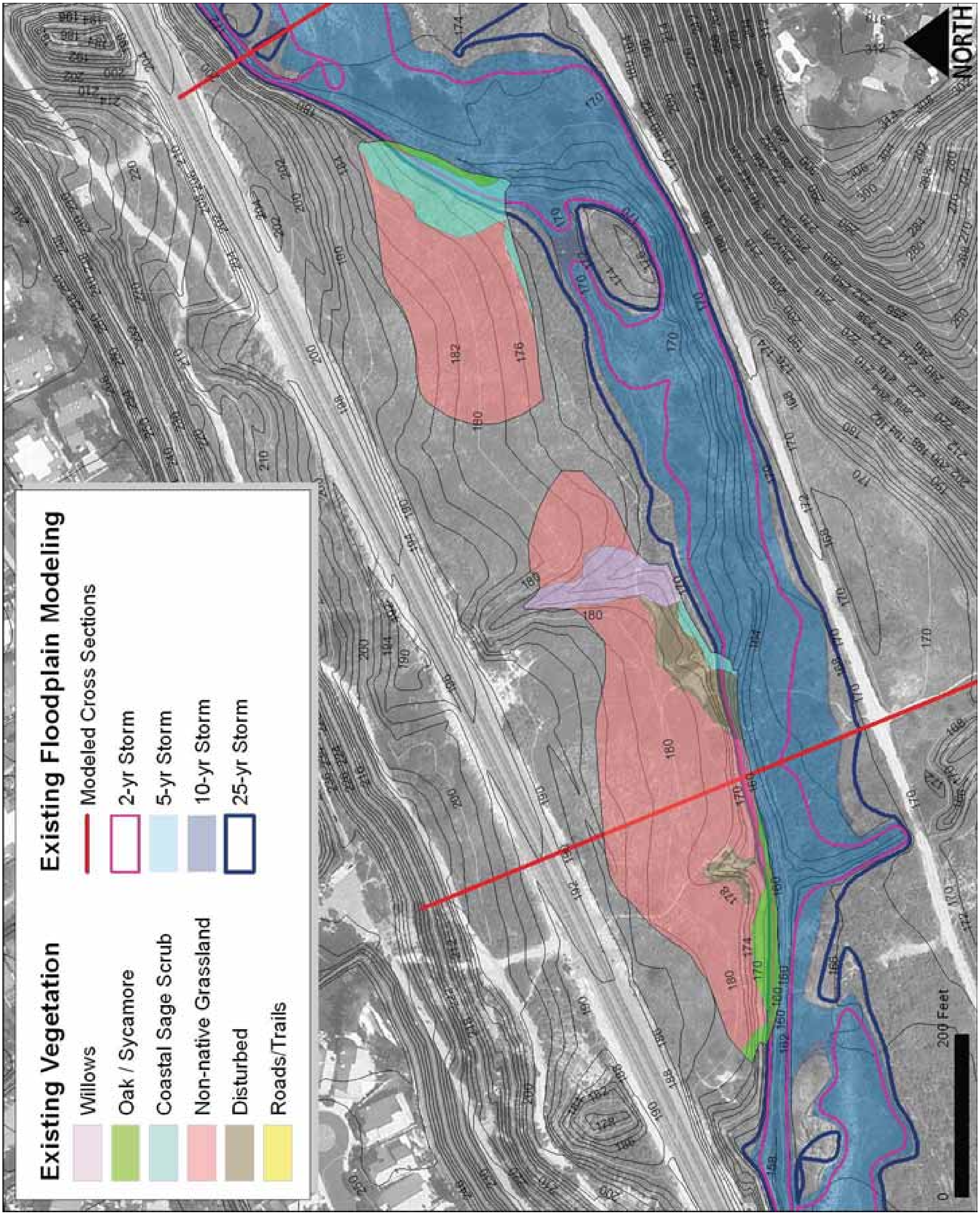
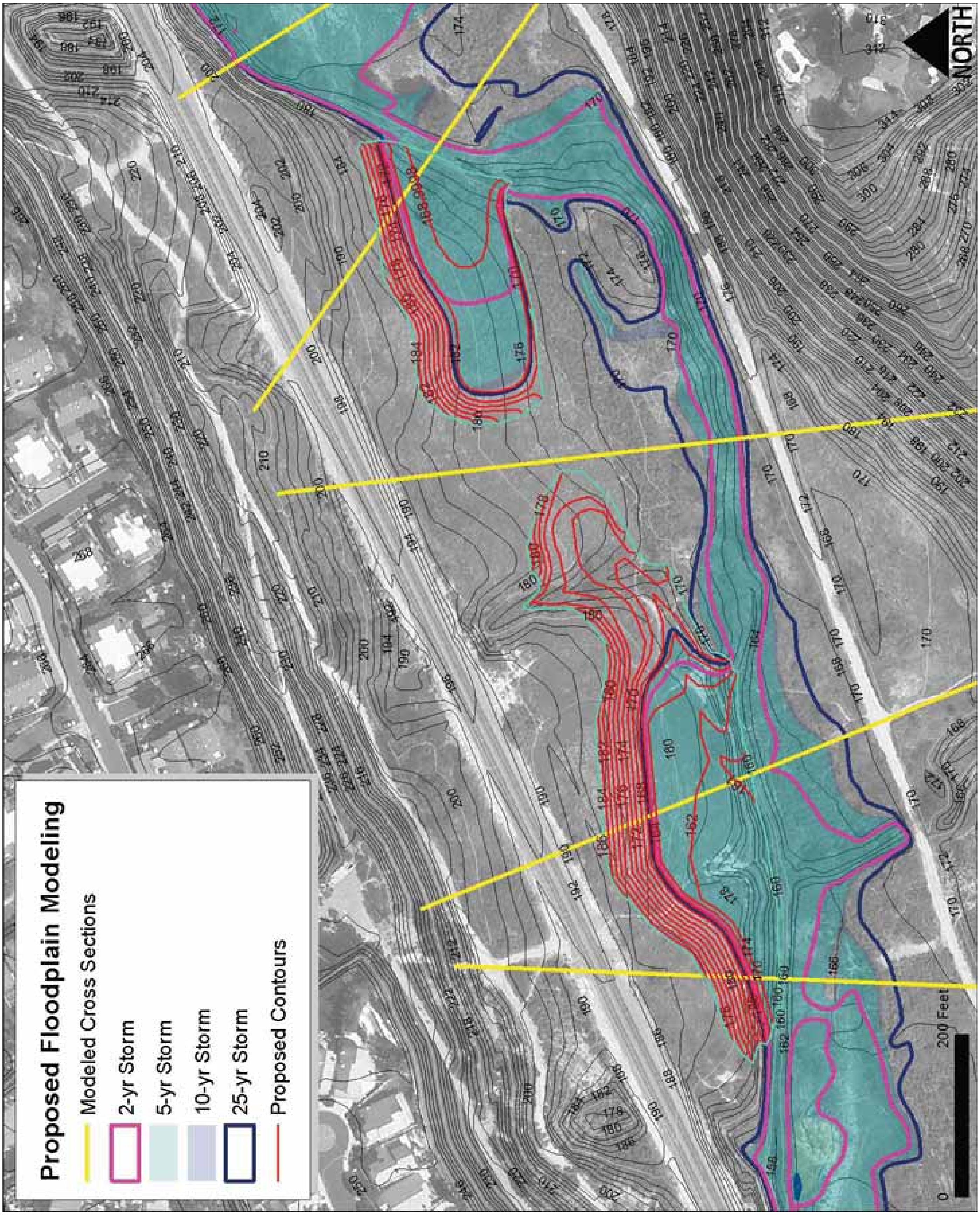


Figure 39 – RC-04 Proposed Vegetation

Figure 40 – RC-04 Floodplain Modeling Results



5.5.9 - Rose Canyon – Site 5

Rose Canyon – Site 5 is situated in a slightly higher elevation than the active channel. It is occupied primarily by non-native grasses as shown in Figure 41. A video of the site can be viewed at: http://bit.ly/RCSite5. Recommendations for this site are to perform minor grading (~4,400 cy of soil removal) so that inundation is possible during the two year storm event. This area would result in a "backwater" effect, in that water would enter the area and flow back to the east. The proposed design demonstrates that this area would be inundated during the two year storm event connecting with a currently isolated sycamore tree. Implementation of Site 5 would result in the active floodplain expansion of approximately 1.2 acres, including the creation of 0.2 acres of Willow Scrub and 0.85 acres of Oak / Sycamore Woodland and removal of non-native habitat. Figure 42 depicts the proposed design of Rose Canyon – Site 5. Figure 43 shows the modeled floodplain analysis.

During final design, the elevation of the eastern portion of the new floodplain could be lowered by approximately 12 inches to inundate a larger portion of the site on a more regular basis.

Table 16: Functional Improvements Rose Canyon - Site 5

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 17: Existing / Proposed Vegetation Rose Canyon - Site 5

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.211
Oak / Sycamore Woodland	0.124	0.971
Coastal Sage Scrub	0.216	0.156
Non-native Grassland	0.998	
Disturbed Habitat		
Roads / Trails		
Total Acres	1.338	1.338

Photo 19: Looking southeast across Site 5

Figure 41 – RC-05 Existing Vegetation and Floodplain Modeling

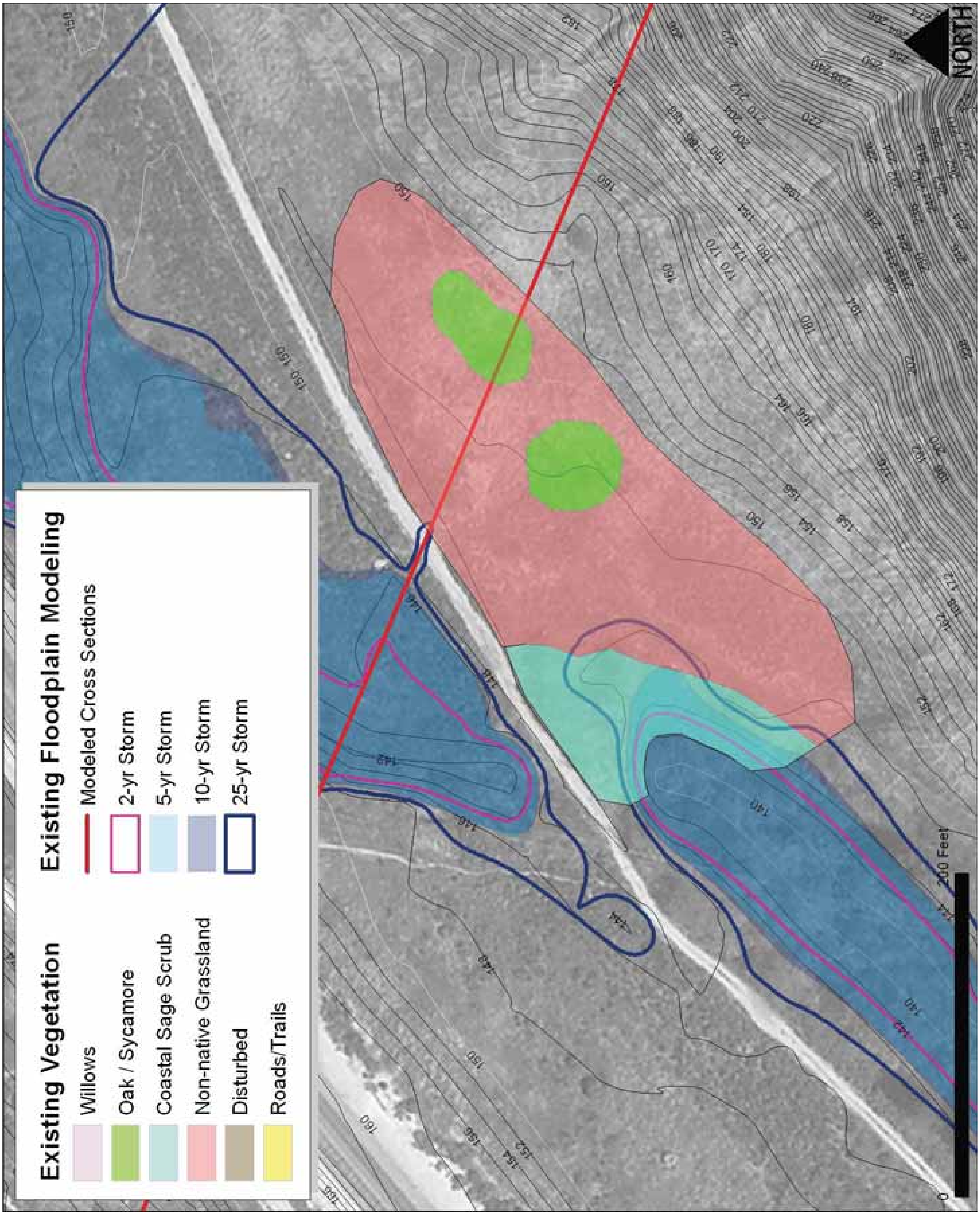


Figure 42 – RC-05 Proposed Vegetation

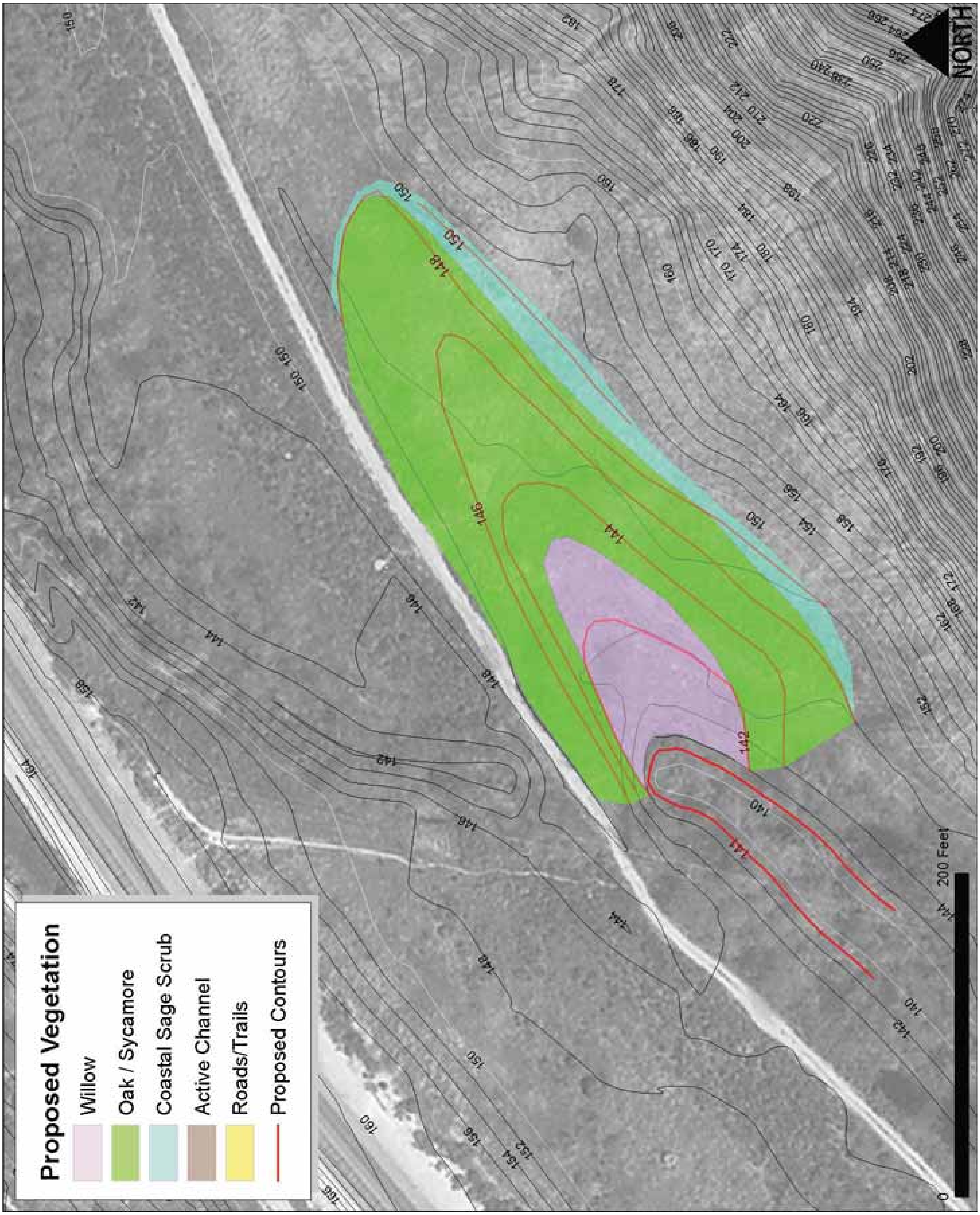
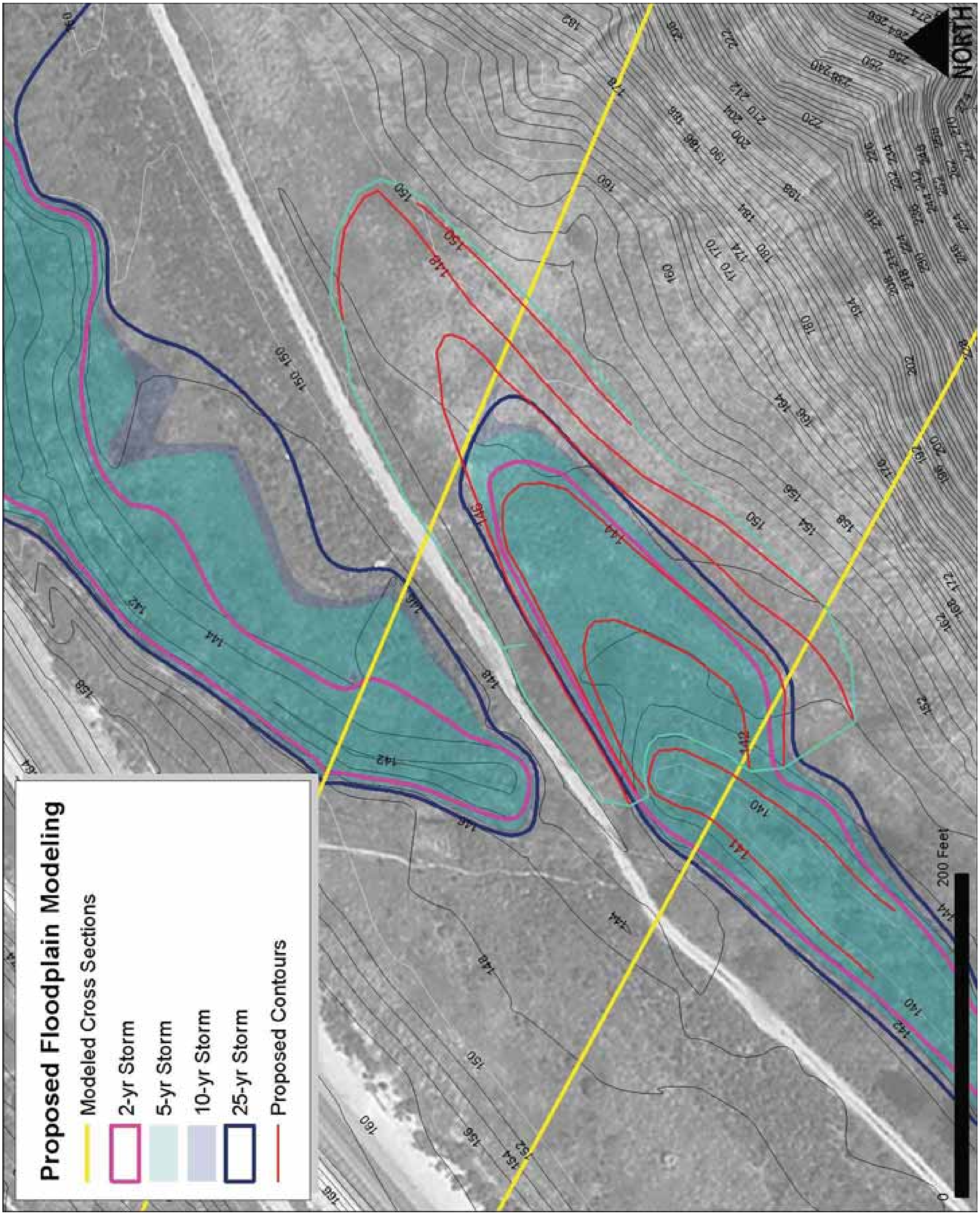


Figure 43 – RC-05 Floodplain Modeling Results



5.5.10 - Rose Canyon – Site 6

This site is at the confluence of a significant unnamed tributary and Rose Creek directly to the east of where the tributary from Gilman Canyon enters Rose Creek. The tributary is highly incised, up to 30 feet in many areas. Rose Creek is incised approximately 5 feet in this area and has no access to its floodplain. The area is dominated by non-native grassland as shown in Figure 44. No video is available of this site. Channel incision upstream of Site 6 and 7 can be viewed at: http://bit.ly/RCIncisedUp6and7. The intent of this site first install in-stream structures to partially raise the bed, coupled with ~8,000 cy of soil removal in the adjacent upland habitat to create wetland habitat and capture the two year storm event. The proposed design demonstrates that this area would be inundated during the two year storm event. Implementation of Site 6 would result in the active floodplain expansion of approximately 1.3 acres, including the creation of 0.2 acres of Willow Scrub and 1.1 acres of Oak / Sycamore Woodland and the elimination of non-native grassland. Figure 45 depicts the proposed design of Rose Canyon – Site 6. Figure 46 shows the modeled floodplain analysis.

During final design, the elevation of the eastern portion of the new floodplain could be lowered by approximately 12 inches to inundate a larger portion of the site on a more regular basis.

Table 18: Functional Improvements Rose Canyon - Site 6

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 19: Existing / Proposed Vegetation Rose Canyon - Site 6

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.228
Oak / Sycamore Woodland	0.368	1.111
Coastal Sage Scrub		0.220
Non-native Grassland	1.191	
Disturbed Habitat		
Roads / Trails		
Total Acres	1.559	1.559

Photo 20: Aerial oblique of Site 6 (Source Bing Maps)

Photo 21: Looking north across Site 6

Figure 44 – RC-06 Existing Vegetation and Floodplain Modeling

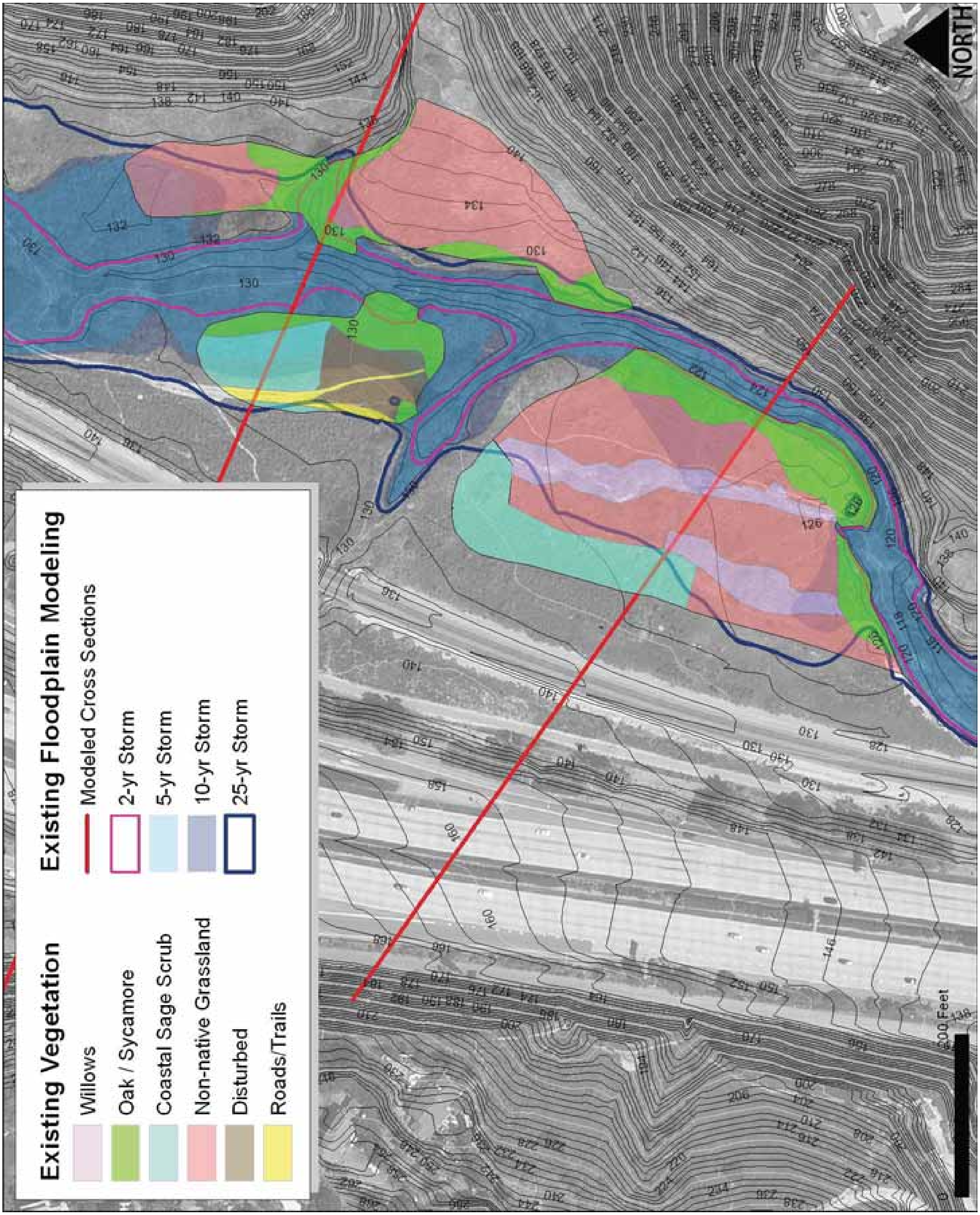


Figure 45 – RC-06 Proposed Vegetation

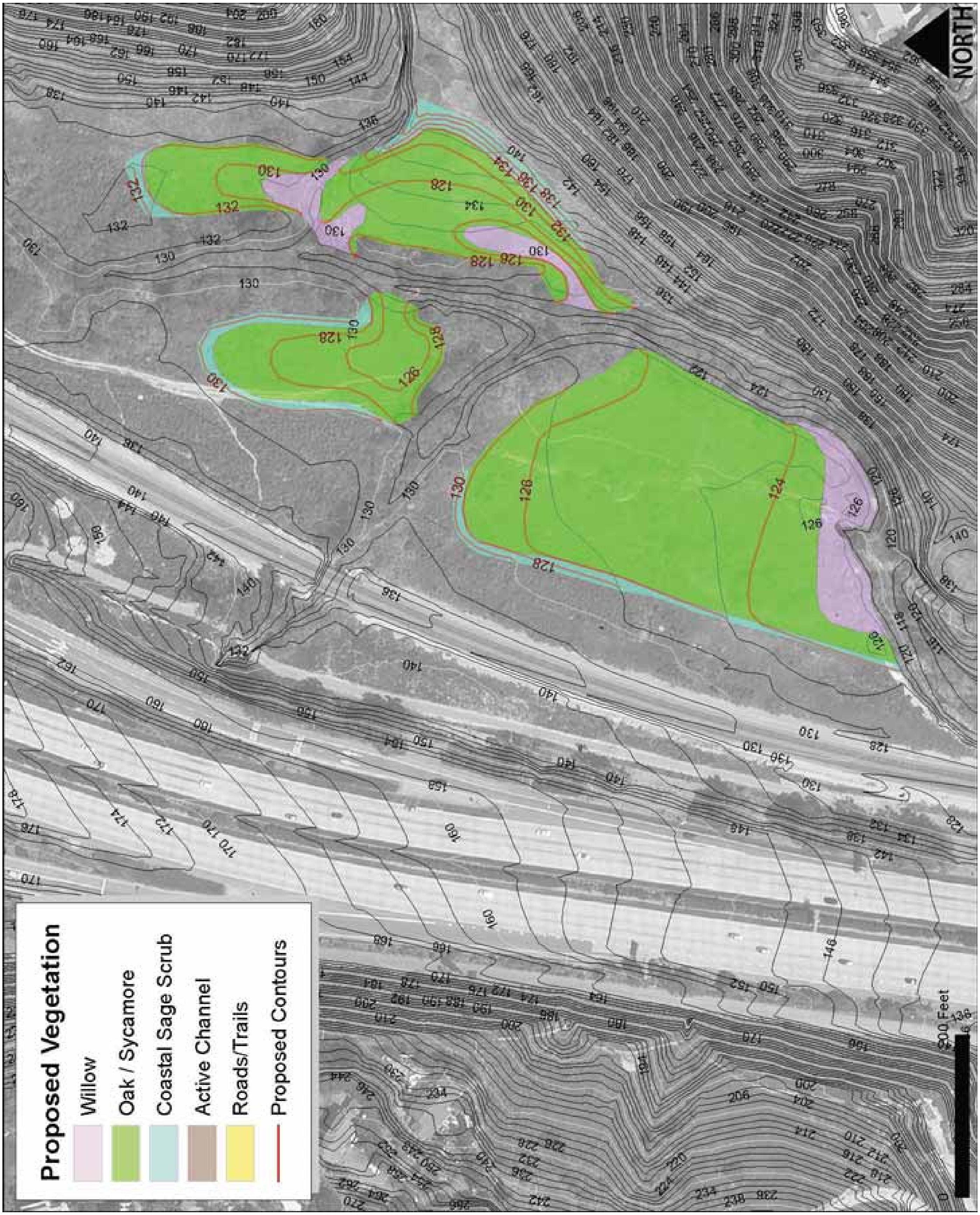
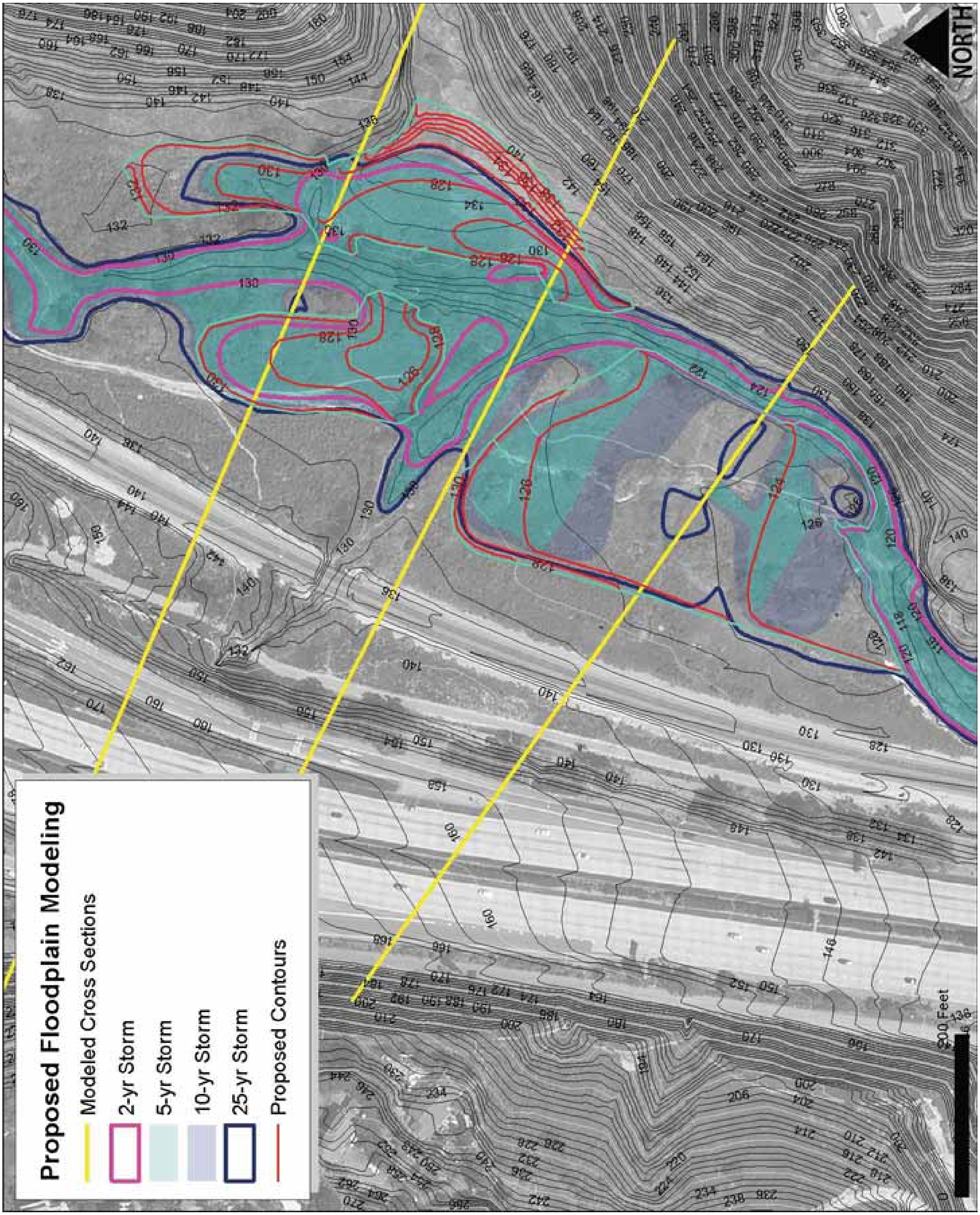


Figure 46 – RC-06 Floodplain Modeling Results



5.5.11 - Rose Canyon – Site 7

The site is adjacent to the Boy Scout Bridge, and on the opposite side of the Rose Creek from Site 6 where the tributary from Gilman Canyon joins Rose Creek. The creek is incised approximately 5 feet in this area and has no access to its floodplain. The site in dominated by non-native grassland and a ribbon of willow scrub as shown in Figure 47. A video of the site can be viewed at: http://bit.ly/RCSite7. Channel incision upstream of Site 7 can be viewed at: http://bit.ly/RCIncisedUp6and7. The intent of this site is to create a series of step pools in both the main channel and adjacent tributaries to bring the grade back up. In addition to step pools, site grading (~8,700 cy of soil removal) to create an active floodplain that will allow overbank flow and a return to a functioning system in a timely manner. A high pressure gas line bisects the site, crossing the existing channel. This gas line will be left in place and not disturbed. Implementation of Site 7 would result in the active floodplain expansion of approximately 2.2 acres, including the creation of 2 acres of Oak / Sycamore Woodland, and the removal of non-native grassland. Figure 48 depicts the proposed design of Rose Canyon – Site 7. Figure 49 shows the modeled floodplain analysis.

During final design, the flows from Gilman Canyon will need to be added to the model to design the step pools along this tributary. Additionally, the elevation of the southern portion of the new floodplain will need to be re-assessed based on the addition of the Gilman Canyon flows to determine if grading adjustments or armorment of the gas pipeline are required.

Table 20: Functional Improvements Rose Canyon - Site 7

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 21: Existing / Proposed Vegetation Rose Canyon - Site 7

Vegetation	Existing acres	Proposed acres
Willow Scrub	0.489	0.305
Oak / Sycamore Woodland	0.775	3.082
Coastal Sage Scrub	0.758	0.330
Non-native Grassland	1.405	
Disturbed Habitat	0.213	
Roads / Trails	0.077	
Total Acres	3.717	3.717

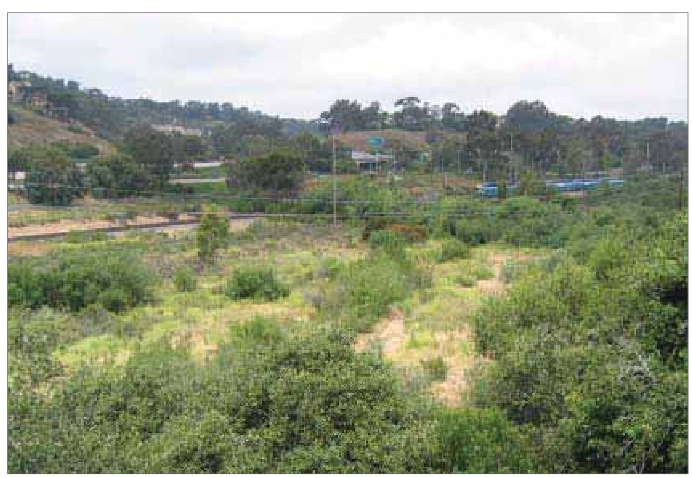


Photo 22: Looking north across Site 7

Figure 47 – RC-07 Existing Vegetation and Floodplain Modeling

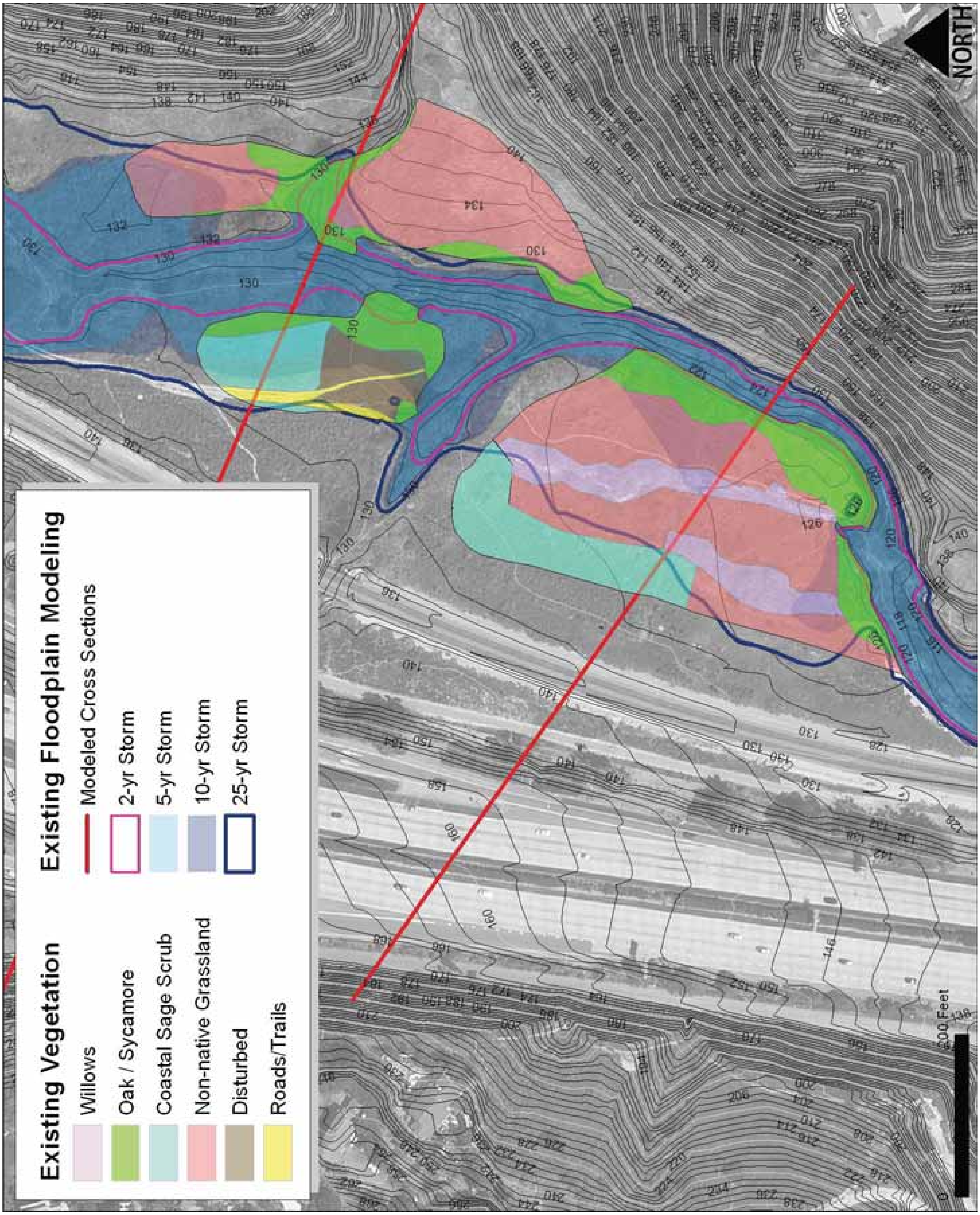


Figure 48 – RC-07 Proposed Vegetation

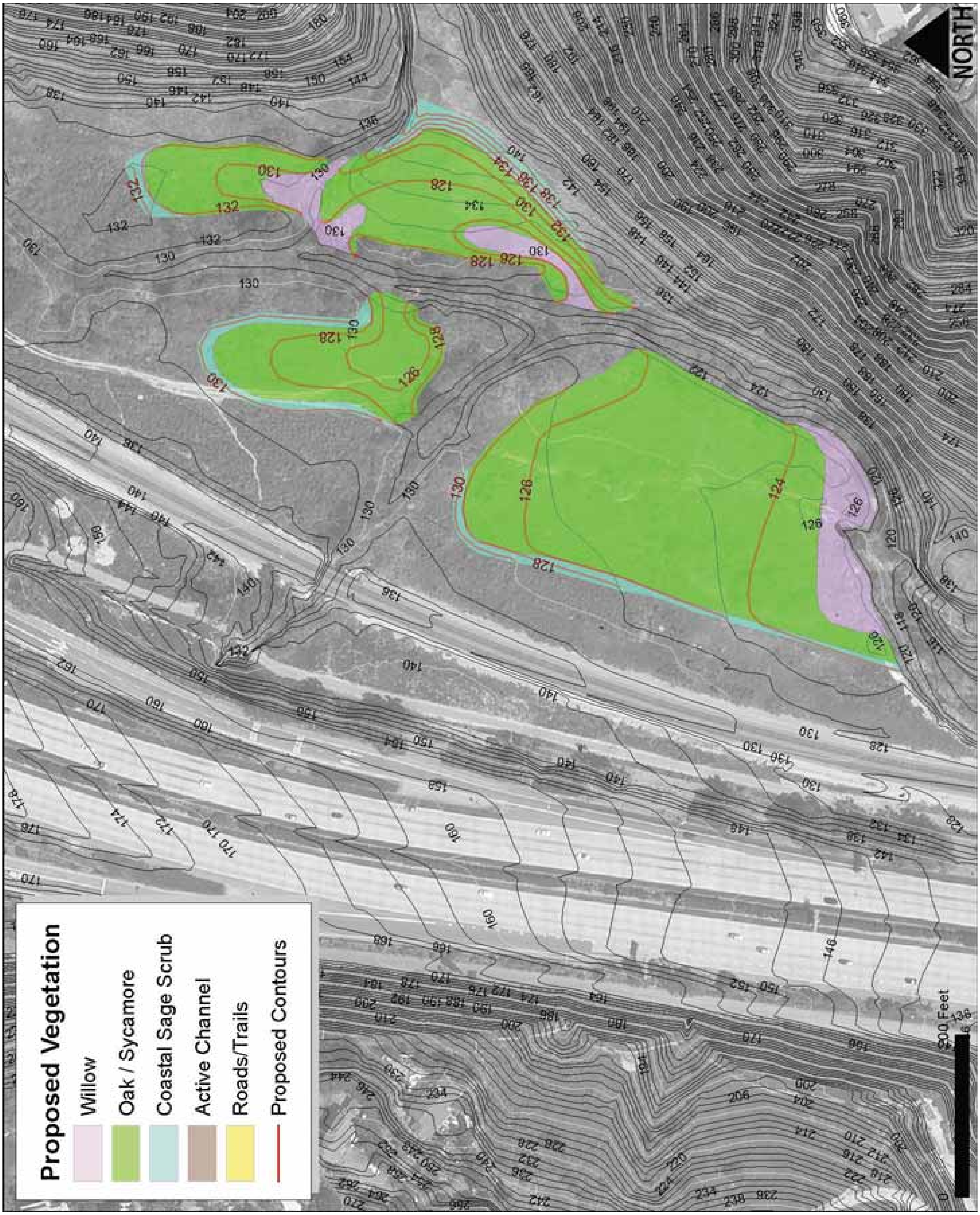
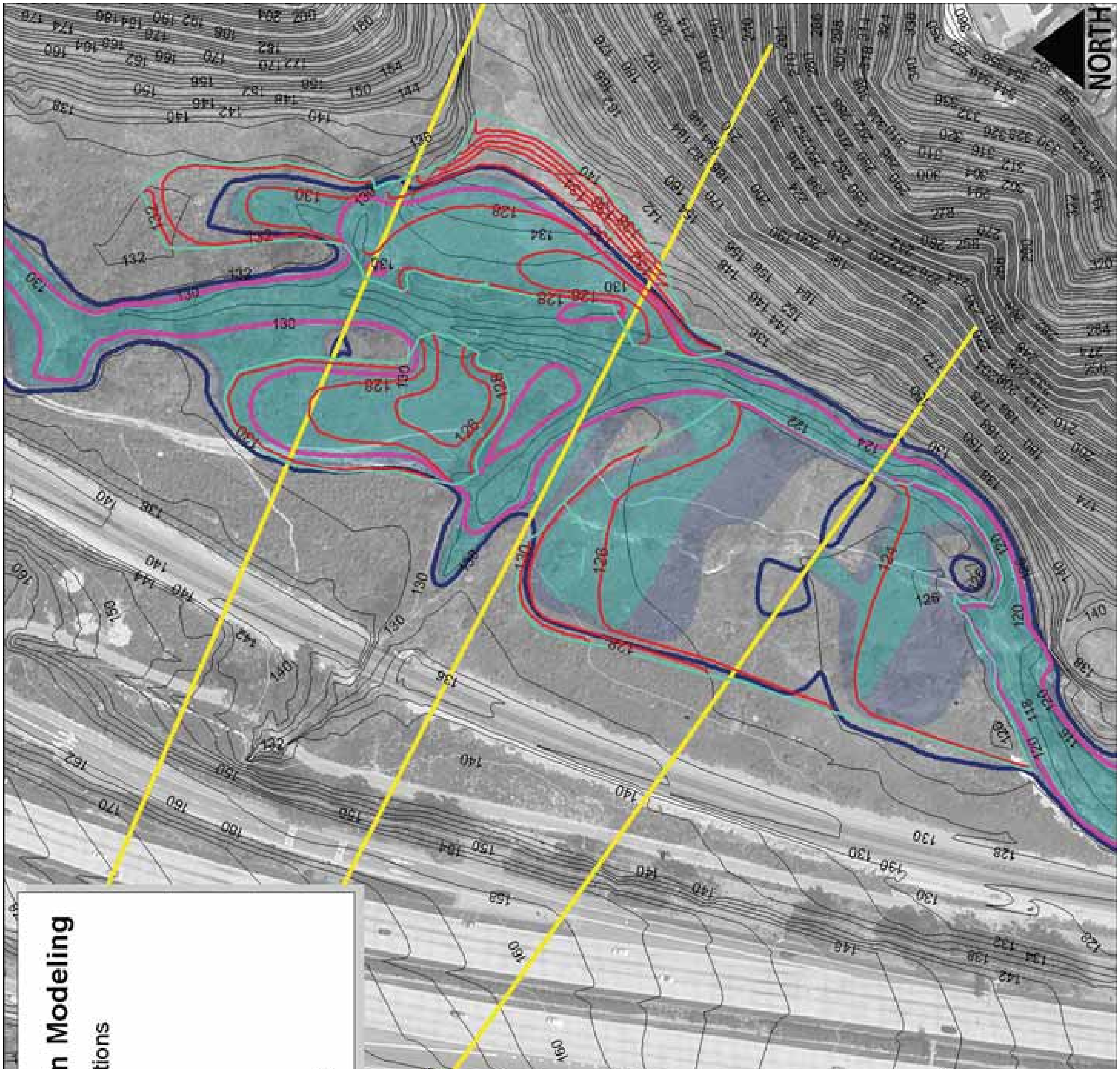


Figure 49 – RC-07 Floodplain Modeling Results



5.5.12 - Rose Canyon – Site 8

Rose Canyon – Site 8 is a relic floodplain habitat that was isolated from the main drainage as a result of State Route 52 and Interstate 5 improvements. It is a relic habitat, in that some of the former vegetation exists as shown in Figure 50, but current hydrologic conditions will not support the community in the long-run. The site is situated to the north of the intersection with Interstate 5 and State Route 52 and to the east of the rail line. A video of the site can be viewed at: http://bit.ly/RCSite8. Recommendations for this site are based upon improving floodplain connectivity. This area receives input only under large flood events. Site grading (~5,000 cy of soil removal) to lower the elevation, allowing increased flows during smaller flood events would result in the net improvement of hydrologic and biological functions. Implementation of Site 8 would result in the active floodplain expansion of approximately 0.2 acres, including the creation of 0.5 acres of Oak / Sycamore Woodland. Figure 51 depicts the proposed design of Rose Canyon – Site 8. Figure 52 shows the modeled floodplain analysis.

Table 22: Functional Improvements Rose Canyon - Site 8

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 23: Existing / Proposed Vegetation Rose Canyon - Site 8

Vegetation	Existing acres	Proposed acres
Willow Scrub	0.135	0.113
Oak / Sycamore Woodland	0.142	0.628
Coastal Sage Scrub	0.567	0.070
Non-native Grassland	0.036	
Disturbed Habitat	0.035	
Roads / Trails	0.082	0.186
Total Acres	0.997	0.997

Photo 23: Looking south across Site 8

Figure 50 – RC-08 Existing Vegetation and Floodplain Modeling

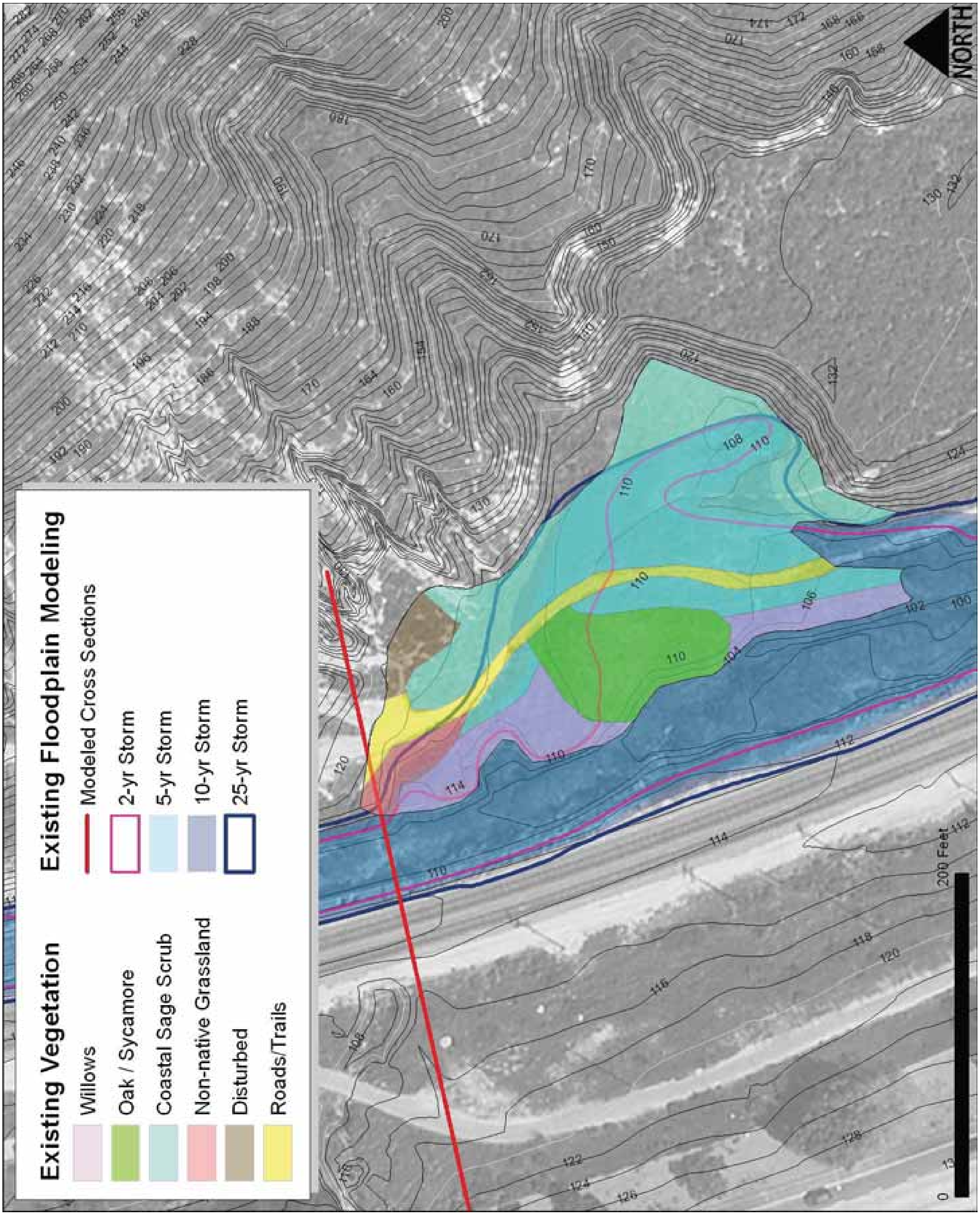


Figure 51 – RC-08 Proposed Vegetation

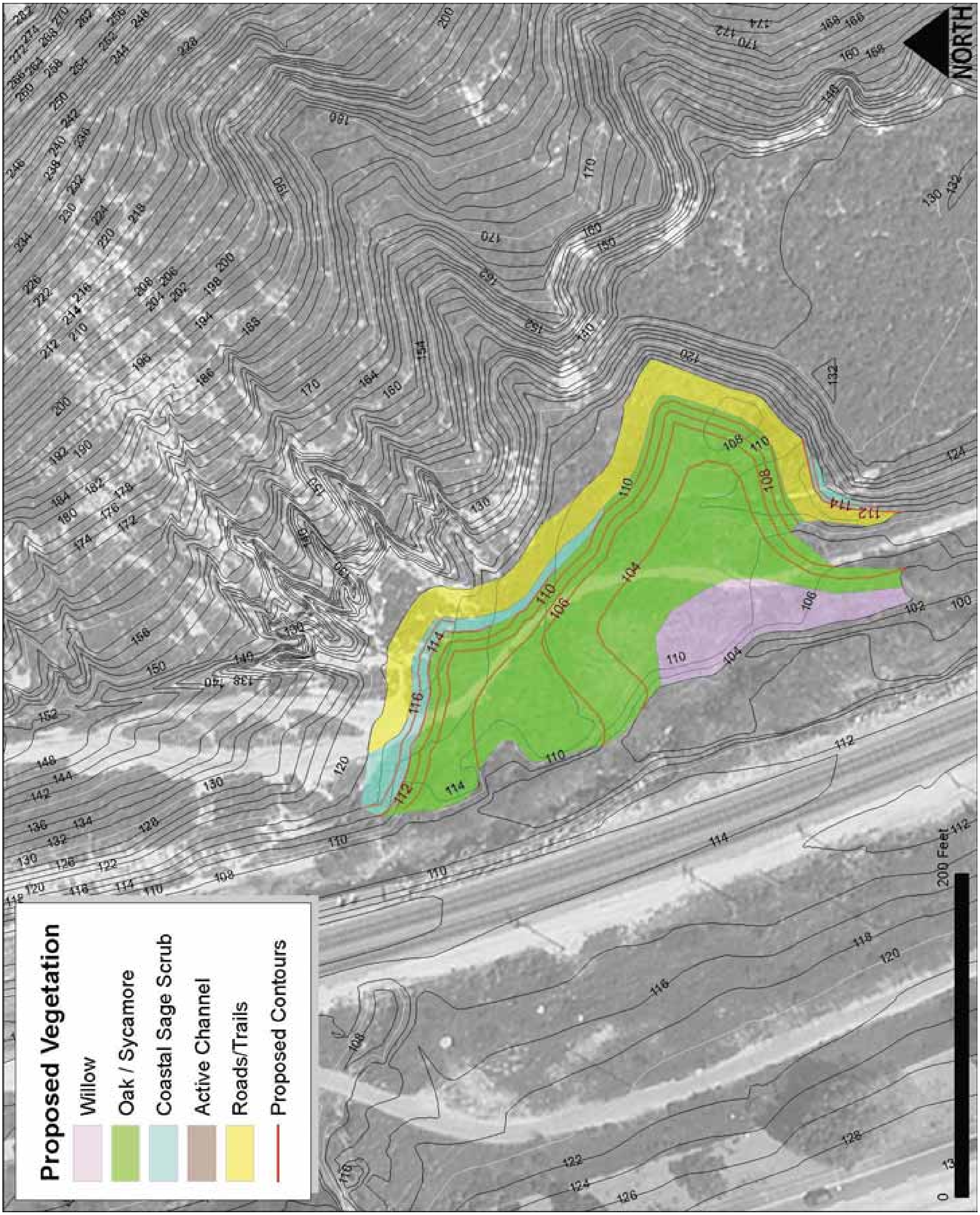
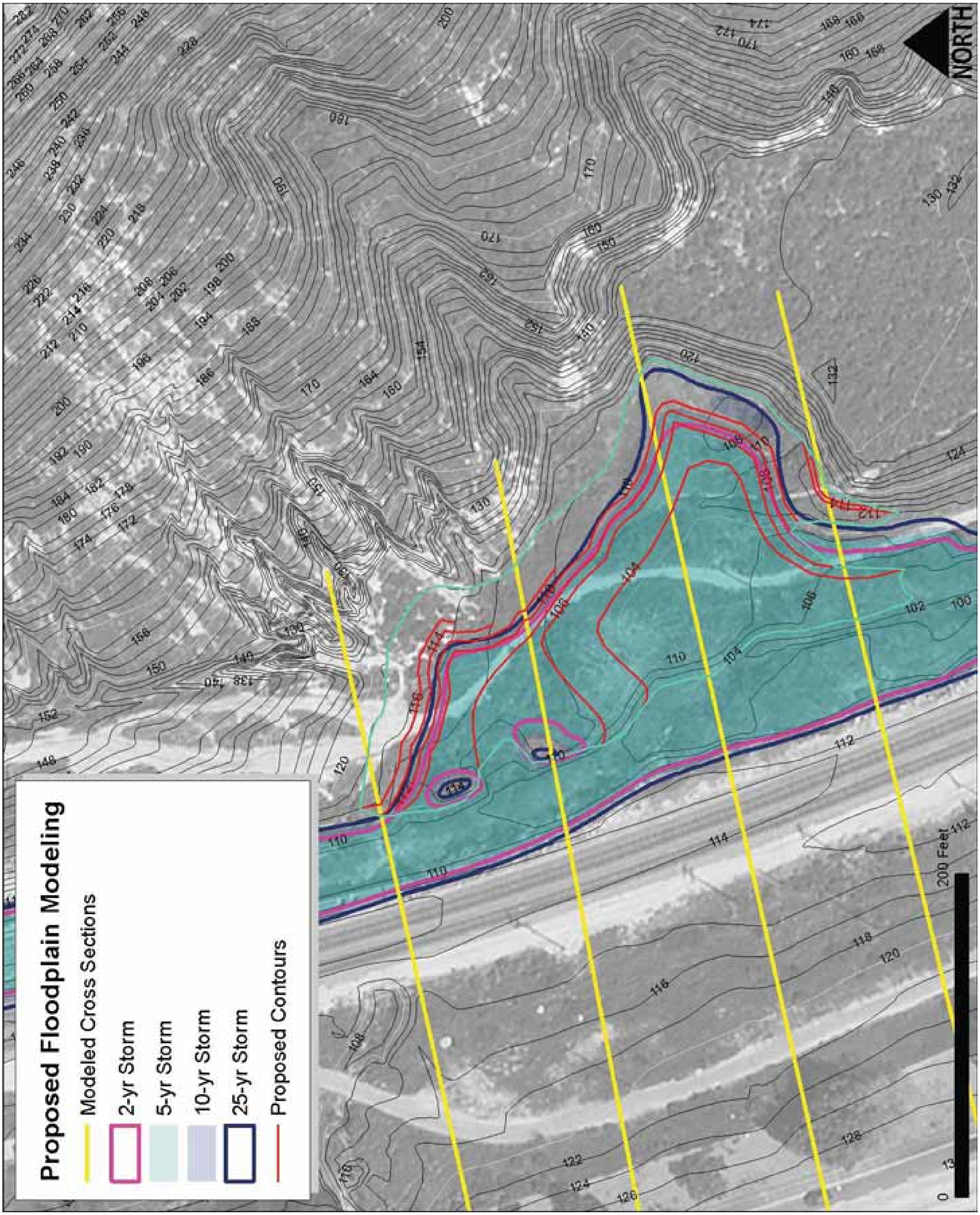


Figure 52 – RC-08 Floodplain Modeling Results



5.5.13 – San Clemente Canyon – Reference Site

The San Clemente Canyon – Reference Site depicts a good example of a sycamore woodland habitat situated within a stable hydraulic environment. A video of the site can be viewed at: http://bit.ly/SCRefSite. In addition to the main channel, numerous small cobble filled channels meander through the woodland. The flow is unrestricted; therefore little to no channel incision is present. Small scour pockets are occupied with emergent wetland vegetation, which is largely absent in other parts of the watershed where channel incision is a problem.

Photo 24: Aerial oblique of San Clemente Reference Site, Source Bing Maps

Photo 25: San Clemente Reference Site looking downstream

Photo 26: San Clemente Reference Site looking upstream

5.5.14 - San Clemente Canyon – Site 1

San Clemente Canyon – Site 1 is a relic floodplain habitat that is now hydrologically isolated from the main channel. A video of the site can be viewed at: http://bit.ly/SCSite1. The sycamores scattered throughout the site is evidence that this habitat was once regularly flooded, but no new recruitment of sycamores has occurred. These sycamores show signs of stress and are slowly dying. City of San Diego Open Space Division biologists have discovered a fungus that may be the culprit in the decline of the mature sycamores in both Rose and San Clemente canyons. The condition of the trees should be monitored over time to see if their condition changes. The upper branches of most of the trees are dead, and they may sometime in the future die completely. Coastal sage scrub, an upland habitat, is now scattered beneath the sycamores as shown in Figure 53. There is a complete absence of sycamore seedlings or saplings or any other riparian species. The active channel has undergone approximately 5 feet of incision, thus flood flows are not able to access the historic floodplain. This condition may continue to deteriorate in the future.

Recommended actions would be to restore the floodplain connection with a combination of small step pools to raise the elevation over time, and site grading (~1,300 cy of soil removal) allowing the 5- and 10-year storm events to reconnect with the floodplain. Implementation of SC Site 1 would result in the active floodplain expansion of approximately 0.5 acres, including the creation of 0.5 acres of Oak / Sycamore Woodland. Figure 54 depicts the proposed design of San Clemente Canyon – Site 1. Figure 55 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain raised 6-12 inches to help contain the 2-yr storm event within the main channel better.

Table 23: Functional Improvements San Clemente Canyon - Site 1

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 24: Existing / Proposed Vegetation San Clemente Canyon - Site 1

Vegetation	Existing acres	Proposed acres
Willow Scrub	0.012	0.029
Oak / Sycamore Woodland	0.077	0.504
Coastal Sage Scrub	0.443	
Non-native Grassland		
Disturbed Habitat		
Roads / Trails		
Total Acres	0.533	0.533

Photo 27: Looking northwest across Site 1

Figure 53 – SC-01 Existing Vegetation and Floodplain Modeling

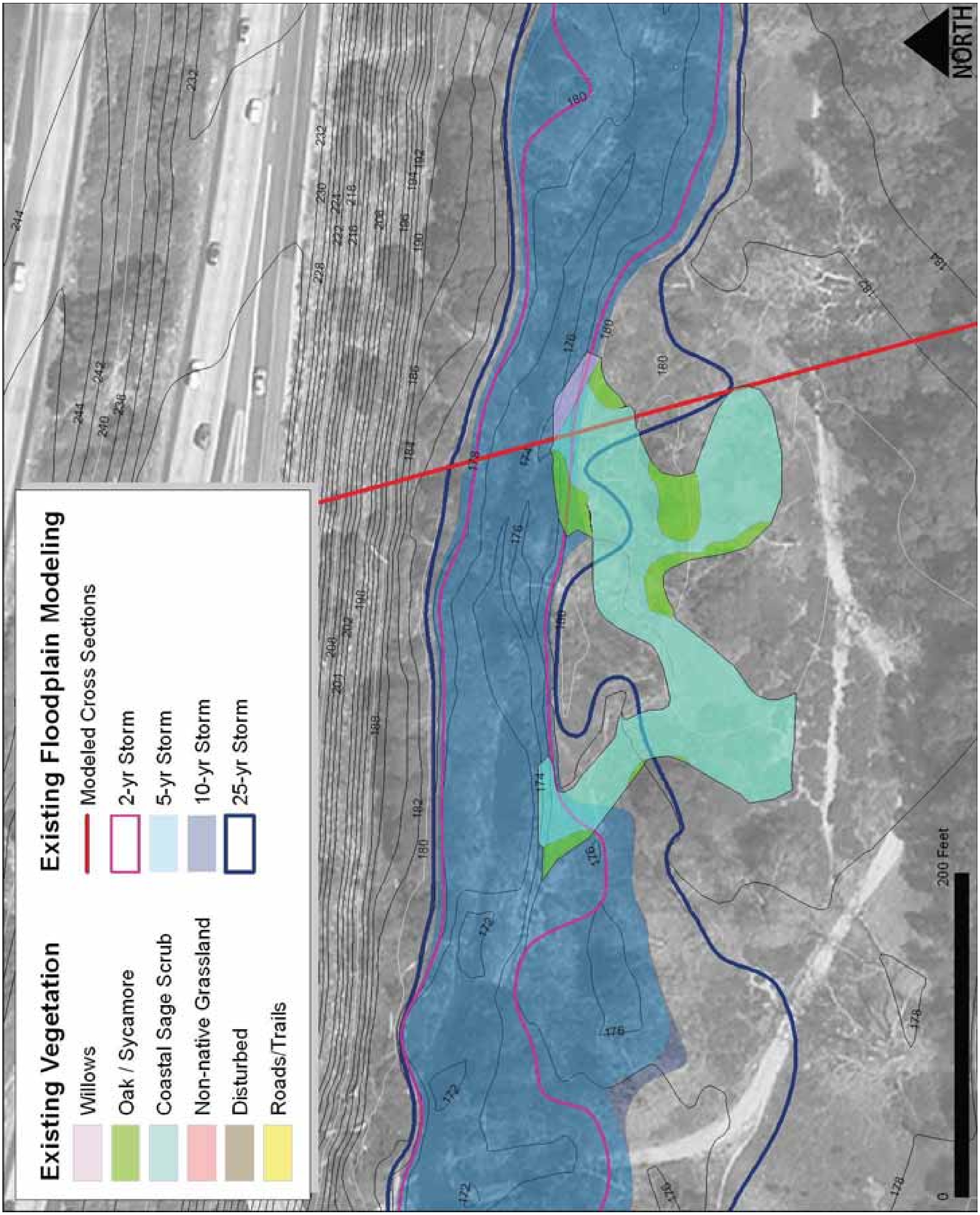


Figure 54 – SC-01 Proposed Vegetation

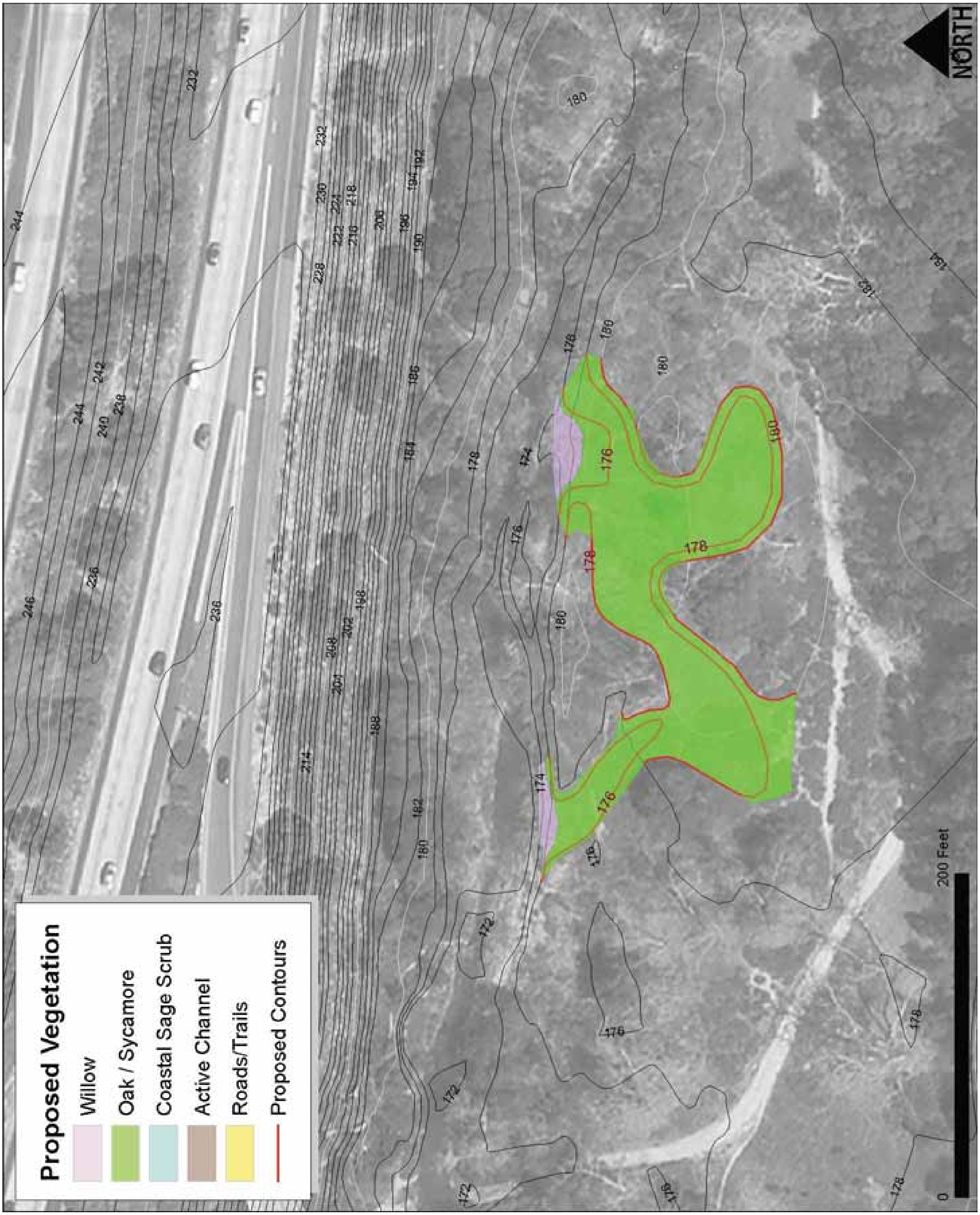
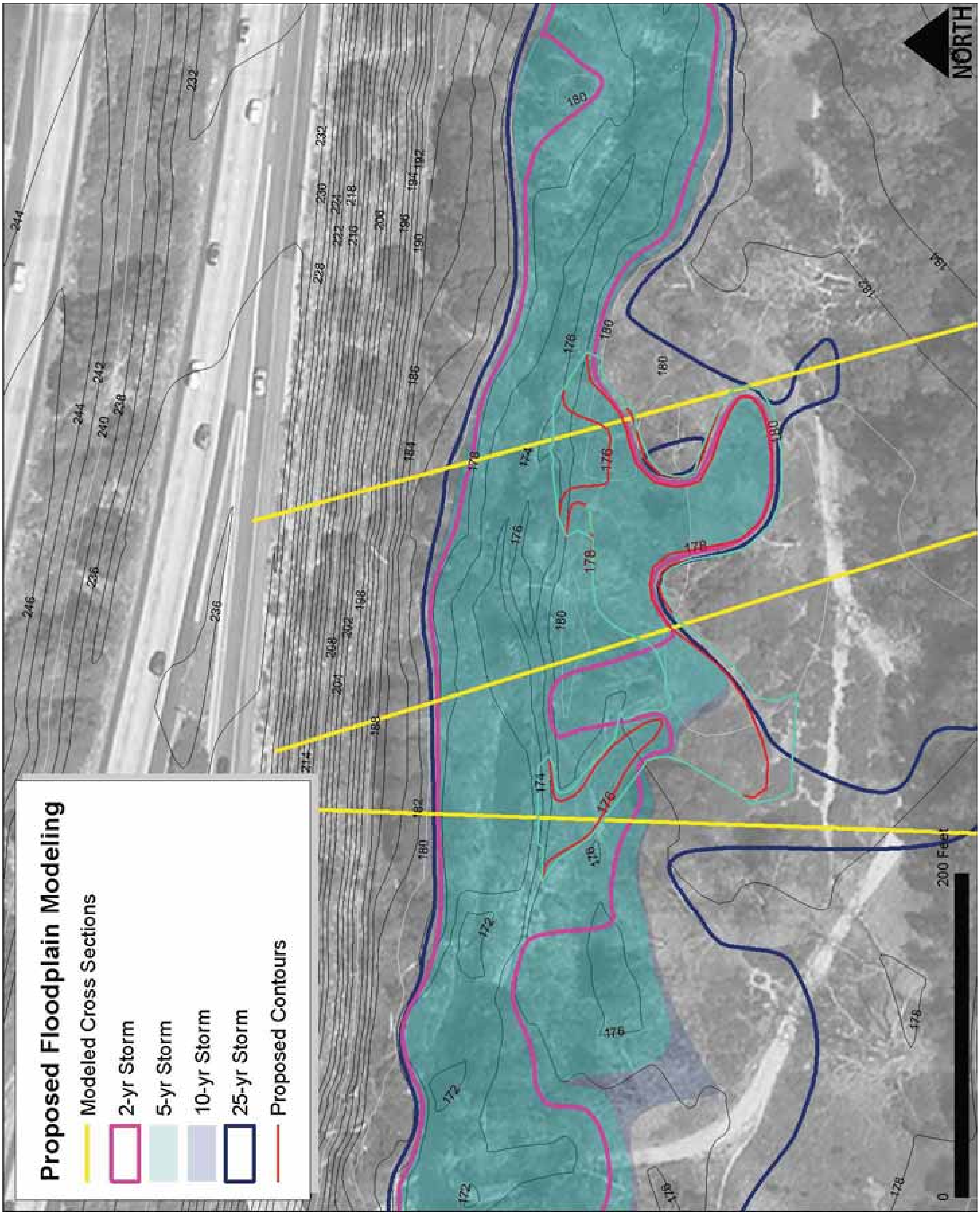


Figure 55 – SC-01 Floodplain Modeling Results



5.5.15 - San Clemente Canyon – Site 2

San Clemente Canyon – Site 2 is also a relic floodplain habitat that is now hydrologically isolated from the main channel. A video of the site can be viewed at: http://bit.ly/SCSite2. Like SC – Site 1, the intent would be to reconnect with the relic floodplain. An in-stream step pool structure would first be installed. The east stream bank would be left in place and the western bank would be graded (~1,500 cy of soil removal) to capture the 5- and 10-year storm events if necessary. The result of the implementation of Site 2 would create a backwater effect. The relic floodplain contains non-native grassland as well as coastal sage scrub habitat as shown in Figure 56. Implementation of SC Site 2 would result in the active floodplain expansion of approximately 0.3 acres, including the creation of 0.4 acres of Oak / Sycamore Woodland. Figure 57 depicts the proposed design of San Clemente Canyon – Site 2. Figure 58 shows the modeled floodplain analysis.

During final design, a more detailed hydraulic analysis will be required to ensure the main channel will remain in its current location and not try to re-align through the site.

Table 25: Functional Improvements San Clemente Canyon - Site 2

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 26: Existing / Proposed Vegetation San Clemente Canyon - Site 2

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.056
Oak / Sycamore Woodland	0.154	0.543
Coastal Sage Scrub	0.279	
Non-native Grassland	0.078	
Disturbed Habitat	0.018	
Roads / Trails	0.070	
Total Acres	0.599	0.599

Photo 28: Looking southeast across Site 2

Figure 56 – SC-02 Existing Vegetation and Floodplain Modeling

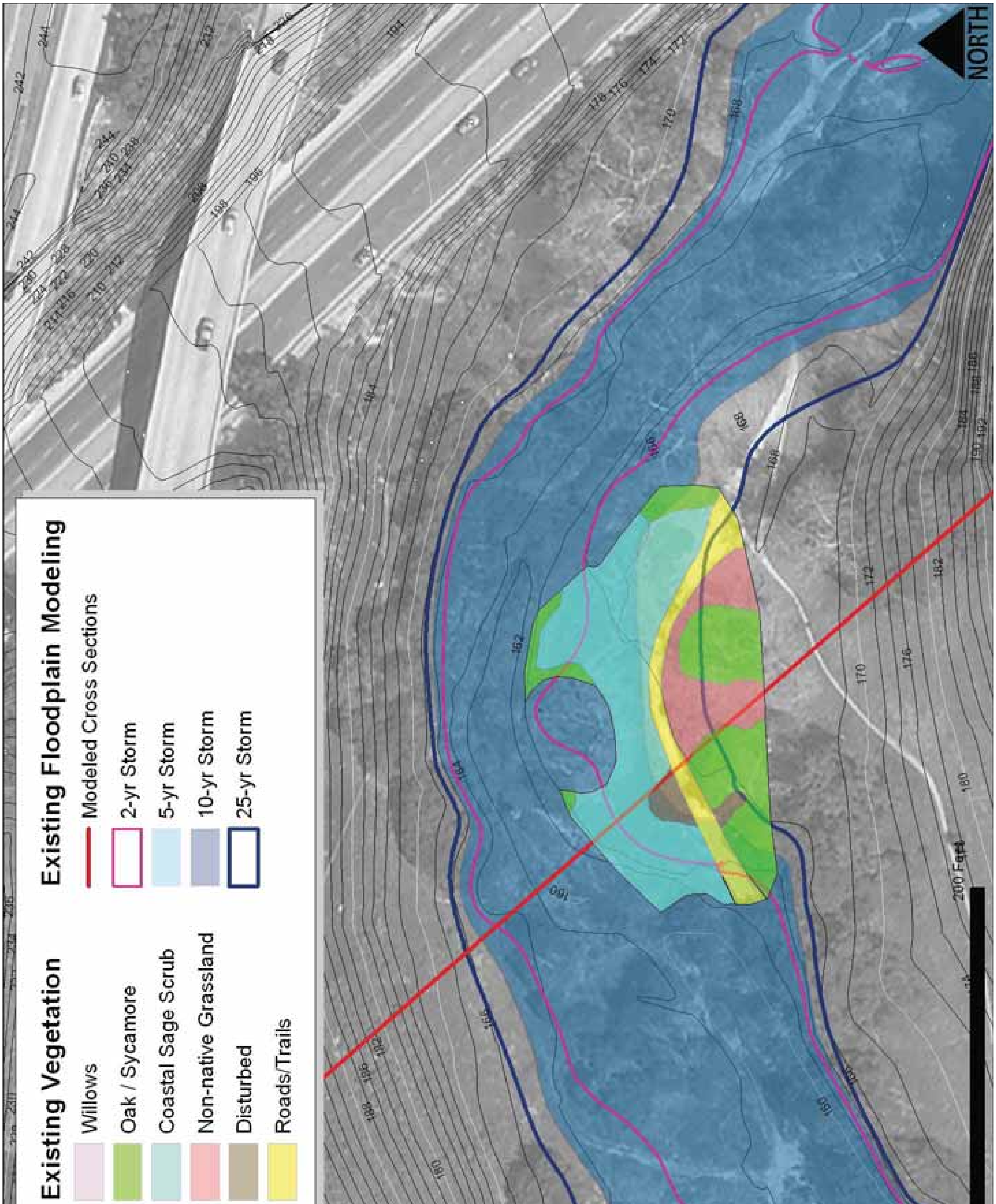
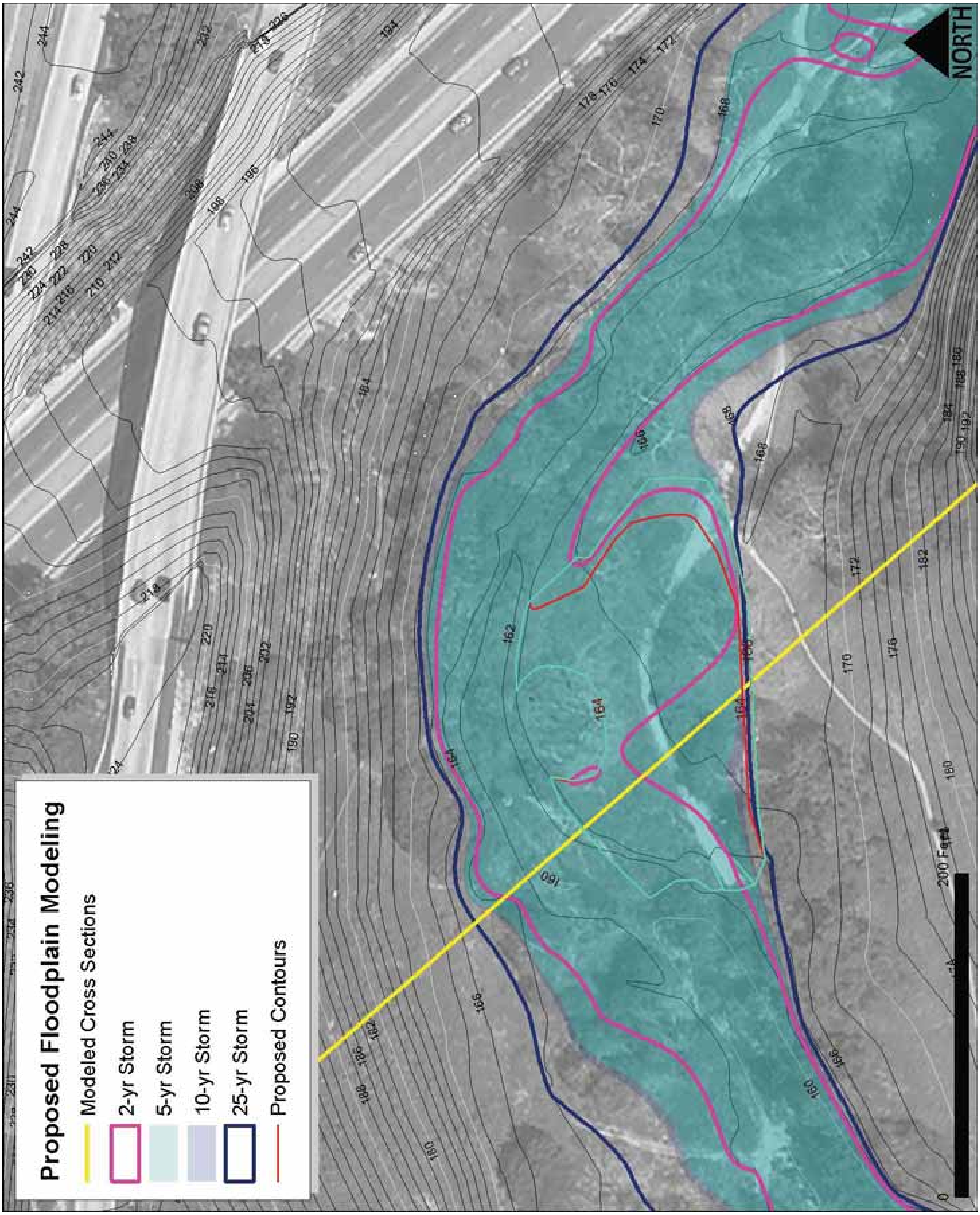


Figure 57 – SC-02 Proposed Vegetation

Figure 58 – SC-02 Floodplain Modeling Results



5.5.16 - San Clemente Canyon – Site 2a

San Clemente Canyon – Site 2a is also a relic floodplain habitat that is now hydrologically isolated from the main channel. Like SC – Site 2, the intent would be to reconnect with the relic floodplain. An in-stream step pool structure would first be installed. The east stream bank would be left in place and the western bank would be graded (~1,600 cy of soil removal) to capture the 5- and 10-year storm events if necessary. The relic floodplain contains non-native grassland as well as coastal sage scrub habitat as shown in Figure 59. Implementation of SC Site 2a would result in the active floodplain expansion of approximately 0.3 acres, including the creation of 0.4 acres of Oak / Sycamore Woodland. Any coastal sage scrub habitat removed would be replaced in the immediate vicinity to ensure no loss of this valuable habitat. Figure 60 depicts the proposed design of San Clemente Canyon – Site 2a. Figure 61 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain could be raised 6-12 inches to allow more of the 2-yr storm event to remain within the existing channel.

Table 27: Functional Improvements San Clemente Canyon - Site 2a

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 28: Existing / Proposed Vegetation San Clemente Canyon - Site 2a

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.069
Oak / Sycamore Woodland	0.084	0.456
Coastal Sage Scrub	0.106	
Non-native Grassland	0.335	
Disturbed Habitat		
Roads / Trails		
Total Acres	0.526	0.526

Photo 29: Looking southwest across Site 2a

Figure 59 – SC-02a Existing Vegetation and Floodplain Modeling

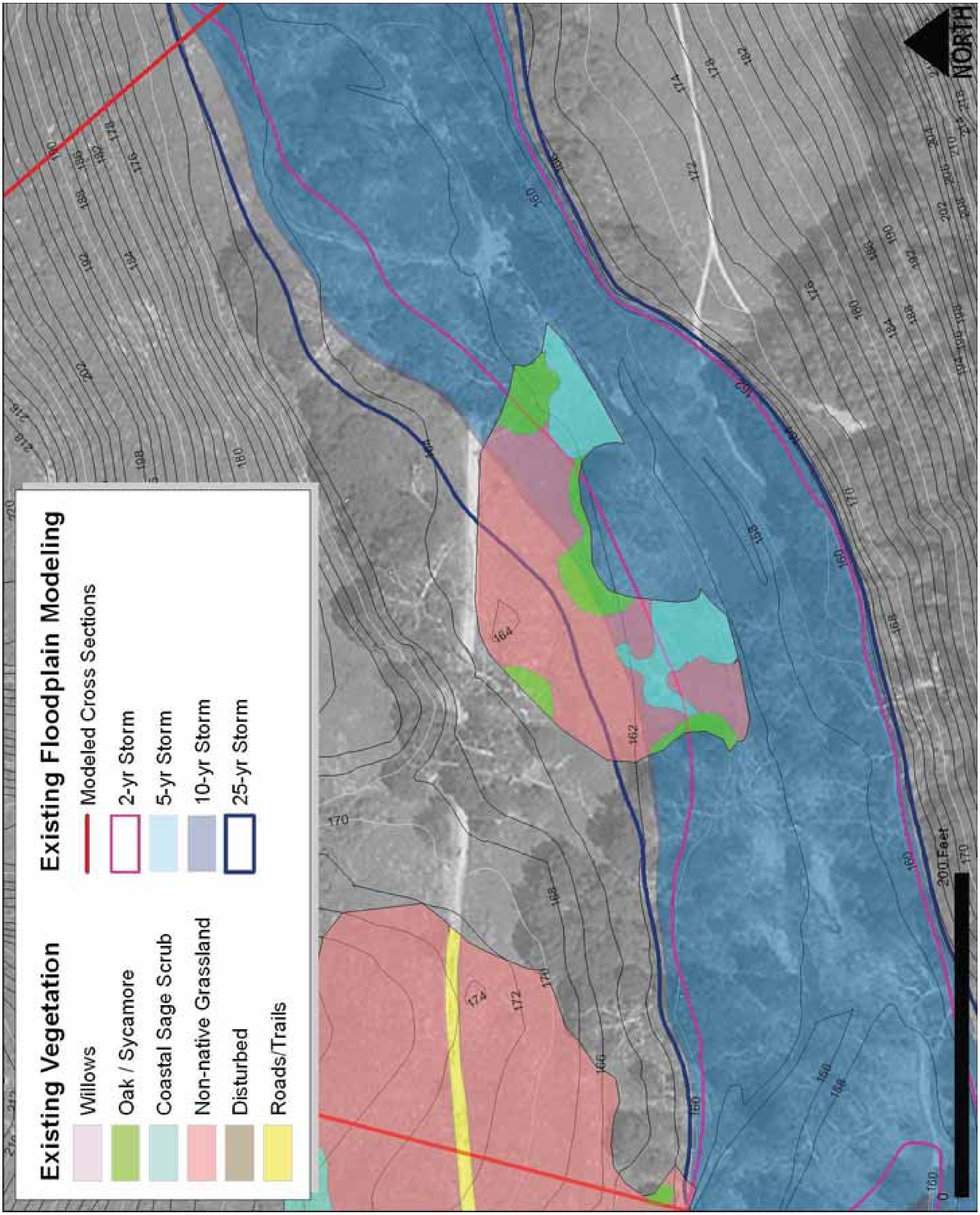


Figure 60 – SC-02a Proposed Vegetation

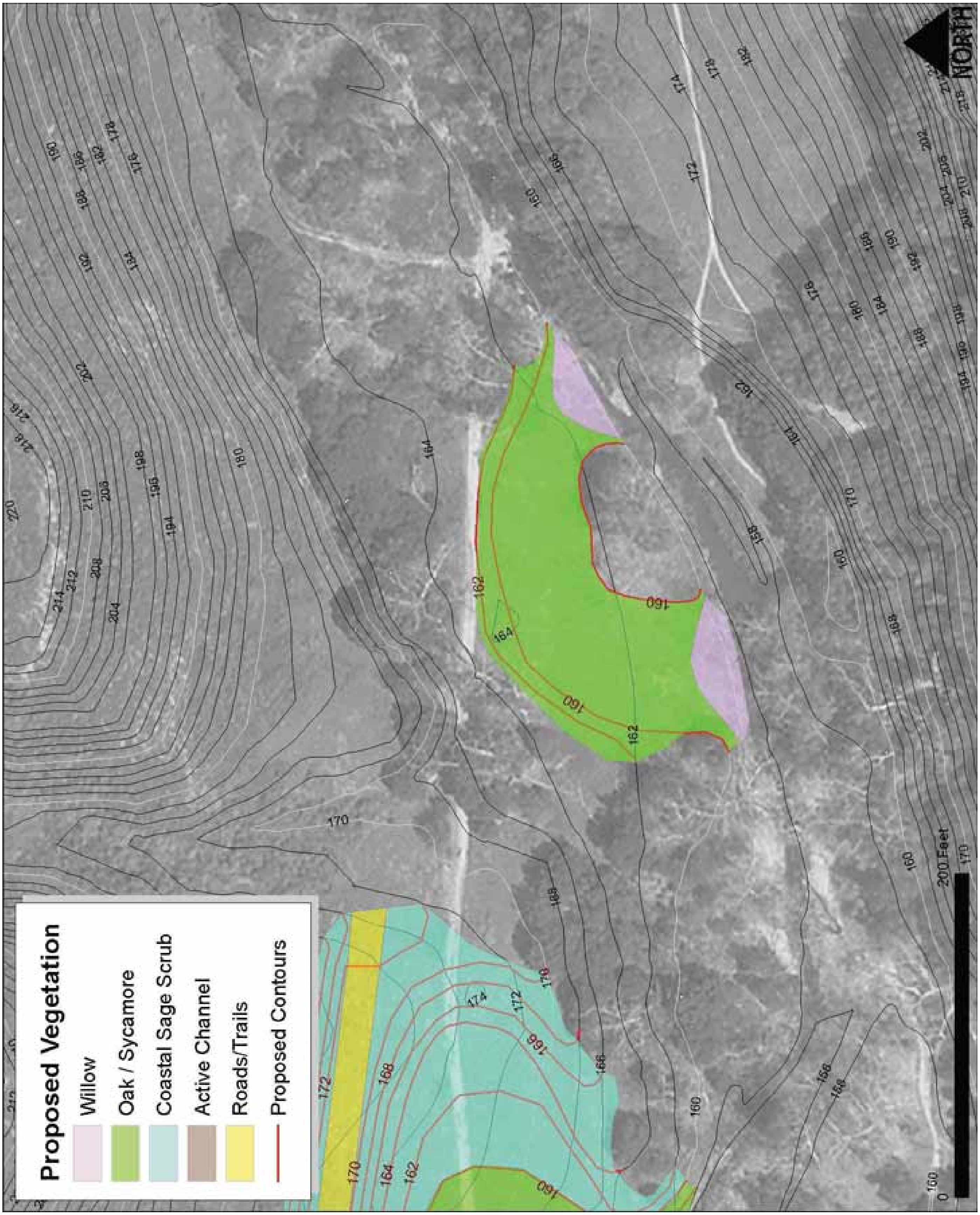
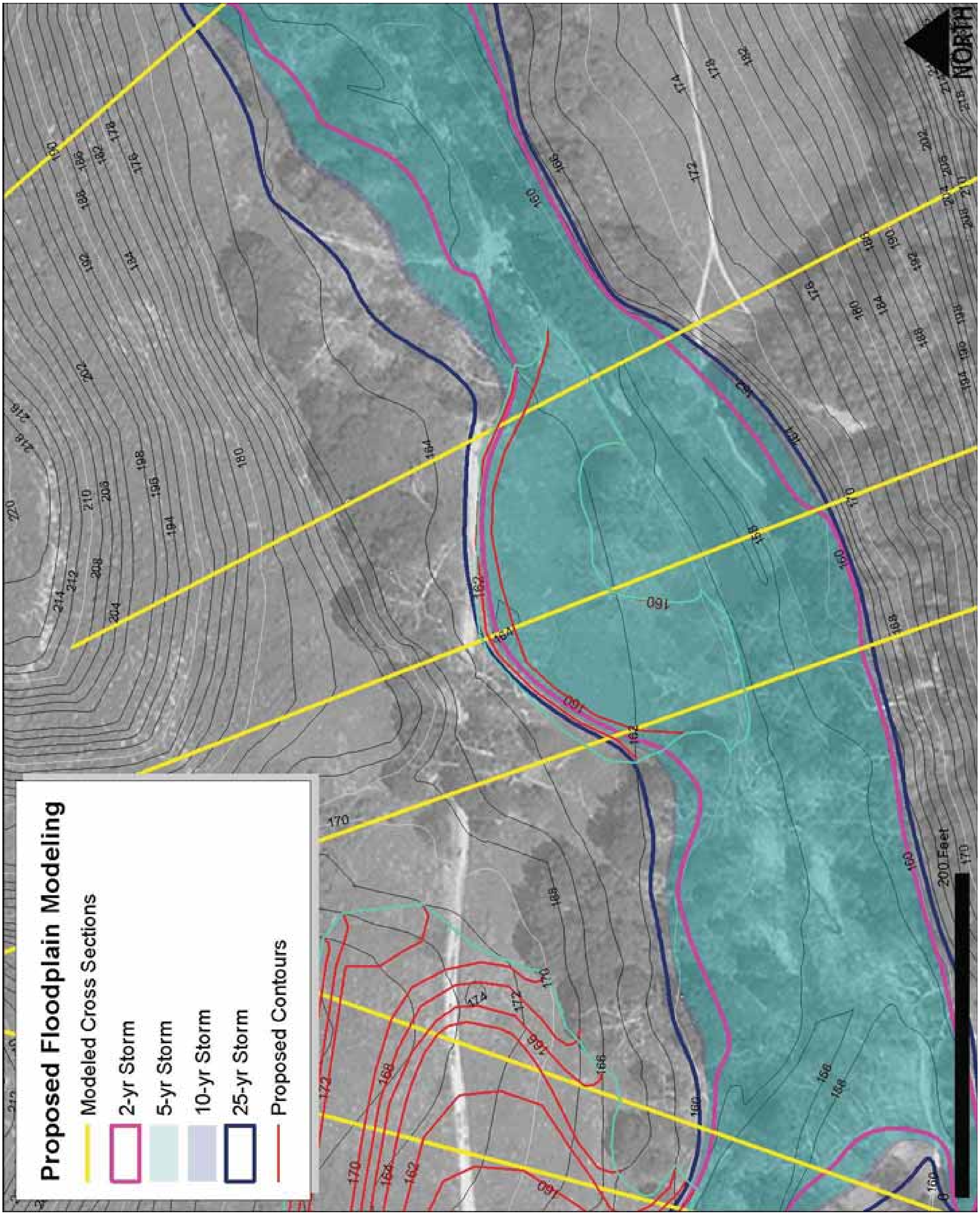


Figure 61 – SC-02a Floodplain Modeling Results



5.5.17 - San Clemente Canyon – Site 3

San Clemente Canyon – Site 3 consists of upland, non-native vegetation that is hydrologically disconnected from San Clemente Creek. A video of the site can be viewed at: http://bit.ly/SCSite3. The identified site is primarily occupied by upland non-native grassland. Some scattered relic sycamores are present as shown in Figure 62. The intent is to restore the floodplain connection. The creek is incised and confined solely to its narrow channels in this area. Recommended actions include the local relocation of the buried sewer line that is situated directly adjacent to the creek, use step pools to raise the elevation of the bed, and lowering of the adjacent upland areas (~21,000 cy of soil removal) to allow overbank flows in a 5- and 10-year storm events. Discussions with the City of San Diego Public Utilities Department will be required to determine final feasibility, design and implementation costs. Implementation of SC Site 3 would result in the active floodplain expansion of approximately 1.0 acres, including the creation of 1.0 acres of Oak / Sycamore Woodland, as well as the removal of non-native grassland. Figure 63 depicts the proposed design of San Clemente Canyon – Site 3. Figure 64 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain could be lowered 18-24 inches to allow better connectivity with the 5-yr storm event.

Table 29: Functional Improvements San Clemente Canyon - Site 3

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 30: Existing / Proposed Vegetation San Clemente Canyon - Site 3

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.075
Oak / Sycamore Woodland	0.089	1.045
Coastal Sage Scrub	0.301	1.052
Non-native Grassland	1.915	
Disturbed Habitat		
Roads / Trails	0.109	0.242
Total Acres	2.414	2.414

Photo 30: Looking west across Site 3

Figure 62 – SC-03 Existing Vegetation and Floodplain Modeling

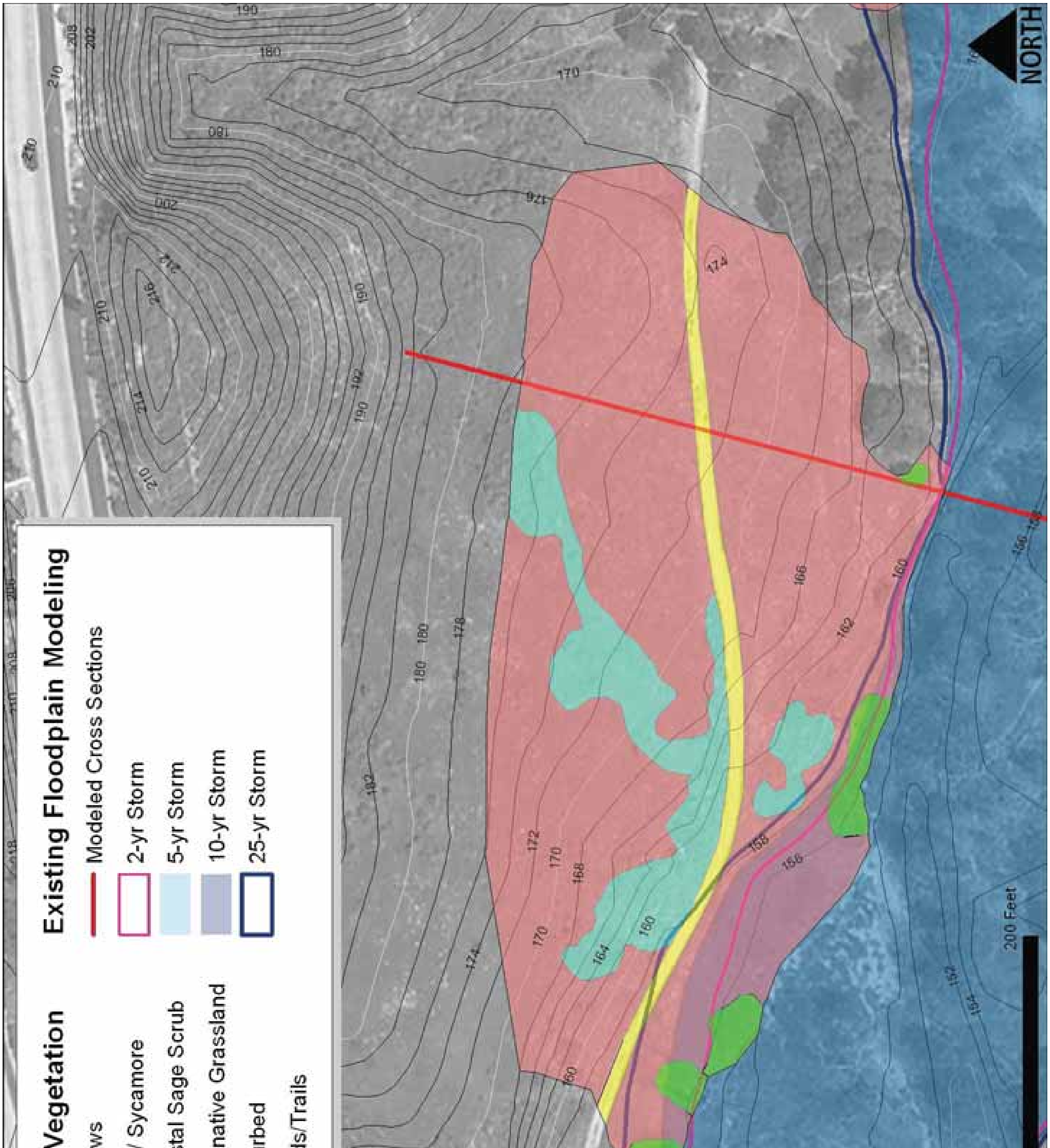


Figure 63 – SC-03 Proposed Vegetation

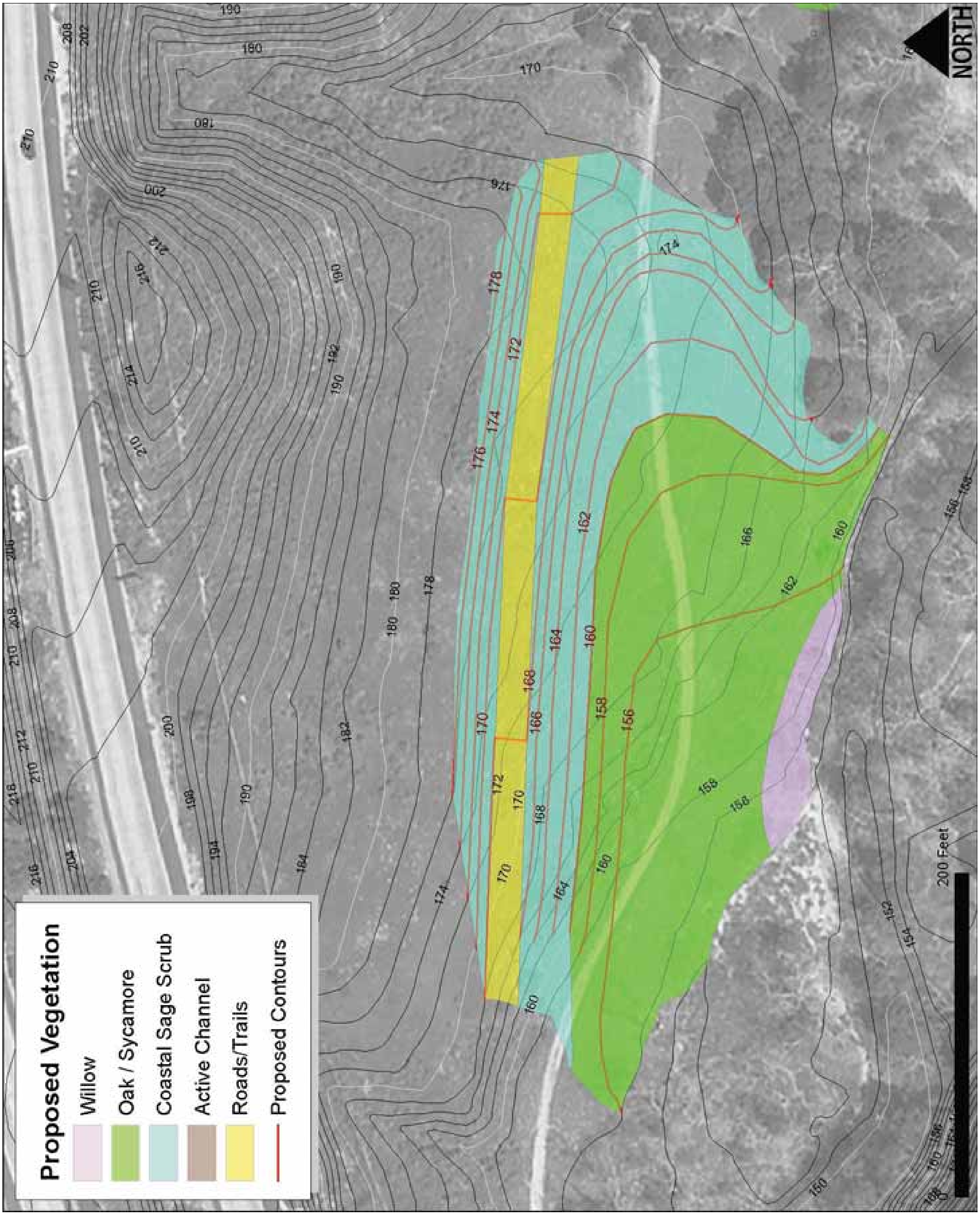
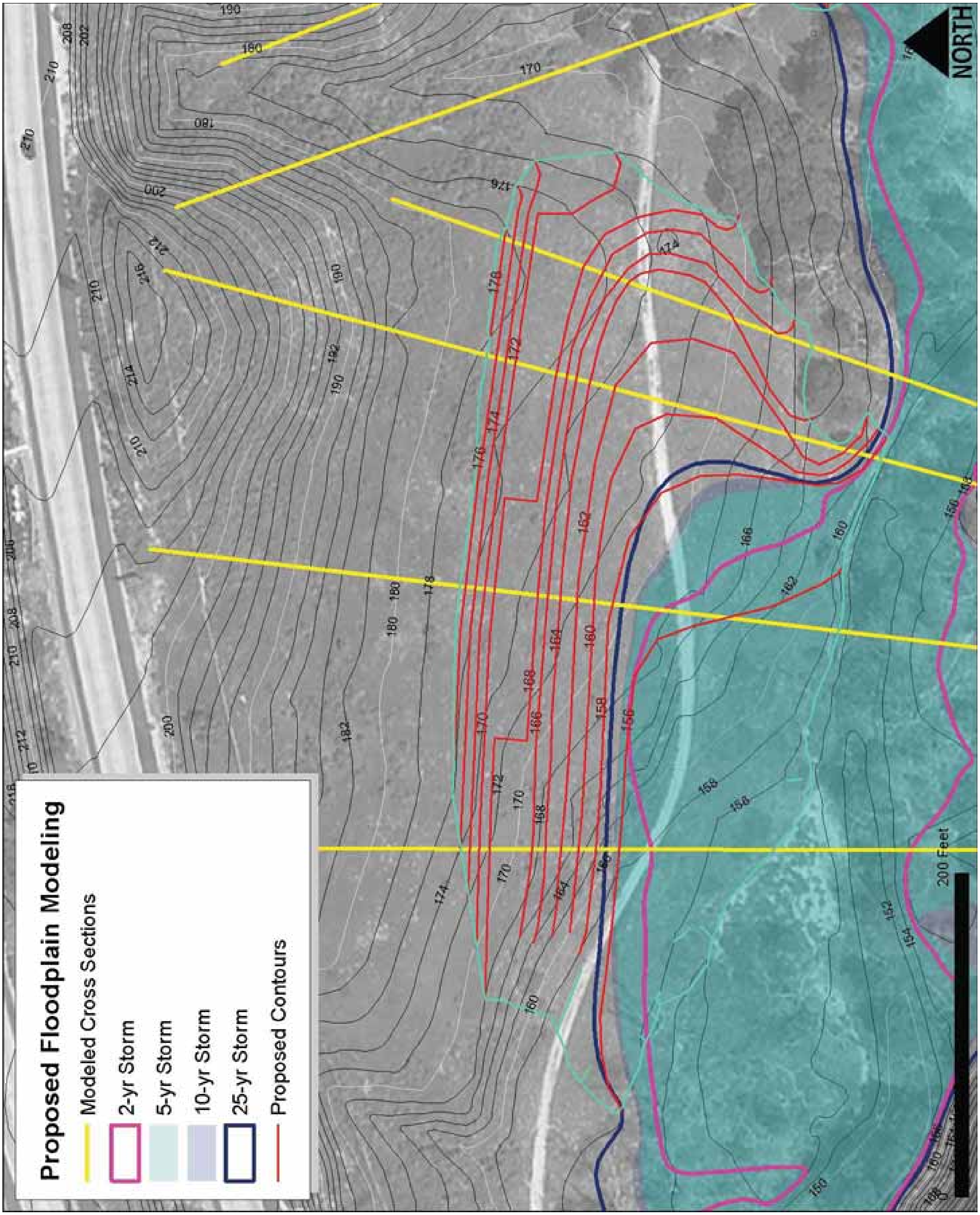


Figure 64 – SC-03 Floodplain Modeling Results



5.5.18 - San Clemente Canyon – Site 4

San Clemente Canyon – Site 4 consists of the restoration of floodplain habitat that is currently isolated due to channel incision. A video of the site can be viewed at: http://bit.ly/SCSite4. Channel incision ranges anywhere from 3-6 feet. The targeted restoration area is now occupied by upland non-native grassland surrounded by sycamores as shown in Figure 65. Recommended actions would include the installation of in-stream step pool structures, as well as the grading of the area to allow overbank flows in a 5- to 10-year flood event. The adjacent sewer line does need to be locally relocated to implement Site 4, but is recommended in relation as part of Site 5. Implementation of SC Site 4 would result in the active floodplain expansion of approximately 0.15 acres, including the creation of 0.15 acres of Oak / Sycamore Woodland, as well as the removal of non-native grassland. Figure 66 depicts the proposed design of San Clemente Canyon – Site 4. Figure 67 shows the modeled floodplain analysis.

During final design, the site extents should be maximized through a more detailed assessment of the health of the existing mature Sycamores to determine how close grading activities can occur and if any should be removed.

Table 31: Functional Improvements San Clemente Canyon - Site 4

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 32: Existing / Proposed Vegetation San Clemente Canyon - Site 4

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.017
Oak / Sycamore Woodland	0.029	0.152
Coastal Sage Scrub		
Non-native Grassland	0.111	
Disturbed Habitat		
Roads / Trails	0.028	
Total Acres	0.169	0.169

Photo 31: Looking northwest across Site 4

Figure 65 – SC-04 Existing Vegetation and Floodplain Modeling

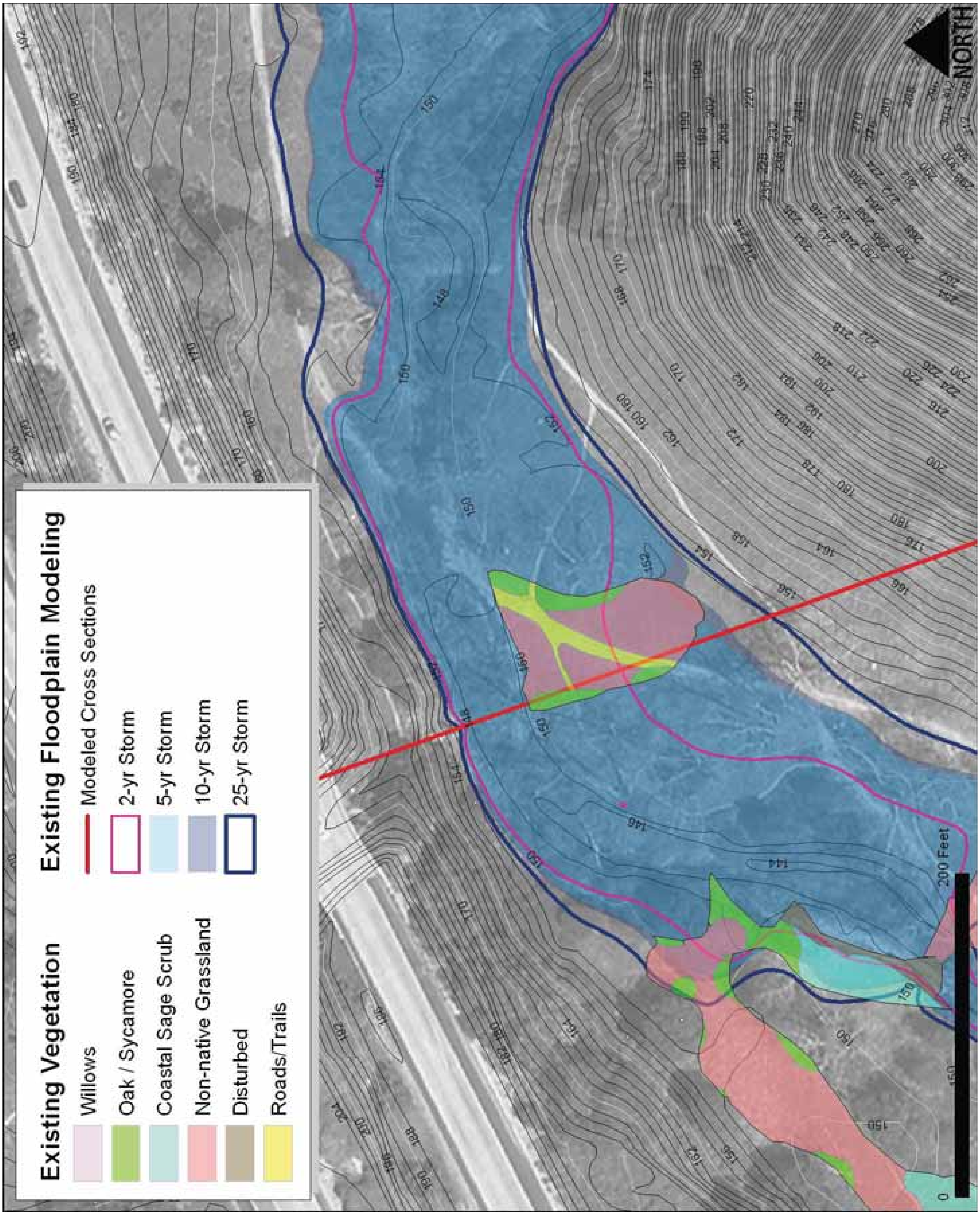
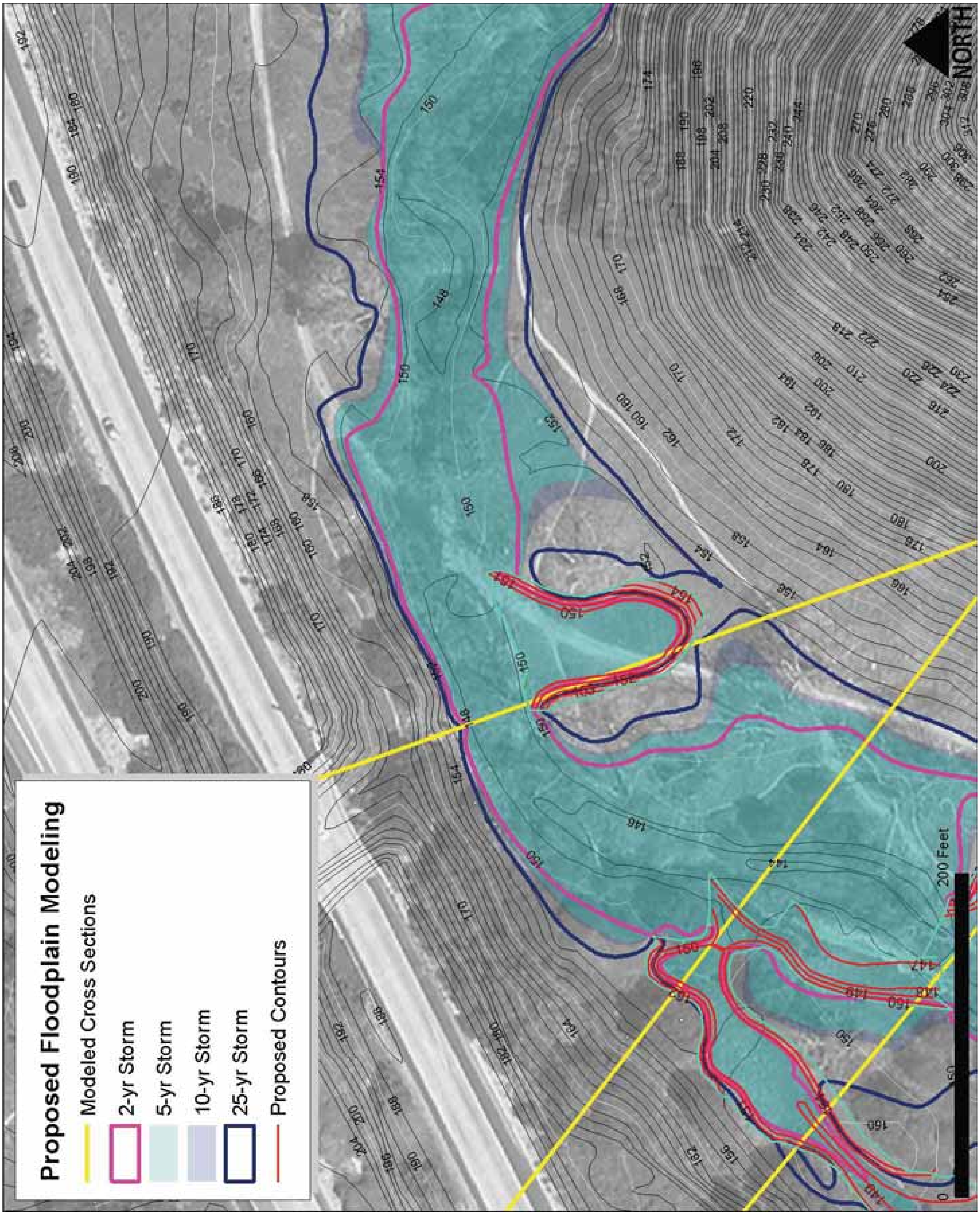


Figure 66 – SC-04 Proposed Vegetation

Figure 67 – SC-04 Floodplain Modeling Results



5.5.19 - San Clemente Canyon – Site 5

San Clemente Canyon – Site 5 is adjacent to SC Site 4. The site is occupied by upland non-native grassland as shown in Figure 68 and does not receive overbank flow, due to channel incision. A video of the site can be viewed at: http://bit.ly/SCSite5. Like other Sites identified in San Clemente, the proposed action will result in the floodplain reconnection. Both in-stream step pools and site grading will allow flows to overbank flow in 5- and 10-year flood events. The local relocation of the sewer line along the eastern edge is also proposed. Implementation of SC Site 5 would result in the active floodplain expansion of approximately 1.0 acres, including the creation of 0.15 acres of Willow Scrub and 1.0 acres of Oak / Sycamore Woodland, as well as the removal of non-native grassland. Figure 69 depicts the proposed design of San Clemente Canyon – Site 5. Figure 70 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain along the eastern portion of the site should be raised in the northern area by 6-12 inches and lowered in the southern area by 6-12 inches to maintain full connectivity with the 5-yr storm event while keeping the 2-yr storm event within the existing channel. The intent within the western portion of the site is to provide a 10-yr secondary channel to improve the hydraulic connectivity of this area. More detailed surveys of the native grasslands in this area are needed to ensure the project footprint does not impact them.

Table 33: Functional Improvements San Clemente Canyon - Site 5

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 34: Existing / Proposed Vegetation San Clemente Canyon - Site 5

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.140
Oak / Sycamore Woodland	0.162	1.134
Coastal Sage Scrub	0.150	0.148
Non-native Grassland	1.008	
Disturbed Habitat	0.024	
Roads / Trails	0.077	
Total Acres	1.422	1.422

Photo 32: Looking northeast across the eastern portion of Site 5

Photo 33: Looking north across the western portion of Site 5

Figure 68 – SC-05 Existing Vegetation and Floodplain Modeling

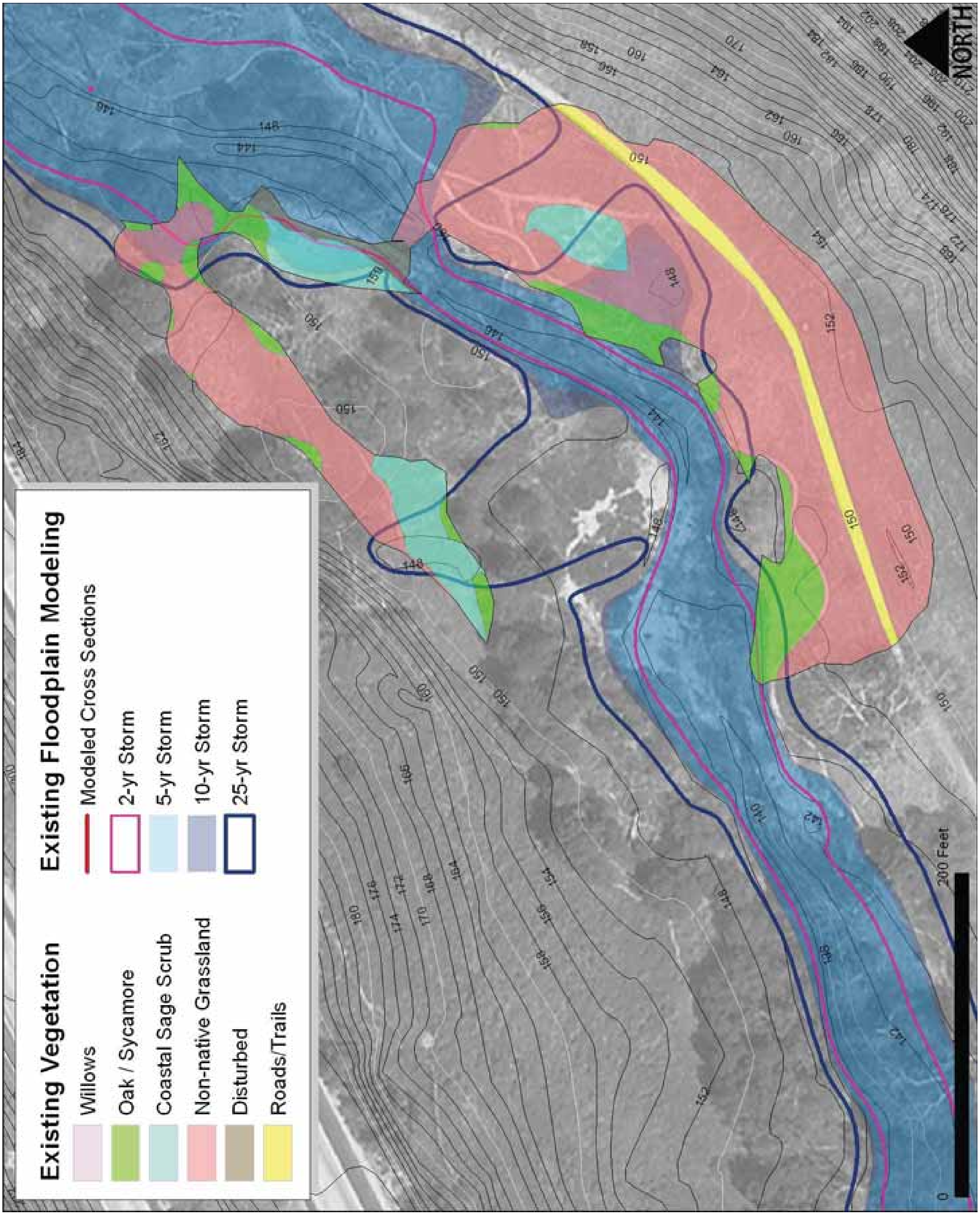


Figure 69 – SC-05 Proposed Vegetation

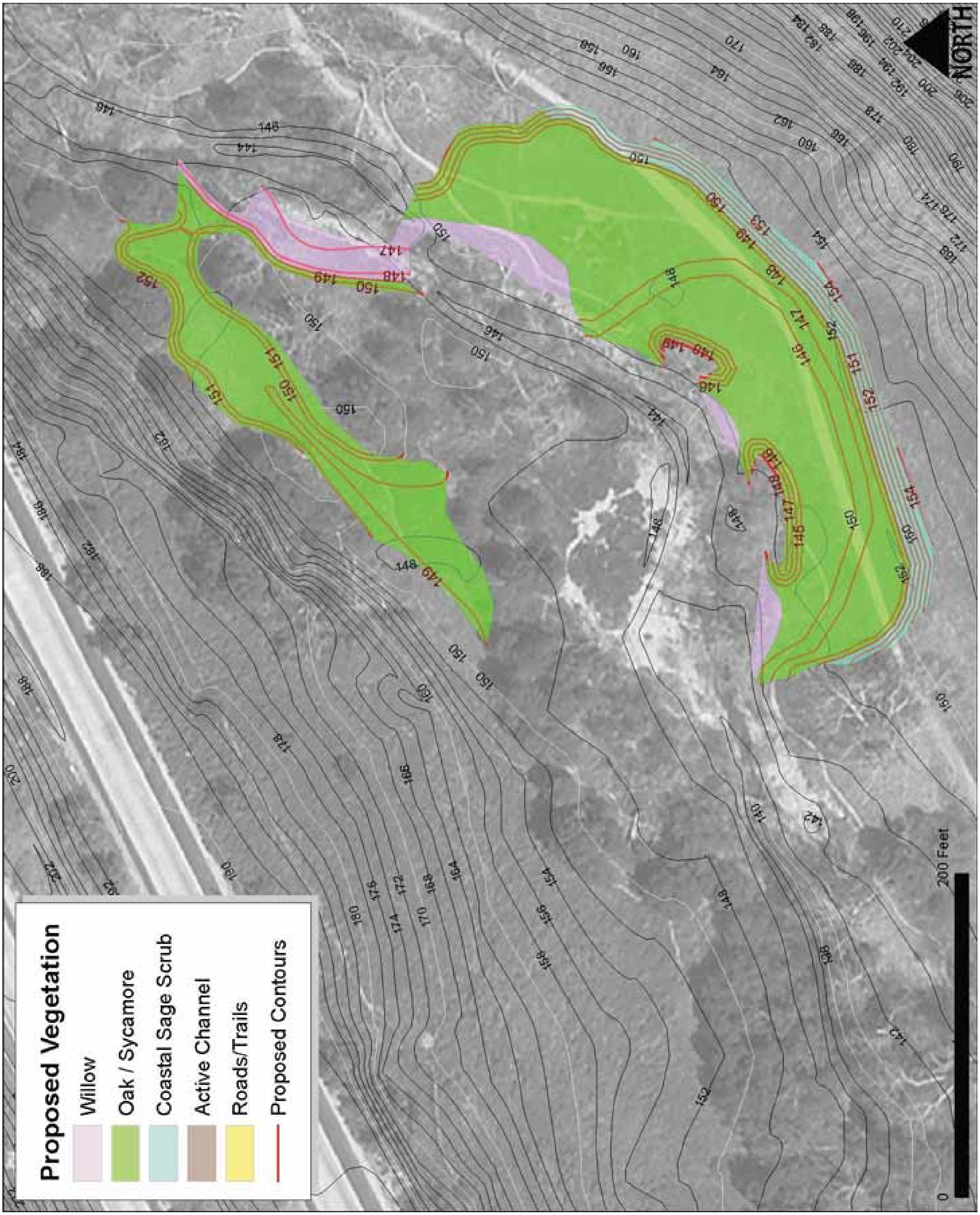
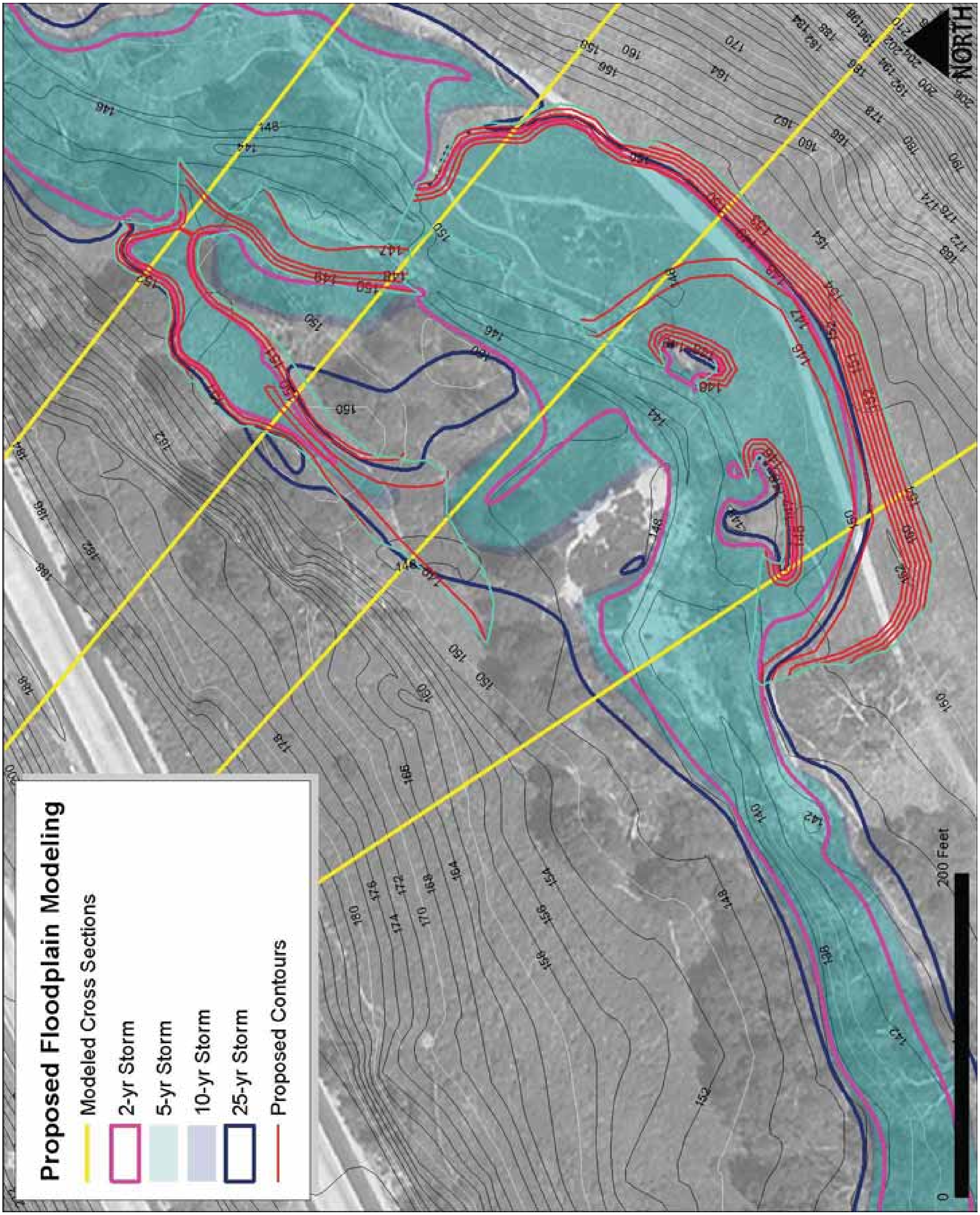


Figure 70 – SC-05 Floodplain Modeling Results



5.5.20 - San Clemente Canyon – Site 6

San Clemente Canyon – Site 6 is located near Regents Road. Recommended actions include the local relocation of the public restroom, sewer line, picnic areas and parking lot to allow restoration of the floodplain connection. Both in-stream step pool structures and site grading would restore the floodplain connection. A video of the site can be viewed at: http://bit.ly/SCSite6. The site includes a bathroom located in the floodplain (2-year flood events), picnic areas and a parking lot. The intent is to relocate, not eliminate, these recreational amenities. Figure 71 shows the existing vegetation within the site. The existing sycamores in this area are either dead or dying, and no new sycamore recruits are found. The channel is incised, thus restoration of the floodplain is proposed through the relocation of the structures, installation of in-stream step pools, and site grading (~2,400 cy of soil removal) to allow for inundation by 5- and 10-year storm events within this area. The local relocation of the sewer line is also proposed. Implementation of SC Site 6 would result in the active floodplain expansion of approximately 3.5 acres, including the creation of 3.5 acres of Oak / Sycamore Woodland and 0.8 acres of Coastal Sage Scrub. Figure 72 depicts the proposed design of San Clemente Canyon – Site 6. Figure 73 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain along its southern edge should be lowered by 12-18 inches to provide full inundation at a 5-yr storm event.

Table 35: Functional Improvements San Clemente Canyon - Site 6

Floodplain Restoration Functional Improvements		Yes	No
Habitat			
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 36: Existing / Proposed Vegetation San Clemente Canyon - Site 6

Vegetation	Existing acres	Proposed acres
Willow Scrub		
Oak / Sycamore Woodland	0.426	3.971
Coastal Sage Scrub		0.799
Non-native Grassland	4.036	
Disturbed Habitat		
Roads / Trails	1.187	0.878
Total Acres	5.648	5.648

Photo 34: Looking east across Site 6 from the public restroom

Photo 35: Looking west across Site 6 from the entry road

Figure 71 – SC-06 Existing Vegetation and Floodplain Modeling

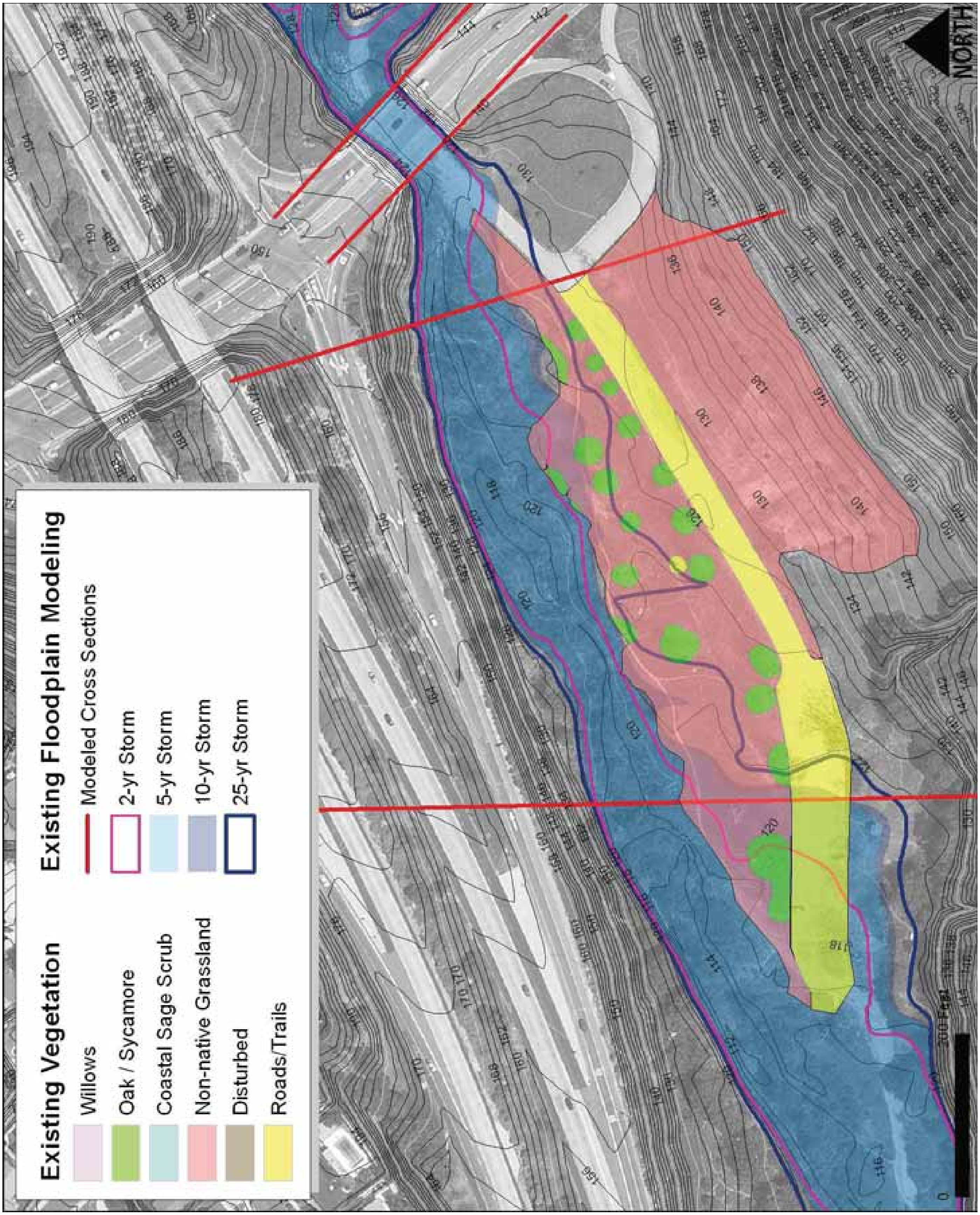


Figure 72 – SC-06 Proposed Vegetation

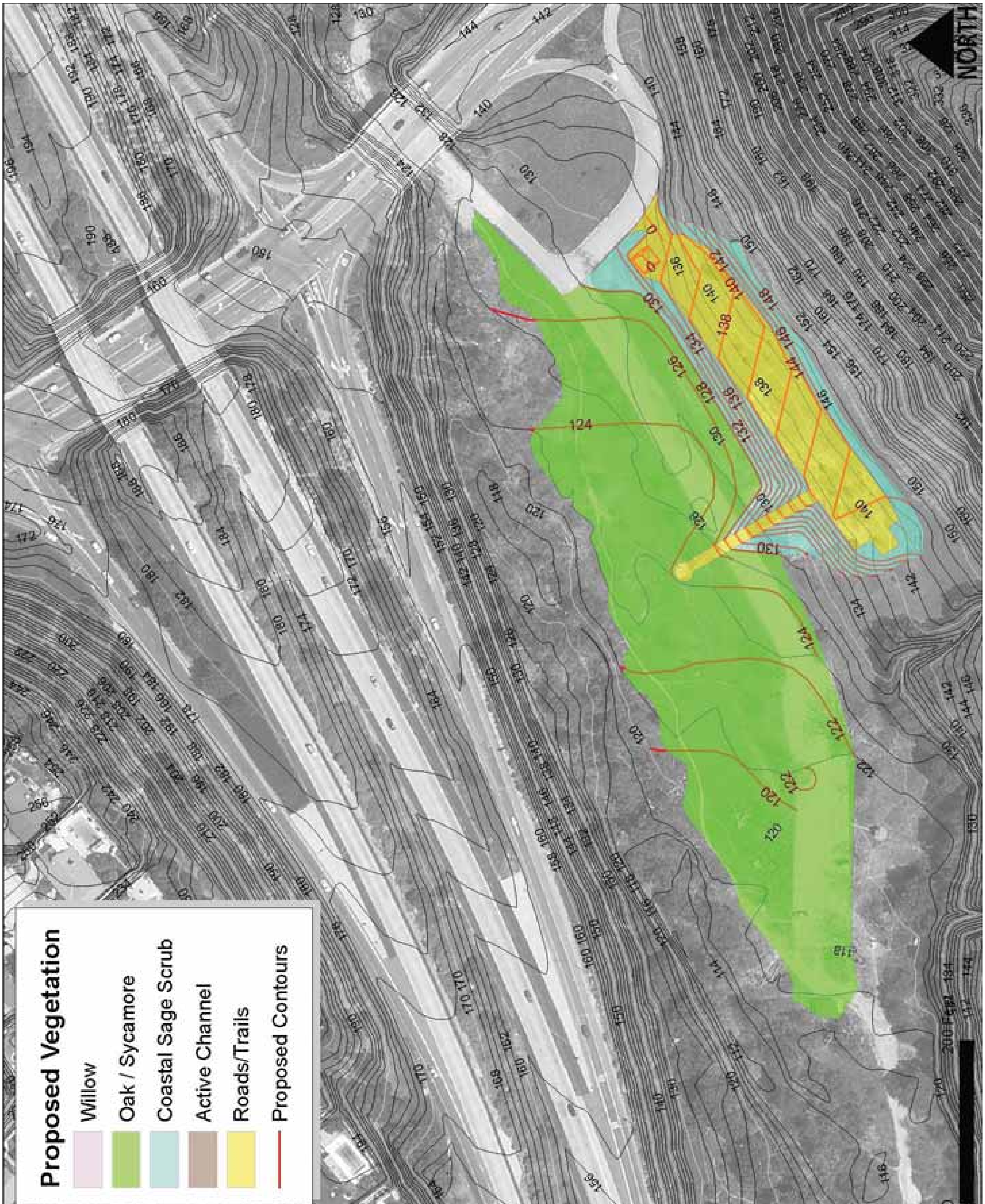
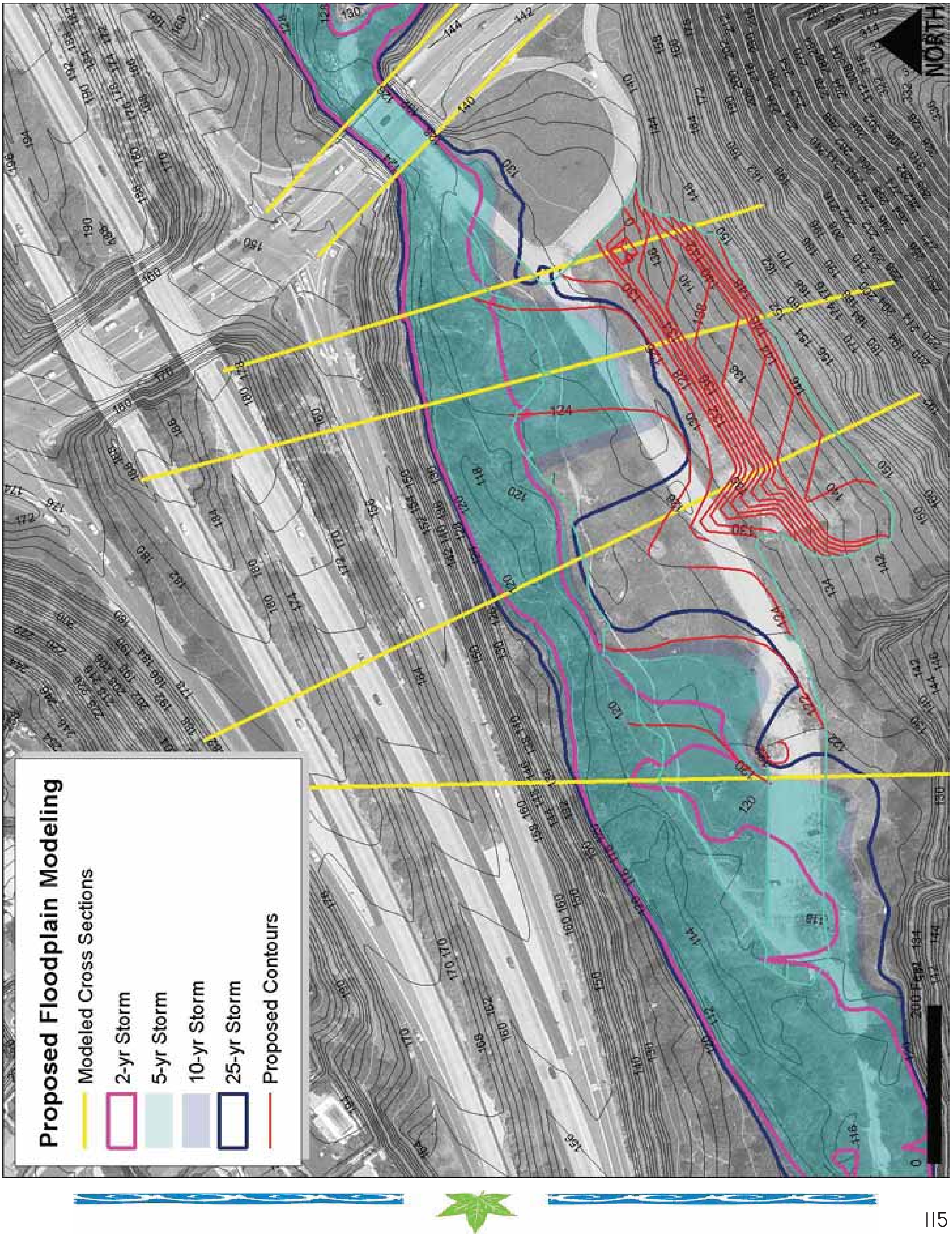


Figure 73 – SC-06 Floodplain Modeling Results



5.5.21 - San Clemente Canyon – Site 7

San Clemente Canyon – Site 7 is a small site occupied by non-native grassland. This area is relic floodplain and is currently isolated due to channel incision. Recommended actions are to restore the floodplain connection. A video of the site can be viewed at: http://bit.ly/SCSite7. The limits of the site are bound between two sycamore trees as shown in Figure 74. The installation of in-stream step pool structures and site grading (~500 cy of soil removal) to the elevation of the 5- and 10-year flood event, will create additional floodplain habitat and allow for additional functional gains. Implementation of SC Site 7 would result in the active floodplain expansion of approximately 0.25 acres, including the creation of 0.25 acres of Oak / Sycamore Woodland, as well as the removal of non-native grassland. Figure 75 depicts the proposed design of San Clemente Canyon – Site 7. Figure 76 shows the modeled floodplain analysis.

During final design, the extents of the site should be maximized to the east and west between the existing oaks and sycamore trees.

Table 37: Functional Improvements San Clemente Canyon - Site 7

Floodplain Restoration Functional Improvements			
Habitat		**Yes**	**No**
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 38: Existing / Proposed Vegetation San Clemente Canyon - Site 7

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.020
Oak / Sycamore Woodland	0.011	0.283
Coastal Sage Scrub	0.008	
Non-native Grassland	0.254	
Disturbed Habitat	0.030	
Roads / Trails		
Total Acres	0.303	0.303

Photo 36: Looking east across Site 7

Figure 74 – SC-07 Existing Vegetation and Floodplain Modeling

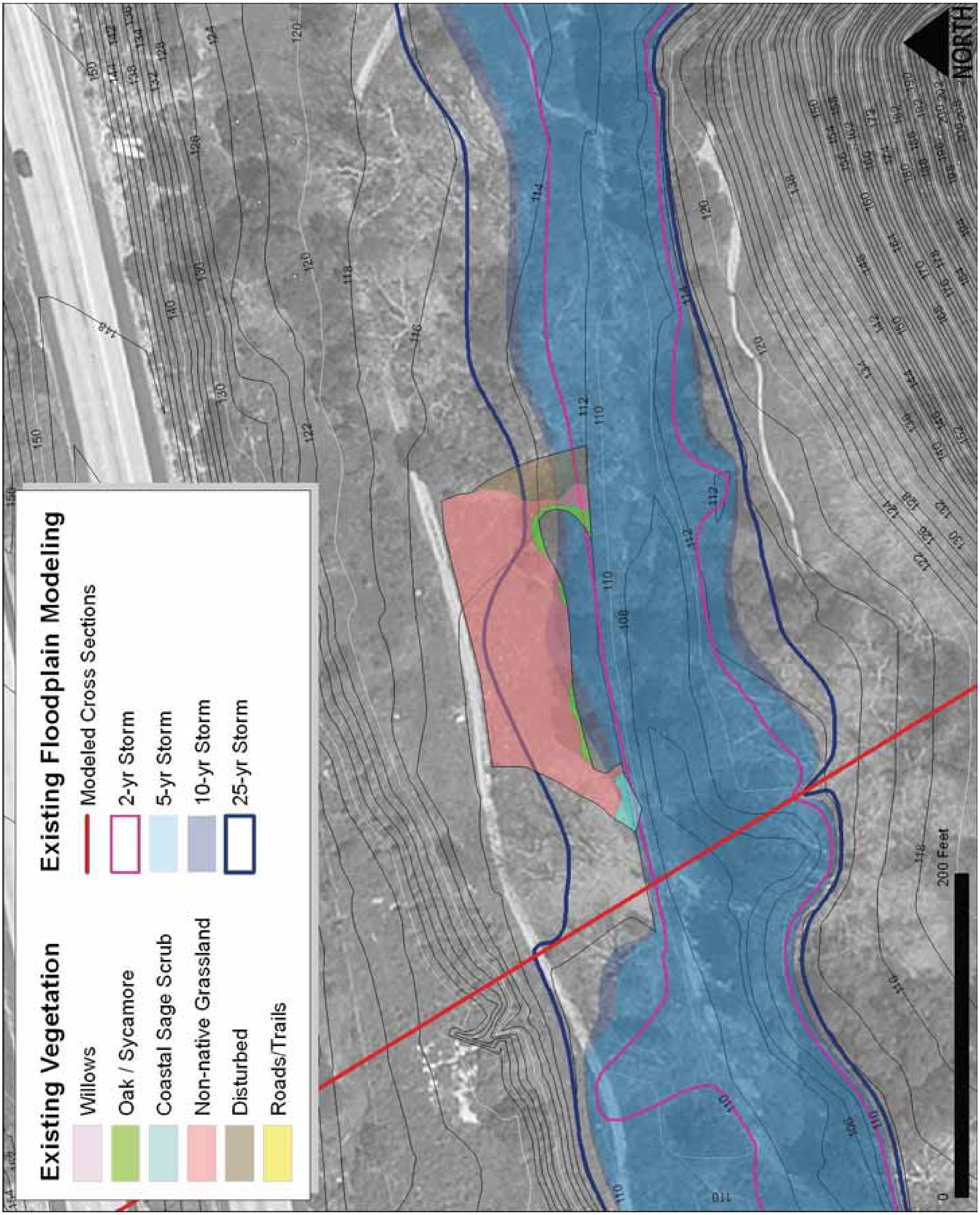
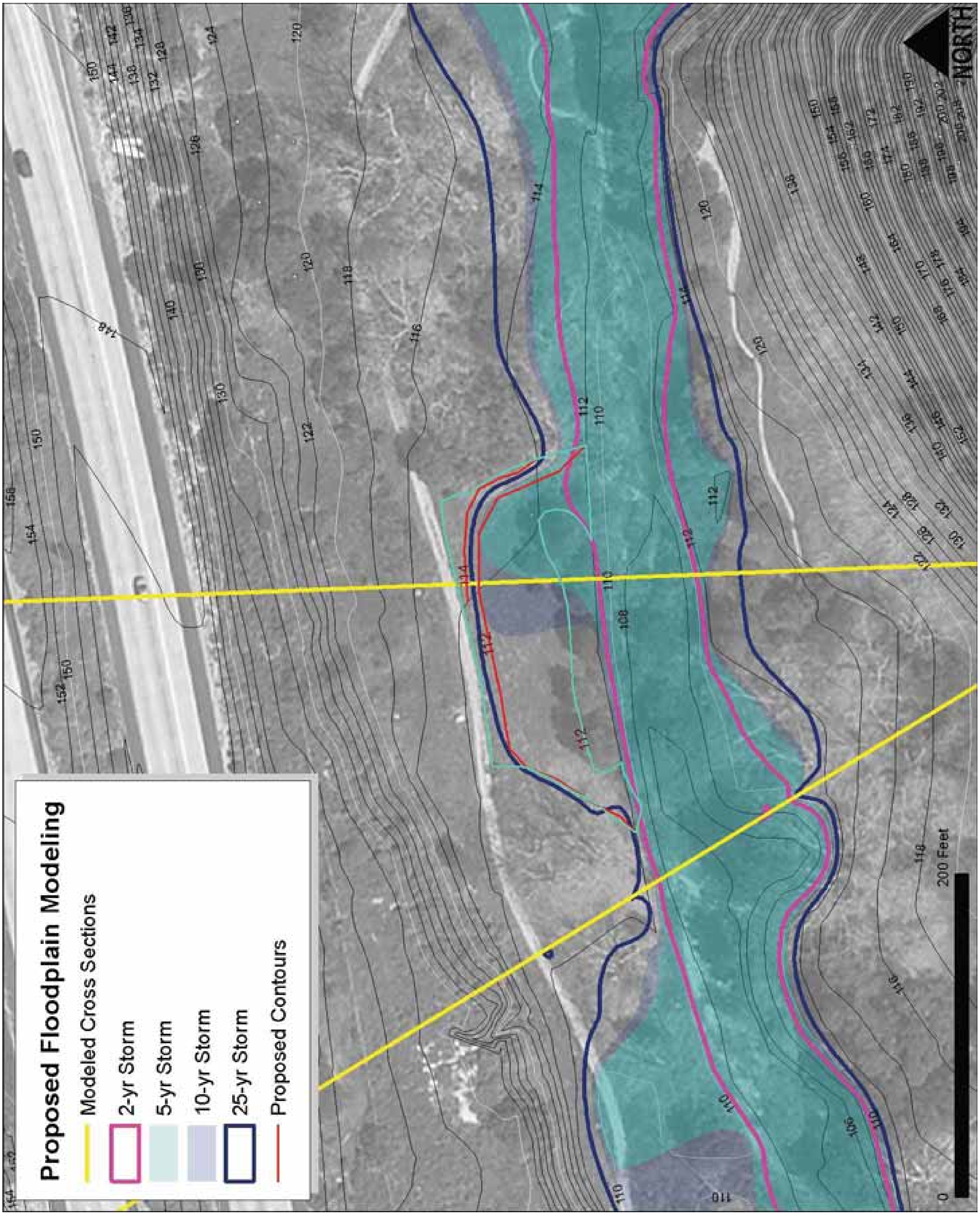


Figure 75 – SC-07 Proposed Vegetation

Figure 76 – SC-07 Floodplain Modeling Results



5.5.22 - San Clemente Canyon – Site 8

San Clemente Canyon – Site 8 is also a relic floodplain. The site is dominated by non-native grassland with a few pockets of coastal sage scrub as shown in Figure 77. Channel incision in this area exceeds 5 feet and slope instability is evident. Adjacent gabion baskets currently hold a part of the slope in place. Recommended actions are to restore the floodplain connection. A video of the site can be viewed at: http://bit.ly/SCSite8. Localized sewer realignment out of the creek and into the uplands is proposed. In-stream step pool structures should be installed as a first measure. Following the step pool installation, site grading (~7,000 cy of soil removal) to allow overbank flow if floodplain reconnection is not achieved with the step pools alone is recommended while leaving the existing sycamore and oaks in place if possible. Secondary channels around these islands would allow for the preservation of these individuals, if elevational differences between the active channel and the 5- and 10-year flood events are not too severe. If these individuals are infected with the identified fungal pathogen, then they should be removed to prevent spread of the disease. Implementation of SC Site 8 would result in the active floodplain expansion of approximately 1.25 acres, including the creation of 1.25 acres of Oak Sycamore Woodland and 0.25 acres of Coastal Sage Scrub, as well as the removal of non-native grassland. Figure 78 depicts the proposed design of San Clemente Canyon – Site 8. Figure 79 shows the modeled floodplain analysis.

During final design, the elevation of the new floodplain should be lowered 6-12 inches in the eastern portion to provide full connectivity during the 5-yr storm event. It should also be raised 12-18 inches in the western area to maintain more of the 2-yr storm event within the existing channel.

Table 39: Functional Improvements San Clemente Canyon - Site 8

Floodplain Restoration Functional Improvements		Yes	No
Habitat			
	Increase in riparian habitat	x	
	Nesting grounds	x	
	Foraging grounds	x	
	Shelter	x	
	Improved wildlife corridor	x	
Hydrology			
	Flood storage	x	
	Flood alteration	x	
	Groundwater discharge		x
	Groundwater recharge	x	
Water Quality			
	Nutrient transformation	x	
	Sediment storage	x	
	Retention of pollutants	x	
	Retention of nutrients	x	
	Erosion reduction	x	

Table 40: Existing / Proposed Vegetation San Clemente Canyon - Site 8

Vegetation	Existing acres	Proposed acres
Willow Scrub		0.041
Oak / Sycamore Woodland	0.046	1.223
Coastal Sage Scrub	0.271	0.251
Non-native Grassland	1.129	
Disturbed Habitat		
Roads / Trails	0.069	
Total Acres	1.515	1.515

Photo 37: Looking east across Site 8

Figure 77 – SC-08 Existing Vegetation and Floodplain Modeling

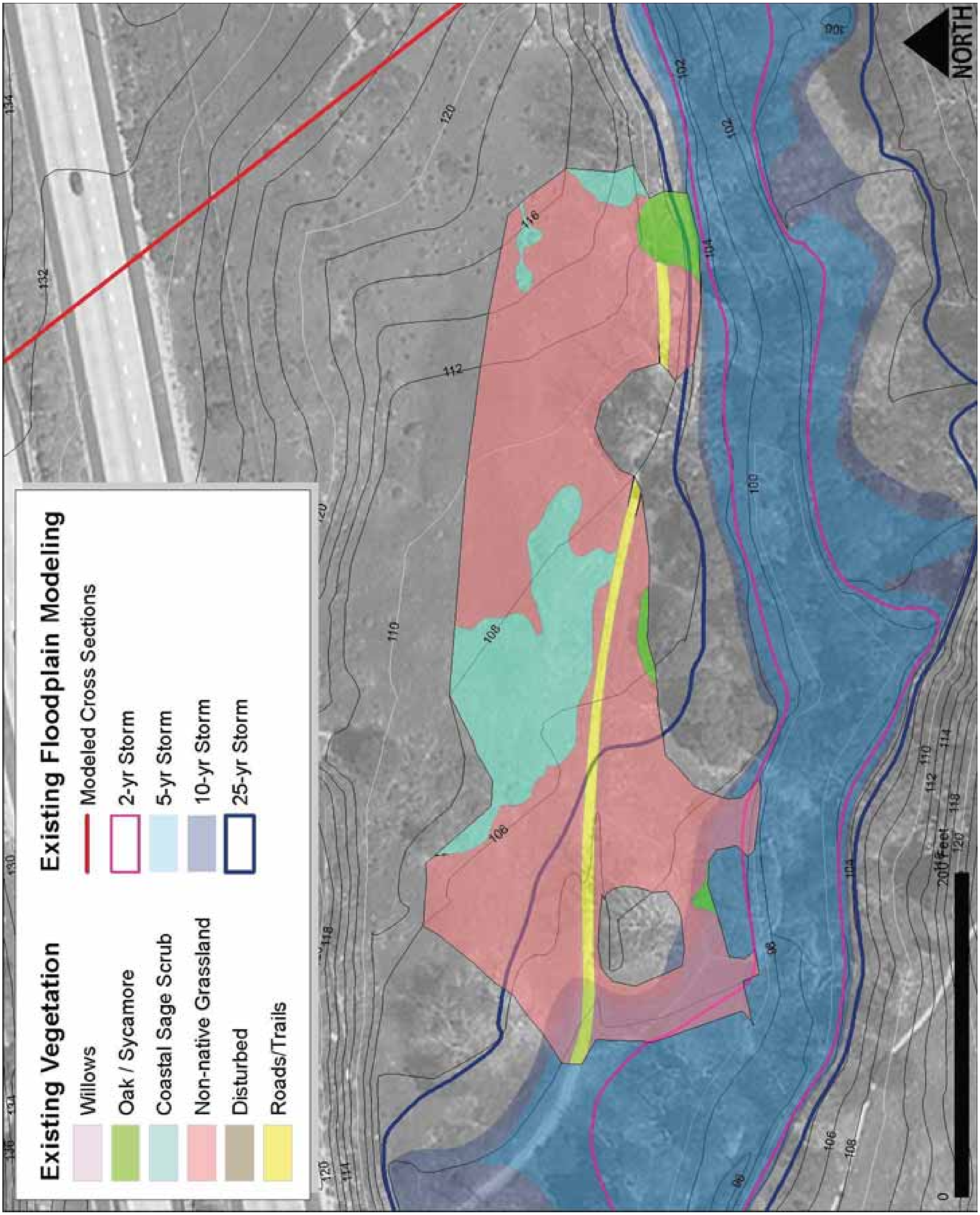
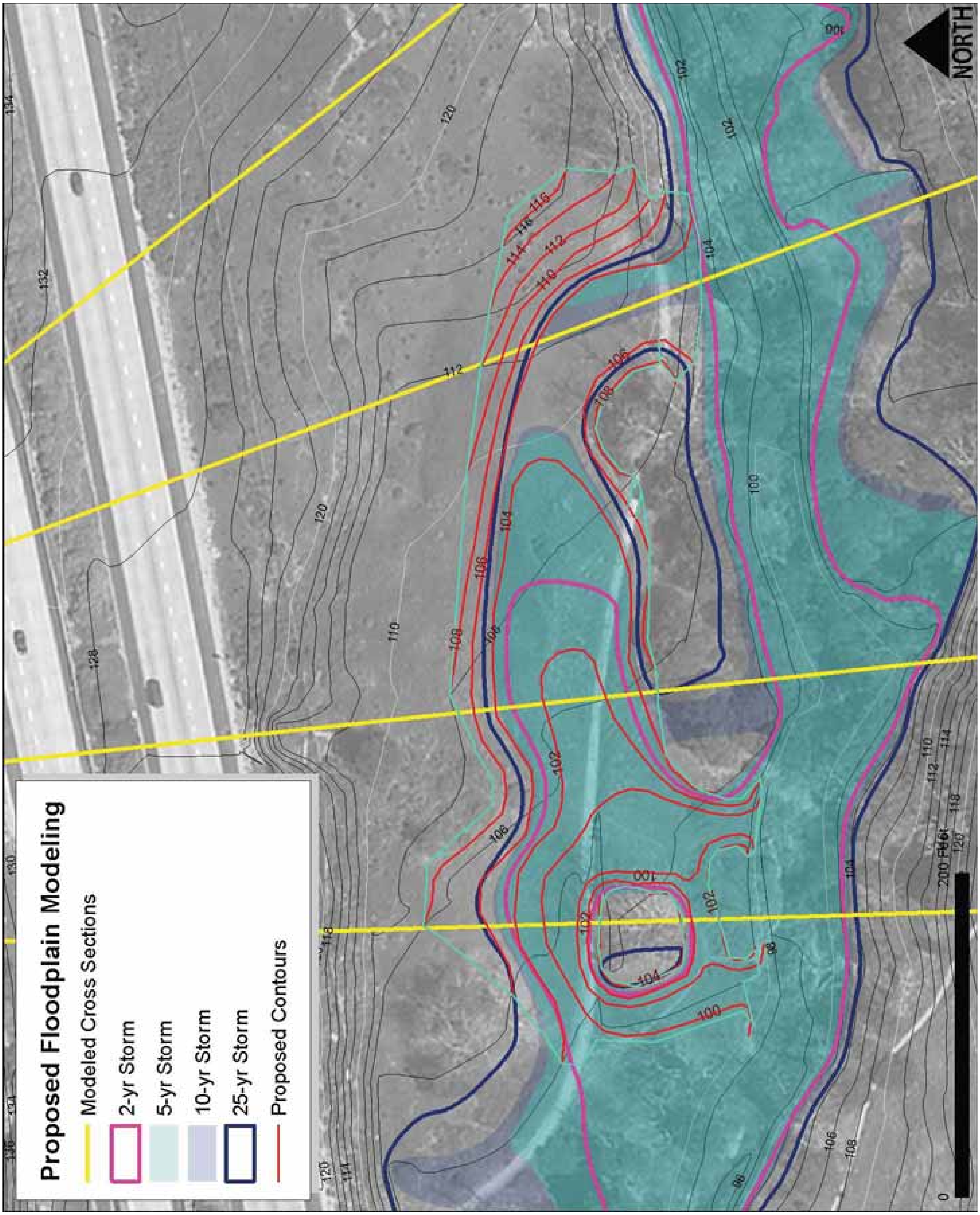


Figure 78 – SC-08 Proposed Vegetation

Figure 79 – SC-08 Floodplain Modeling Results



5.5 – RESULTS & DISCUSSION: SITES TO RESTORE WATER QUALITY FUNCTIONING

5.5.1 - Rose Canyon - Potential Water Quality Sites

Approximately 55 sites have been identified within Rose and San Clemente Canyons that could be suitable locations to improve water quality. The scope of this study does not include design details or hydrologic analysis, therefore only general concepts will be discussed. Figure 80 depicts the locations identified within the Rose and San Clemente Canyons. A video of one potential site can be viewed at: http://bit.ly/RCWQSite. Water quality improvement functions can include one or more of the following:

1. Increased water storage
2. Ground-water recharge
3. Floodflow alteration
4. Sediment stabilization
5. Sediment/toxicant retention
6. Nutrient removal/transformation

In an urbanized watershed, ideally water conservation and reduction in impermeable surfaces would result in a long-term solution to improve water quality. In the meantime, until long-term solutions can be implemented, non-point water quality features could be implemented. Some of these features could include:

1. The construction of water quality basins to capture runoff from the surrounding neighborhoods;
2. Piping runoff to the bottom of the slopes instead of allowing it to discharge at the top of the slopes which is currently causing severe erosion problems;
3. Repair of slopes that are currently eroding, and plant with stabilizing vegetation
4. Specific water quality treatment systems at storm drains.

By capturing and treating some runoff before it enters the main channels impacts resulting from the urbanization of the watershed can be reduced, resulting in small and incremental improvements in water quality.

Photo 38: Sample Storm Drain BMP to slow water velocities and reduce erosion

Photo 39: Storm drain outfall showing severe erosion downstream due to high water velocities

Photo 40: Large gullies have formed below many storm drain outfalls

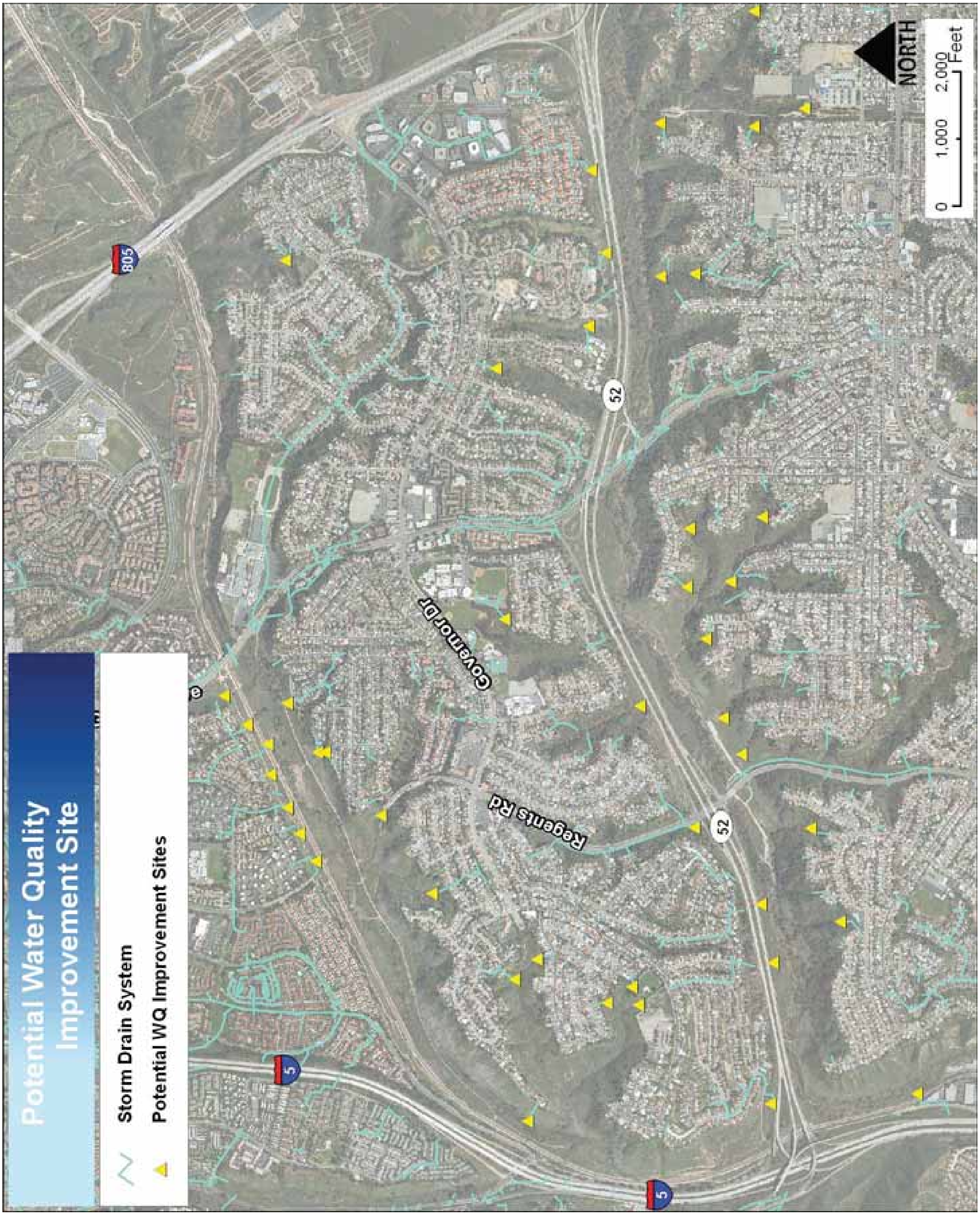
Photo 41: Streambank erosion is common downstream of storm drain outfalls

Photo 42: Debris can cause blockages

Photo 43: Improperly installed culverts can create areas of severe erosion

Photo 44: Trash and invasive non-native species are common below storm drain outfalls

Figure 80 – Potential Water Quality Improvement Sites



6. Implementation & Management

6.1 - DESIGN RECOMMENDATIONS

As discussed in section 2.3.7, the hydraulic model was constructed at the watershed scale. The topographic data used to construct the model was collected at 500 to 1000 foot intervals and not at a scale appropriate for analyzing the final design of particular restoration scenarios.

At a minimum, collecting additional topographic and hydraulic roughness data at a scale appropriate (50 to 100 foot intervals) for developing the final design of selected restoration scenarios is recommended. This additional detail should be incorporated into the existing HEC RAS model and used to test and refine the hydrologic function of a particular restoration project. Additional sediment transport studies to determine if step pool structures are a feasible restoration tool are also recommended as an early action item.

Depending on the complexity of the hydrologic interaction between the low-flow channel and the floodplain, and if step-pools are to be implemented for the restoration project being designed; it may be necessary to develop a 2-dimensional model to examine the hydrologic function in greater detail. 2-dimensional models allow for greater accuracy and more precise understanding of hydraulic properties associated with floodplain flows. They will also allow the designer and stakeholders to more easily visualize how in-stream step pool features help to enhance floodplain connectivity. The existing HEC RAS model would be useful in providing the local boundary condition (incoming flows and downstream water surface elevation) data necessary for model development.

Additionally, developing a better understanding of the incoming suspended sediment load will be essential in examining the ability of potential floodplain restoration sites to retain fine sediment particles during storm events, which is important to improving water quality within the RCW and Mission Bay. This could be accomplished by deploying instrumentation that measures the turbidity during storm events while an individual simultaneously collects water samples that would be analyzed for suspended sediment concentration. By developing a relationship between flow, turbidity and suspended sediment concentration, one has the ability to better quantify incoming sediment loads and enhance the design of a particular restoration project to capture these particles and thereby improve water quality.

6.2 – IMPLEMENTATION RECOMMENDATIONS

The sites currently presented in the previous sections combine to create a total of 23 acres of expanded wetland habitat, with 14.33 acres within Rose Canyon and 8.67 acres within San Clemente Canyon. The vegetation impacts associated with these gains are shown in Table 41. As depicted in the table, non-native grassland accounts for the vast majority of the impacted habitat at 17.43 acres, followed by coastal sage scrub at 3.46 acres, and disturbed habitat with

Table 41: Habitat Comparison Pre and Post Restoration

	San Clemente Canyon			*Rose Canyon*			*Total*		
	Existing	*Proposed*	*Difference*	*Existing*	*Proposed*	*Difference*	*Existing*	*Proposed*	*Difference*
Coastal Sage Scrub	*1.56*	*2.25*	*0.69*	*7.85*	*3.70*	*(4.16)*	*9.41*	*5.95*	*(3.46)*
Disturbed Habitat	*0.07*	*-*	*(0.07)*	*1.19*	*-*	*(1.19)*	*1.26*	*-*	*(1.26)*
Non-Native Grassland	*8.87*	*-*	*(8.87)*	*8.56*	*-*	*(8.56)*	*17.43*	*-*	*(17.43)*
Oak-Sycamore Woodland	*1.08*	*9.31*	*8.23*	*3.71*	*17.37*	*13.66*	*4.79*	*26.69*	*21.90*
Dirt Roads	*1.54*	*1.12*	*(0.42)*	*0.87*	*0.44*	*(0.43)*	*2.41*	*1.56*	*(0.85)*
Active Channel	*-*	*-*	*-*	*-*	*0.19*	*0.19*	*-*	*0.19*	*0.19*
Open Water	*0.00*	*-*	*(0.00)*	*-*	*-*	*-*	*0.00*	*-*	*(0.00)*
Willow Scrub	*0.01*	*0.45*	*0.44*	*0.98*	*1.45*	*0.48*	*0.99*	*1.90*	*0.91*
Totals	*13.13*	*13.13*		*23.16*	*23.16*		*36.29*	*36.29*	
Wetlands Gained			*8.67*			*14.33*			*23.00*

1.26 acres. Of these impacts, only the 3.46 acres of coastal sage scrub are of any real concern and these acres would be easily recovered by revegetating soil disposal areas.

There are multiple mechanisms by which the recommended sites could be implemented. Funding could be secured through public and private sources to complete the site design and implement the project. This funding could be under the direction of a non-profit entity, in order to ensure that the sites are implemented in a manner that is cohesive. Alternatively, habitat mitigation sites are scarce in San Diego County. These sites could be implemented as part of an in-lieu fee program, whereas developers or others needing habitat mitigation could pay into a pool of funding, and the non-profit entity would be responsible for implementing individual projects as money becomes available. The risk of using an in-lieu fee program is that sometimes unforeseen circumstances happen during the implementation and the project becomes more expensive than originally planned, thus the non-profit may not be able to afford to finish the project. The third option would be to make these sites available for habitat mitigation, but implementation would be the sole responsibility of the permit holder. This would overcome the risk of running out of money; however it could result in the overall loss in continuity between sites, as well as predictability within an implementation schedule and quality of work. Additionally, with the majority of sites being on City of San Diego owned land, the Department of Park and Recreation - Open Space Division could take a leadership role and work with an appointed oversight committee comprised of local environmental stakeholders. This would help integrate the restoration of Rose and San Clemente Creeks into the City's MSCP responsibilities as well.

6.3 – MANAGEMENT RECOMMENDATIONS

Once the habitat restoration/creation areas are implemented and the targeted success criteria met, long-term management of the sites will be necessary in order maintain the integrity of the system. Management activities may include regular removal of invasive species, trail maintenance, trash removal, etc. Management of this large area should be conducted by one management entity, such as a non-profit, or a branch of the local government. City Parks and Recreation should be the lead entity, and could partner with one or more non-profits or advisory councils to prioritize and complete maintenance activities. Typically an endowment is set up to cover the costs of long-term management. Moneys for the endowment may be rolled into the initial cost of doing the project or collected as part of the habitat mitigation fees, if project is implemented in that manner.

How these site are implemented is one of the most important factors in the entire process. Several mitigation areas within the watershed have had challenges due to insufficient hydraulic modeling, even though qualified contractors designed and implemented the projects. Using good data, and a qualified team of restoration professionals is of prime importance in the implementation of these sites. Long-term management by qualified individuals, as well as sufficient funding is also critical.

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Appendix A. Videos of Restoration Sites

Rose Canyon

Rose Cyn – Reference Site:	http://bit.ly/RCReferenceSite
Rose Cyn – Site 1:	http://bit.ly/RCSite1
Rose Cyn – Site 2:	http://bit.ly/RCSite2
Rose Cyn – Reference Site Near 2:	http://bit.ly/RCRefNear2
Rose Cyn – Site 2a:	http://bit.ly/RCSite2a
Rose Cyn – Site 2b:	http://bit.ly/RCSite2b
Rose Cyn – Pampas Grass & Euc Removal site	http://bit.ly/RCExoticRemSites
Rose Cyn - Potential Water Quality Site	http://bit.ly/RCWQSite
Rose Cyn – Site 3:	http://bit.ly/RCSite3
Rose Cyn – Site 4:	http://bit.ly/RCSite4
Rose Cyn – Site 5:	http://bit.ly/RCSite5
Rose Cyn – Incision upstream of 6 and 7	http://bit.ly/RCIncisedUp6and7
Rose Cyn – Site 7:	http://bit.ly/RCSite7
Rose Cyn – Site 8:	http://bit.ly/RCSite8
Rose Cyn – Hwy 5 Exotic Removal Parcel:	http://bit.ly/RCHwy5ExoticRemoval

San Clemente Canyon

SC Cyn – Site 1:	http://bit.ly/SCSite1
SC Cyn – Reference Site:	http://bit.ly/SCRefSite
SC Cyn – Site 2:	http://bit.ly/SCSite2
SC Cyn – Site 3:	http://bit.ly/SCSite3
SC Cyn – Site 4:	http://bit.ly/SCSite4
SC Cyn – Site 5:	http://bit.ly/SCSite5
SC Cyn – Site 6:	http://bit.ly/SCSite6
SC Cyn – Site 7:	http://bit.ly/SCSite7
SC Cyn – Site 8:	http://bit.ly/SCSite8

Appendix B. Acknowledgements & Participating Stakeholders

The project team would like to thank the following persons in providing data and valuable information to make this project successful:

1. City of San Diego, Department of Parks and Recreation: Chris Zirkle, Laura Ball, Josh Garcia, Betsy Miller
2. City of San Diego, PUD: Margaret Llagas
3. David Cannon, Everest International Consultants
4. Chris Kroll, Coastal Conservancy

The project team would like to thank the following participating stakeholders in providing valuable feedback to make this project successful:

5. Friends of Rose Canyon – Debbie Knight, Kevin Wirsing
6. Friends of Rose Creek – Karin Zirk, Billy Paul
7. San Diego Audubon – Mel Hinton, Jim Peugh
8. Friends of Mission Bay Marshes - Roy Little, Randall Stevens
9. San Diego Canyonlands – David Varner, Eric Bowlby
10. City of San Diego, PUD – Mike Faramarzi
11. County of San Diego Flood Control - Rand Allan
12. Mission Bay Park Committee – Judy Swink
13. Rose Canyon Recreation Council – Ben Stevenson
14. Marian Bear Recreation Council - Joseph Steinbaugh, Brent Banta

Appendix C. Stakeholder Comments & Responses to Draft Report

Commenter: Karin Zirk - Friends of Rose Creek		
KZ	The downside mentioned in the step pool side was a lack of sediment flow. I know soil types and organisms are all different, but is there any proven methodology for importing sedimentation to assist in the build up? What about composting locally collected dead plant matter on site and using that?	We are unaware of any project that has imported sediment to re-build a stream bed on a large-scale. Decomposed plant material (compost), while beneficial to plant growth, is not a viable substrate as it would not withstand the sheer forces during flood events.
KZ	I also didn't see the existing flood conditions for the lower portion of the creek (like the map on page 22) where I'm looking for ammunition to remove chunks for the creek from the city's storm drain maintenance. Is there a reason we exclude that from this model?	The existing conditions model does extend from I-805 to Mission Bay for both Rose and San Clemente Creeks. Figures 10 & 11 give an example of the inundation extents that were mapped for the 2, 10, 25, and 100 year events at a couple select locations. These inundation results were mapped for the entire Rose and San Clemente Creeks from I805 to Mission Bay (including lower Rose). Mapping results will be included electronically with the final report in shapefile and Google Earth (.kmz) format to allow everyone to view the inundation extents in the level of detail they prefer.
KZ	There is the map on page 32, which I don't think I'm reading correctly. It looks like the 100 year flood event is 18 feet? The legend is very confusing as it looks like the scale is feet, but if so then the 100 year flood event is 18000 feet which means we're all dead. Where exactly is that measurement set?	The x-axis on Figure 17 is the stationing of the hydraulic model. This stationing is the distance (ft) along the creek starting from Mission Bay (0) to the confluence with San Clemente (18,000). The y-axis is elevation (ft) and is referenced to the NAVD 88 vertical datum (similar to Mean Sea Level).
KZ	Also is there any data from the Water Level Monitoring location at Grand Avenue and the creek.	The data was incorporated into the models. Detailed information is presented in the Technical Appendices.

Commenter: Rand Allan - County of San Diego Flood Control		
R	They did not use any of the historical records we had on stream flow at Rose Canyon Creek or San Clemente Canyon from the 1960s and 70s.	Since land use changes have occurred since the 60's and 70's, it was determined that stream flow data from that period would not be useful in the development or calibration of an existing conditions hydrologic model.
R	They apparently did not use any of the historical rainfall collected by the County (found no mention of what stations were used). My guess is that they used hourly rainfall records from Lindberg Field, which are not representative of the watershed. Records from Kearny Mesa would have been more representative for the middle watershed and records from Poway would have been more representative for the upper watershed. Both stations have 40+ years of detailed record.	As stated in the report, the hydrologic model (HSPF) of the RCW developed for the City by Everest was used to develop the flood frequency analysis and boundary conditions for the hydraulic model used in this study. As developed, the HSPF model utilizes rainfall data from Lindberg Field. However, a comparison of the annual average rainfall was made between the Kearny Mesa and Lindberg Field gauges for the simulated period and we found that Kearny Mesa was ~6% higher annually when compared to Lindberg. Due to the goal and nature of the analysis being undertaken (floodplain terracing /restoration design), this difference was determined not to be significant enough to warrant a change to the existing hydrologic model rainfall inputs. Also, as you suggest, there is an increase in precipitation proceeding east into the upper watershed. However, the land use within the upper watershed is in a fairly natural condition, therefore the increase in precipitation in the upper watershed is likely to have a smaller impact on the runoff produced compared urbanized portions of the middle and lower watershed.
R	Miramar MCAS encompasses more that 60% of the watershed and without some participation by the Marines, the project will only be partially effective.	Land use data suggest that the extent of hydromodification within Miramar MCAS is minimal when compared to the middle and lower portions of the RCW. The increase in urbanized runoff, which has negatively impacted the channel morphology and the ecologic function within the RCW, has been largely influenced by development in the middle and lower portions of the watershed.
R	While following San Clemente Canyon on Google Earth, I noticed that there is a huge sand mining operation in the canyon. This will be causing increased scour downstream.	The effects of this operation have not been analyzed as part of this study. This operation may significantly reduce the sediment load to the lower canyon due to the presence of existing impoundments and unknown levels of extraction. These impoundments may also significantly attenuate flood flows, thereby reducing the transport capacity and scour potential of the flows leaving the impoundments. However, urbanization has increased the magnitude of flows in the lower canyon in conjunction with significantly reducing sediment supply compared to historic conditions, which has led to problems with channel incision and erosion in the lower watershed. It is possible that the sand mining operation may exacerbate these conditions.
R	The abandoned county stream gage on Rose Canyon Creek (at Mission Bay drive before Garnet) is still there and can be used for monitoring with some minor repair.	We may consider relocating one of our current gauges to this location.
R	The county ALERT stream gage on San Clemente Canyon is active and available for use.	We were not aware of this data source. Depending on how long this gauge has been in operation, there may be an overlap with the period simulated in the HSPF model. If so, this data could be used to verify the flows for the overlapping period. Could you point us towards this dataset?
R	There are a few ALERT rain gages in and near the upper watershed that can be utilized on the project. A number of other sites can be chosen for the mid and lower watershed and placed in the ALERT system.	We look forward to collaborating with you as we move forward with additional data collection within the RCW.

Commenter: Chris Zirkle (+ staff) - City of San Diego, Open Space Division, Park and Recreation Department		
City	Statement: Objective to is to support watershed restoration alternatives to support: Floodplain reconnection Improved water quality Creation of wetland habitat, and Estimate beneficial and adverse impacts of	
	Questions:	
City	What is the source of the historical data used to establish the point in time (and the point itself) to which restoration efforts should strive to mimic. Please answer the same question with respect to the statement: "The lack of active management has led to a loss of floodplain habitat".	In an urbanized system, it is impossible to return to a historical point, and therefore an established point in time is not targeted. With the urbanization of the Rose Creek Watershed without associated water quality treatment and flood attenuation projects, the resulting channel incision within the public open space has reduced the functioning of the riparian habitats.
City	At what storm size(s) is floodplain reconnection desired (e.g., dry weather flows, 2-year storm, 5-year storm, etc.)	We targeted 5 and 10 year events for floodplain reconnection.
City	Is it expected that the additional wetland acreage will achieve the City's mandated water quality objectives? Would the restoration proposals inhibit the City's ability to achieve these objectives?	The proposed wetland acreage have not been designed to meet the City's mandated water quality objectives, but would provide incremental benefits towards a number of the objectives. The proposed wetlands would not inhibit the City's ability to achieve these objectives, as these objectives would be more directly assessed during final design and engineering.
City	Where in the report is the beneficial/adverse impacts analysis/does it consider the loss of habitat and type conversion that would occur with the restoration proposals.	We discuss this in our last stakeholder's meeting, and will be inserting this information into the final report in Chapter 6 starting on page 127.
City	Can you add another goal to facilitate ongoing maintenance of existing and proposed infrastructure that is planned to be installed or remain in the canyons (e.g., expand item 6 on page 33 to include all infrastructure)? What is the status of the Regents Road bridge?	Unfortunately the goal of this report is based upon improving ecological functions within the watershed, not facilitating maintenance activities by the City. The City would have project review and approval authority prior to implementation and can ensure infrastructure access is maintained. The status of the Regents Road Bridge is uncertain, but did impact our ability to recommend an additional restoration site that would be within its footprint.
City	Statement: "For example, the degradation of the active channel has resulted in the inability of the flows to overbank in the smaller storm events. Thus in San Clemente Canyon we see sycamore habitat being converted to non-native grassland and coastal sage scrub, resulting in an overall net loss of riparian habitat. Over time these relic sycamores, being unable to access sufficient soil moisture, will die off."	
City	Questions:	
City	What is the basis for concluding that there has been an overall loss of riparian habitat?	From a biological perspective channel incision has prevented the overbank flow into adjacent habitat - particularly sycamore woodland. In many areas the encroachment of upland species provides us evidence of this loss of riparian function. The sycamores may be present, but the riparian functioning is impaired.

City	How does overbanking negatively affect soil moisture availability to sycamores, particularly given the contribution to groundwater by subsurface irrigation water movement?	Overbank flow positively affects sycamore woodland in that they require mesic conditions (higher soil moisture) to thrive as well as reproduce. Where floodplain reconnection has been lost, the reproduction of new sycamore seedlings is absent. Channel incision also contributes to localized lowering of the groundwater table by providing a steeper gradient from the upland to the streambed.
City	Is there data that suggests that groundwater levels are lower than they historically have been?	No groundwater data was collected. No known source of groundwater were available to review. Other studies have found that incised channels lower the local groundwater table in adjacent floodplain terraces, even if there is more water in the system due to urban runoff.
City	Please contact Betsy Miller regarding our recent discovery that a fungus is killing some of the sycamores in one or both of these canyons.	This discovery will be incorporated into the Report on page 88.
City	Statement: "Many endangered plant and animal species are dependent on wetland and riparian habitats for their survival in the Rose Creek watershed. The loss or conversion of habitat over time signifies a reduction in overall habitat quality for wildlife."	
City	Question: Are many endangered plant and animal species dependent upon upland habitats for survival in the watershed (i.e., gnatcatcher and coastal sage scrub)?	With the loss of the functioning riparian habitat we have seen primarily non-native grassland encroach into the floodplain terraces. Limited coastal sage scrub has established under mature sycamores, where there is low soil moisture and virtually no overbank flow. Coastal sage scrub cannot persist in moist soil conditions. The evidence of upland habitat within the floodplain is the greatest evidence that the riparian community is not functioning. Several California gnatcatchers are present in the upland slopes within the watershed. Prior to any work being implemented sensitive species surveys would be required to ensure the protection of any sensitive species.
City	Statement: The last paragraph on page 3 indicates that the floodplain is hydrologically isolated from the channel and that if it was connected, groundwater discharge and recharge would be improved.	
City	Questions:	
City	Is there evidence to suggest that the floodplain is hydrologically isolated with respect to groundwater (i.e., does "Some recharge also take place when floodwater moves across the flood plain and seeps down into the water-table aquifer"?	Groundwater levels were not monitored with this effort and the following discussion is based upon knowledge and experience associated with the interaction between streams and groundwater and field observations made during this effort. Generally in arid climates, groundwater levels fluctuate seasonally, being closer to the ground surface during the wet season and gradually lowering through the summer / dry season. There is little direct evidence that supports the water table being at or very near the ground surface on the floodplains within the canyons at any point during a typical year. The primary evidence supporting this hypothesis is the lack of a sustained baseflow within the creeks at any time during a typical year. Generally, when flows break from the low-flow channel and spread across a floodplain, there is a significant increase in the ground surface area subjected to overland flow. This increase in the inundated surface area allows for water to be absorbed at a significantly higher rate as it infiltrates through the unsaturated zone toward the aquifer.

City	Particularly given the assumed influx of subsurface over-irrigation flows, is there evidence to suggest that the groundwater aquifer is not currently fully charged?	Based on our observations and the vegetative platforms that exist within the canyons, it's our opinion that Rose and San Clemente's low-flow channels serve as conduits that convey surficial irrigation flows. That being, the majority of these irrigation flows are likely transported to the creeks surficially, primarily through storm drainage networks. As irrigation water enter the low-flow channels during the dry season, the water infiltrates into the streambed creating a localized saturated zone beneath the streambed. Water within this saturated zone moves vertically and horizontally in the downstream direction creating a saturated linkage with the aquifer. This is typically referred to as a "loosing stream" as depicted in the diagram at this link: http://jan.ucc.nau.edu/~doetqp-p/courses/env302/lec5/Image26.gif). The difference between what's depicted in the diagram and what is likely occurring in Rose and San Clemente Creeks is majority of water movement during the dry season occurs below the surface of the streambed. This localized saturated zone provides adequate moisture near the margins of the stream to support dense networks of vegetation. Again, the primary evidence supporting the assumption that the water table is not at or very near the ground surface within the canyons is the lack of a sustained baseflow. An example of a stream with a sustained baseflow supported by a fully charged aquifer is depicted in the diagram at the following link: (http://jan.ucc.nau.edu/~doetqp-p/courses/env302/lec5/Image20.gif).
City	Would increased water conservation requirements affect groundwater levels in the canyons and would the restoration sites still be viable if irrigation water use is substantially reduced?	If irrigation water use was significantly reduced within the watershed, this would likely minimize the extent and influence of nuisance flows within the saturated zone that exists beneath the streambed along Rose and San Clemente Creeks. This would negatively impact the wetland vegetative communities that exist along the margins of the creek
City	Statement: When wetlands are present, "Water quality improvement can be significant as water leaves these riparian areas (Mitsch and Gosselink, 1993; Elder, 1987)"	
City	Questions:	
City	Is this research applicable to the rainfall and groundwater conditions in Rose Creek?	Most of the data on water quality improvements come from studies that look at nutrient transformation and removal from urban runoff. Rainfall tends not to be polluted and we do not have data. Since most of the transformation and sequestration occurs as a result of the plants as they absorb the nutrients, or as the soils adsorb (rather than absorb) the toxins, they may provide some improvement to groundwater conditions.
City	Can you provide more recent/applicable references?	The intent of this reference was to show that there have been studies of this nature. More detailed assessment will be required as each site moved forward into final design and engineering.
City	Would the proposal result in an increase in mosquito populations?	Possibly yes, though the goal is to create no standing water. Depending upon the nature of the soils in these area, much of the water may either flow through the system or absorbed into the soil.
City	At what storm sizes would water quality improvements be expected?	Water quality improvements would vary in type and scale under different storm events. No effort was made to quantify the benefits at this time.
City	Can you come closer to quantifying the expected water quality improvements, taking into account the expected retention/contact time, rather than just saying "significant".	Since this is intended for a planning level document, we are unable to quantify the expected water quality improvements.

City	Statement: "This deepening and widening process has hydrologically disconnected the channel from its floodplain, which has reduced or eliminated the frequency of floodplain inundation."	
City	Questions:	
City	What is the storm size currently required to reconnect the channel to the desired amount of floodplain inundation compared to the 5-10 year storm size that is preferred (is that a correct interpretation of this language: "Restoration of the 5 and 10 year return interval is the priority to restore and/or created adjacent floodplain habitat.") to reconnect the channel to the desired amount of floodplain inundation in the proposed condition? A rough estimate is adequate.	Under existing conditions, some level of floodplain inundation is present within the majority non-concrete lined portions of Rose and San Clemente Creeks for the 5 and 10 year return intervals. However, based on the channel geometry observed with this effort, it is apparent that the channel has become increasingly incised moving downstream through the watershed, which has resulted in a reduction in inundation area for a given return interval flow. It's difficult to quantify the exact loss of inundation area from channel incision, but comparing the inundation extents from the less impacted portions (restoration areas, upstream portions) of Rose and San Clemente Creeks to lower, more incised sections, it's apparent that the loss of inundation area is significant.
City	Is it anticipated that groundwater will be sufficient for the restoration sites to thrive for the five to ten years between return floods? If that is the case, are the return floods needed at all in order for the sites to be self-sufficient?	A stated previously, groundwater levels in arid climates fluctuate seasonally, being closer the ground surface during the wet season and lowering during the dry season. The seasonal proximity of the groundwater to the ground surface of the floodplain is an important component for the establishment of certain vegetative communities as is the periodic inundation from overbank flows.
City	Statement: Some temporary impacts on adjacent riparian or coastal sage scrub habitat are acceptable, given that these habitats are either replaced in other nearby places, or restored following floodplain restoration/creation.	
City	Questions:	
City	Please define "temporary".	They have not been defined with the stakeholders. Typically the regulatory agencies (ACOE, RWQCB, USFWS, CDFG) are comfortable with the lost habitat being replaced to fully functioning within 5 years.
City	Is CEQA or permit-driven mitigation expected for implementation of the restoration sites?	No. See Chapter 6 of the draft document.
City	Statement: Relocation of sewer lines presently situated either in the active floodplain or in adjacent valley bottom is acceptable. The same applies to power lines.	
City	Question: Do you have any cost estimates for this and are such relocations proposed at any of the restoration sites?	No cost estimate has been done since this is only a planning level document.
City	Statement: Relocation of hiking trails, parking lots, bathrooms, and picnic areas are acceptable, as long as they remain in the relative area and the relocation does not negatively impact existing recreational uses.	
City	Question: Is any such relocation proposed?	See San Clemente Canyon Site 6 which the bathrooms fall within the 5 year flood flows as shown in Figure 71 on page 113.

Commenter: Deron Bear - Marian Bear Natural Park Recreation Council		
MBRC	One of the principal reasons for conducting the analysis was to investigate whether increasing the floodplain holding capacity would sufficiently reduce peak flows downstream in Rose creek so that the concrete flood control structures could be removed. As discussed in the analysis the hydrologic analysis indicates the reduction in peak flow is not sufficient for this. What then is to be accomplished by altering the cross-sections of San Clemente Canyon at the 9 restoration sites?	Assessing the viability of concrete channel removal was only one of the principal reasons for conducting the analysis, not the only. The consultant team worked with stakeholders, including representatives of the Marian Bear Natural Park Recreation Council to establish additional goals relative to the improvement of wetland values and functions as described in Section 1.4 on page 5.
MBRC	Where can we visit a site where an incised stream channel has been reunited successfully with its historic floodplain? Can you refer us to any sources that discuss such projects and show photographs of the results?	There are numerous projects throughout southern California. The Southern California Wetlands Recovery Project is a good source of information regarding projects completed within the region. http://www.scwrp.org/pdfs/WRP-Completed-Projects_June-2010.pdf
MBRC	In San Clemente Canyon there are 2 on-going restoration projects, now nearing their 4-year post-construction mark. One is located 5000 feet east of the Genesee bridge over the creek; the other is 1000 feet east of the Regents Road bridge. The projects included major grading of the canyon floor to establish additional riparian forest areas along the creek. Do the analysis authors consider that these projects have successfully reunited the stream channel with the floodplain? How does the reshaping of the canyon floor proposed in the analysis differ from that performed in the existing restoration projects?	The mitigation project site east of Genesee provides better floodplain reconnectivity than the project east of Regents Road. Neither of these projects had any hydraulic modeling information available to them during the design and engineering phases, which would have allowed better analysis and implementation to ensure floodplain reconnection during targeted storm events. The potential restoration sites in this report do not vary dramatically in design intent from these mitigation sites, but have benefited from preliminary hydraulic analyses to help inform the conceptual design process, which in turn should result in a higher probability of successful floodplain reconnection and improvement of wetland functions.
MBRC	The analysis mentions construction of step pools as another way of connecting a stream channel with its floodplain. Without additional hydraulic modeling can the authors estimate the likely effectiveness of such pools in San Clemente Creek? We feel the pools might be less disruptive of the existing canyon ecosystem.	Without additional sediment monitoring data it is difficult to estimate the likely effectiveness of in-steam step pools to raise the streambed and reconnect the existing floodplains. Initial efforts are underway to collect integrated sediment and stream flow data to help make a preliminary determination regarding the potential viability of in-stream step pools. The results of this monitoring will be provided to the stakeholders as a supplement to this report.

MBRC	The level of the 52, 5 and 805 freeways will remain fixed and the land will be maintained to support these freeways. Since the level of the freeways will not change and the freeway walls will not erode naturally over time, the normal erosion process does not occur. In our opinion, leveling the floor of the canyon would not be a one-time mitigation project, but an ongoing process that could potentially damage the fragile ecosystem by consistent disruption.	The existing freeway infrastructure does pose long-term challenges to restoration efforts, but are not considered fatal flaws to floodplain restoration. Even with freeway encroachment into the historic floodplain areas, there remains adequate floodplain areas to improve wetland functions via floodplain reconnection through in-stream step pools or grading activities. All wetland restoration efforts within the watershed will need to consider stream and floodplain hydraulic conditions to determine if a stable stream environment can be established or if ongoing degradation will continue after project implementation. If ongoing degradation is anticipated, then the project should either be re-designed or postponed until the degradation can be addressed.
MBRC	Would low check dams upstream be effective in controlling the sediment from runoff generated in Miramar and the urbanized southern side of San Clemente Canyon? Several existing sewer crossings of the creek are now exposed and seem to be functioning as low dams.	In-stream step pools can be effective in controlling sediment movement within the stream if there is adequate sediment supply and stream velocities can be reduced to allow the deposition and retention of sediment. For in-stream step pools to be successful, an integrate set of step pools will likely be required to create a stable conditions along entire stream reaches where channel incision has occurred. Individual step pools may raise the streambed immediately upstream, but if not properly designed, can cause additional erosion downstream by increasing the slope of the stream and localized velocities.
MBRC	Erosion at storm drain discharge points (one of the major sources of erosion) is mentioned in the analysis but no corrective action, management, or maintenance is proposed.	The focus of the report was on the analysis of the main channels of Rose and San Clemente Creeks. The project scope and associated modeling tools were developed at a level of detail to allow the assessment of storm drain discharges. We agree that they are a major contributor of erosion and should be assessed for corrective measures, but were outside the scope of this effort.
MBRC	We do not feel that removing nine acres of grassland and replacing it with mixed oak/sycamore riparian forest is appropriate for wildlife preservation. While the existing grasslands are not native to the canyon, they have existed in their present state for a long enough time (+/-100 years) to have established their own community of animal species. These species are now part of the larger ecosystem of the entire canyon.	We agree that the wholesale removal of grasslands within the canyons is not appropriate and could result in impacts to local wildlife. Our recommended approach to restoration is first through the use of in-stream step pools, which would restore floodplain connectivity and allow natural processes to establish a new mix of habitat types over time. If in-stream step pools are infeasible or ineffective, then local stakeholders and regulators will need to determine if the long-term constriction and type conversion of the riparian corridor is acceptable, or if more dramatic restoration, such as what is proposed in this report, is appropriate.
MBRC	We would like additional evidence supporting the analysis's conclusion that riparian trees are stressed by the inability of the creek to overtop its banks. Is the visible dieback at the tops of many sycamore trees solely the result of down cutting of the streambed or are other causes at work as well? Is there evidence that other species are stressed by starvation of the floodplain?	The Report has been modified to clarify known facts versus professional opinions relative to the current status of the sycamores within the canyons. The primary observation the team was concerned with was the very limited numbers of juvenile trees within the study area, as well as the apparent lack of appropriate physical environment for sycamore recruitment. See pages 5, 21 and 24.

MBRC	Could the riparian forest be more effectively improved by additional plantings over the existing terrain using seedlings already naturalized for the canyon? Over the years members of our recreation council have successfully restored several areas of the canyon just using canyon plants. On the other hand, the contract revegetation of the restored areas east of Regents Road and east of Genesee has produced an unnatural thicket of plants with newly planted oaks and sycamores largely overgrown by the faster-growing willow. Perhaps this will revert to a more natural-appearing landscape when the sprinkler systems are removed in another year, but this is by no means certain.	A tree planting program could be used to replace and expand particular tree species, however, this should not be represented as restoration. For restoration to occur, modifications to the physical environment must be made to allow the individual tree species to self propagate under natural conditions, which is what is being recommended via the use of in-stream step pools or grading of the floodplain.
MBRC	The analysis proposes nine areas where stream function is to be improved. In our experience the mitigation activities already undertaken in just two areas of the canyon have had the following detrimental effects: 1) Daily movement of construction equipment along the park road damaged the road and its margins. 2) Construction noise drove out animals for lengthy periods of time. 3) Grading of terrain destroyed flourishing burrowing animal habitat. 4) Poorly designed trail construction in some areas now limits pedestrian access.	It is unfortunate that these projects have left a negative impression on Recreation Council. The first two impacts listed are temporary in nature and can be somewhat mitigated by altering construction methods or timing and should be included part of any project. The third impact is part of the trade-offs that must be considered as part of any restoration project and should be addressed during project development to ensure these types of impacts are considered and addressed. It is difficult to respond to the last impact as a specific issue is not presented. In general, ongoing recreational access should be addressed during project development to ensure appropriate facilities are included and maintained.
MBRC	The recent outbreak of the Gold-Spotted Oak Borer in San Clemente Canyon represents a major threat. Plans for any oak revegetation should consider tree spacing and choosing species with the best chance for survival.	We agree that tree spacing should be considered during tree planting programs and restoration efforts to minimize the risk of infection by insects and diseases. We do not agree that alternate species, other than those that naturally occur in the area, should be considered as part of a restoration project.
MBRC	Denuding the canyon floor of topsoil and associated microorganisms can produce unknown results. Does the analysis have any plan or procedure for possible unknown results?	Topsoil can by stockpiled appropriately to retain the microorganisms and replaced after grading activities have occurred. This would normally be considered as part of the final design and engineering of the project.

MBRC	The analysis envisions that the projects will be managed adaptively - that is, restoration plans will be fine-tuned as more is learned about how the water-shed is responding to the restoration activities. In our experience, most projects are planned, funded and executed, with the stakeholders left without resources to deal with any unanticipated effects at the end. The authors of the analysis should develop a schedule for the remediation proj-ects so that the consequences of each stage are understood and repaired before embarking on the next phase. It is far more important that we get a limited initial phase "right" rather than embarking on a larger project whose outcome is uncertain	This report is only a feasibility level planning study and not a formal project proposal. Any future project proposal resulting from this report or any oth-er source will need to address maintenance and management concerns. If the Recreation Council feels that inadequate resources have been provided by past projects, then an assertion needs to be made during future project development that additional long-term funding is required before a project can be implemented.
MBRC	Anticipated outcomes need to be quantified so that the degree of their attainment can be verified at the end of the restoration.	We acknowledge and agree with this concern. This level of quantitative analysis would be part of the project development associated with final design and engineering.

ROSE CREEK WATERSHED WETLAND, RIPARIAN, WATER QUALITY, RESTORATION OPPORTUNITIES,

AND ANALYSIS

Policy Statement

Marian Bear Memorial Park, a 467 acre open space park, was dedicated by action of the City Council to preserve this portion of San Clemente Canyon in its natural state. Marian Bear, an active community member, was instrumental in advocating for and assuring, through that advocacy and leadership, that the City Council would indeed take that action to protect the park for the enjoyment of all citizens.

The Marian Bear Natural Park Recreation Council, chartered in 1986, was tasked with developing a Master Plan for the optimum use, preservation, and maintenance of the park. This Plan, a "Natural Resource Management Plan", was approved by City Council on January 31, 1994.

While the NRMP identifies and discusses rehabilitation and restoration opportunities and provides for specific mitigation protocols for projects within the park which require such measures, the NRMP does not identify or specifically address any such proposals or projects located outside the park as "candidates" for potential mitigation within the park. While there are elements in Mr. Carpenter's report which are consistent with elements in the NRMP, it does not logically follow that they are congruent or consistent with the intent or policy goals of the NRMP, the charter and bylaws of the Marian Bear Natural Park Recreation Council, or the action of the City Council creating the park. Those policy statements having been made, should an opportunity arise whereby the park would receive an "extraordinary benefit" through a mitigation proposal from a project proponent known to have a credible and quantifiable track record of successful project completion and have the known and verifiable financial and staff/contractual resources for assuring the required long-term success of such a project, the Recreation Council could consider it at its regularly scheduled public meetings.

As a point of information, it should be pointed out that there are no "wetlands" in the park except for a small area immediately east of the Regents Road overpass which is informed by continual, if not continuous, run-off originating from Lakehurst Canyon uphill to the south and outside the park. The word "riparian" is derived directly from Latin "ripa" meaning "bank of a stream or river". Riparian habitat is not a wetland; the plants associated with each kind of habitat are generally quite different.

<u>MOTION:</u>

The Marian Bear Natural Park Recreation Council does acknowledge the "Rose Creek Watershed Wetland, Riparian, Water Quality, Restoration Opportunities, & Analysis" report presented by Senior Associate Mark Carpenter of KTU&A, one of the consultants for the San Diego Earthworks. The Council very much appreciates his presentations and subsequent discussions with the Recreation Council. The Recreation Council, however, does not endorse the report for the following reasons:

The Recreation Council opposes any implications or statements in any proposal or report that Marian Bear Memorial Park be identified or used as a "mitigation bank" for any project outside the park. The Recreation Council asserts strongly and without qualification that the notion that the park can or should be used as a "mitigation bank" is contrary to the City Council action dedicating the park and equally contrary to the mission, goals, and purpose of the Marian Bear Natural Park Recreation Council. The Marian Bear Natural Park Recreation Council cannot endorse this report as the Recreation Council additionally finds that to do so would be in direct conflict with the legacy of Marian Bear and the Recreation Council's respect for that legacy.

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