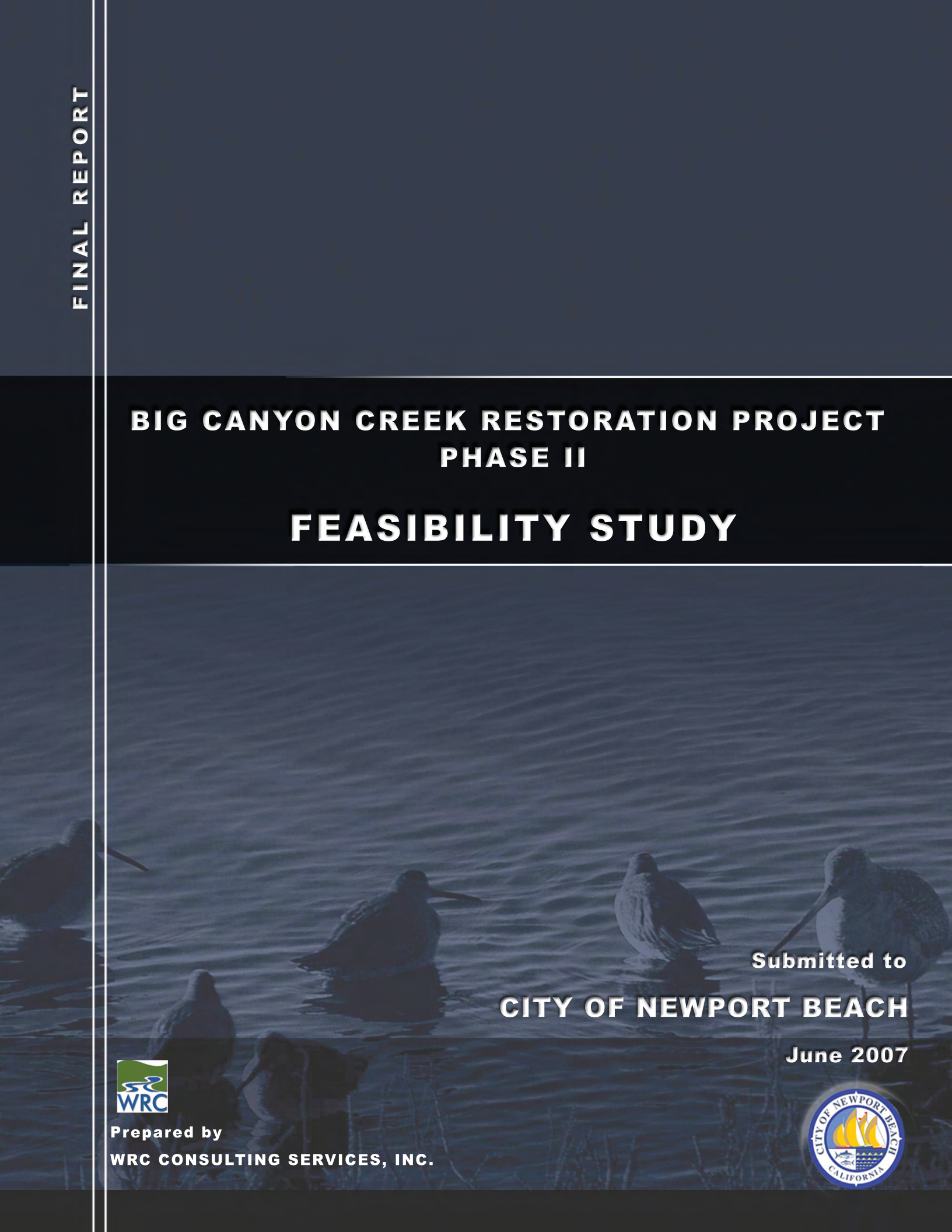
FINAL REPORT

# BIG CANYON CREEK RESTORATION PROJECT
# PHASE II

# FEASIBILITY STUDY



Submitted to

**CITY OF NEWPORT BEACH**

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Prepared by
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## *BIG CANYON CREEK RESTORATION PROJECT PHASE II*
## *FEASIBILITY STUDY PROJECT TEAM*

| | |
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Additionally, Ms. Aubrey Dugger (GreenInfo Network) and Mr. Rick Ware (Coastal Resources Management) each made significant contributions to the project.

## *ACKNOWLEDGEMENTS*

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Special thanks to the following funding agencies: City of Newport Beach, State Coastal Conservancy, and Regional Water Quality Control Board. The leadership provided by Dave Kiff, Wanda Cross and Greg Gauthier was essential to project success. Additionally, the insights and guidance provided by the project stakeholders identified throughout this report was instrumental to the success of the study and highly appreciated.

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## LIST OF ACRONYMS

ADA.....Americans with Disabilities Act
BMP ..... Best Management Practice
$BOD_5$..... Biochemical Oxygen Demand (standard 5-day test)
CBI.....Clean Beaches Initiative
CCC ..... California Coastal Commission
CCI.....Community Conservancy International
CEC ..... Cation Exchange Capacity
CEQA.....California Environmental Quality Act
CFR.....Code of Federal Regulations
cfs .....Cubic Feet per Second
CNDDB .....California Natural Diversity Database
CRHCP .....California Riparian Habitat Conservation Program
CSS.....Coastal Sage Scrub
CWA..... Clean Water Act
CZMA.....Coastal Zone Management Act
DFG .....California Department of Fish and Game
DPR .....California Department of Parks and Recreation
EFH .....Essential Fish Habitat
EPA.....U.S. Environmental Protection Agency
ERL..... Effects Range-Low
ESA.....Endangered Species Act
ESHA ..... Environmentally Sensitive Habitat Area
FHWA .....Federal Highway Administration
FSC.....Federal Species of Concern
FWS..... Free Water Surface
GPS .....Global Positioning System
HOT .....Highest Observed Tide
HTL ..... High Tide Line
IS.....Initial Study
LCP.....Local Coastal Program
MBAS..... Methylene Blue Active Substances
MHW .....Mean High Water
MHHW .....Mean Higher-High Water
MLW..... Mean Low Water
MLLW..... Mean Lower-Low Water
MND.....Mitigated Negative Declaration
MTL.....Mean Tide Line
NACo .....National Association of Counties
NAVD 88 .....National American Vertical Datum of 1988
NFWF.....National Fish and Wildlife Foundation
NMFS.....National Marine Fisheries Service
NPS..... National Parks Service
NRCS.....Natural Resources Conservation Service
NWP..... Nationwide Permit
OCSD..... Orange County Sanitation District
OHWM .....Ordinary High Water Mark
O&M..... Operation and Maintenance
QAPP .....Quality Assurance Project Plan
RCB ..... Reinforced Concrete Box

## LIST OF ACRONYMS
## (continued)

RTP ..... Recreational Trails Program
RWQCB ..... Regional Water Quality Control Board
SAP ..... Sampling and Analysis Plan
SAR ..... Sodium Absorption Ratio
SUSMP ..... Standard Urban Stormwater Mitigation Plan
TAC ..... Technical Advisory Committee
TDS ..... Total Dissolved Solids
TMDL ..... Total Maximum Daily Load
TSS ..... Total Suspended Solids
USACE ..... United States Army Corps of Engineers
USFWS ..... United States Fish and Wildlife Service
USGS ..... United States Geological Survey
WCB ..... California Wildlife Conservation Board
WQO ..... Water Quality Objectives
WRC ..... WRC Consulting Services, Inc.
WRP ..... Southern California Wetlands Recovery Project
YOTY ..... Young-of-the-Year

# EXECUTIVE SUMMARY

The City of Newport Beach undertook the study documented in this report to assess the technical feasibility of a wetland restoration project to restore tidal marsh and establish connectivity of habitat at Big Canyon Creek Nature Park, a 60-acre site located between Upper Newport Bay and the surrounding highly urbanized areas of the City of Newport Beach. The Big Canyon Creek Historic Tidal Wetland Conceptual Restoration Plan, which was developed under Phase I of the project, was assessed and refined during the course of the feasibility study. Several minor refinements were necessary to ensure technical feasibility and the results of the study indicate that the refined plan is technical feasible.

The lower half of Big Canyon is within the Upper Newport Bay State Ecological Reserve, which is a 303(d) listed impaired water body and has been closed to water-contact recreation since 1974. Existing site features include Back Bay Drive, a scenic road constructed across the mouth of Big Canyon through historic tidal wetlands; isolated wetlands behind Back Bay Drive that have been degraded by the dumping of dredge spoils; areas of upland fill that have sufficiently modified the topographic features of Big Canyon to eliminate the natural transition between upland and freshwater habitats to brackish and tidal wetland habitats; a freshwater pond that has been degraded by sediment eroding from the bluffs and the uncompacted dredge spoils; and the presence of invasive, non-native species found throughout the site that have reduced the quality of the native habitats.

The Big Canyon Creek Restoration Project will restore a natural drainage system and a healthy ecosystem including transition from mudflat, salt marsh, freshwater marsh, riparian, to upland habitats. At least 6 acres of tidal wetlands would be created as a result of the project. The restoration activities and elements will collectively provide impoundment, filtration and treatment that will reduce pollutant loads into the Upper Newport Bay and help to achieve the TMDL goals defined by the Water Quality Control Board. In addition, chronic flooding and erosion problems will be controlled by proper grading, drainage, detention, and planting. The plan is also intended to enhance public use and educational opportunities and provide coordinated trail access and interpretive signage.

The elements of the refined plan, and associated benefits, are summarized below.

- **Restore Tidal Marsh** – The historic tidal wetlands at the mouth of Big Canyon Creek will be restored by dredging and realigning the existing Back Bay Drive inland along the historic extent of tidal marsh. The plan will result in the addition of 6.62 acres of coastal salt marsh. The restored tidal marsh will improve the transition between fresh and saltwater habitat, enhance habitat for benthic invertebrates, and increase habitat diversity and complexity.
- **Realign Back Bay Drive** – Realignment is critical to facilitate the mixing of salt and freshwater at the canyon mouth to allow a natural, gradual transition from salt marsh to riparian upland habitat. Back Bay Drive will be realigned approximately 500 feet at the maximum inland extent and will roughly following the historic boundary of tidal wetlands at the mouth of Big Canyon.
- **Freshwater Marsh Modification** – Modification of the freshwater marsh will convert a mixed open water and cattail marsh complex, to a marsh complex that will support a more diverse community of native wetland plants. The existing marsh area is relatively large; however, there is limited effectiveness of this wetland for water quality improvement. The planned freshwater marsh area will be significantly reduced to provide for tidal marsh restoration. The reduced marsh area will be modified with an

open water zone for inflow distribution. Regrading the lower portion and outlet will provide more even flow distribution through the marsh to maximize the pollutant removal function per unit area. The conversion to freshwater marsh through grading provides an opportunity to establish rush and bulrush species appropriate to freshwater marshes that are currently excluded by cattails in the current marsh area.

- **Lower Freshwater Pond** – A series of two freshwater ponds are planned as habitat areas and elements of the water quality improvement design. The lower freshwater pond is designed to be entirely excavated, with the cut material balanced on-site in project fill areas. The pond will have a ten-foot wide, two-foot deep freshwater marsh bench that provides transitions from the pond edge to the bottom of the pond. At the edge of the freshwater marsh bench, the grade will rapidly increase to create a water depth of up to five feet to discourage cattail invasion of the transition and open water area. This bench design will allow a relatively narrow band of diverse wetland plants, which will also support any mosquito abatement control measures that are necessary.

- **Upper Freshwater Pond** – The upper pond is planned primarily to provide a sediment management function. Based on sediment transport analysis, it is expected that primary sedimentation problems will be related to fine materials. Sediment settling will provide reduction benefits for other constituents, including TSS, fecal coliform, and metals. The upper freshwater pond will also provide open water habitat.

- **New Planting and Removal of Invasive Exotics** – New planting and removal of invasive exotic species under the plan will facilitate restoration of tidal marsh, freshwater marsh, freshwater pond, riparian and upland habitats.

  Riparian habitat throughout Big Canyon will be enhanced through removal of non-native invasive species such as Brazilian pepper tree and lollipop tree. Approximately 1.29 acres of riparian willow woodland will be restored adjacent to the new freshwater marsh and pond where ornamental pepper trees now exclude native species. The federally listed threatened Coastal California gnatcatcher (Polioptila californica) forages and nests in coastal sage scrub in the project area vicinity.

  Based on mapping of exotic species densities, approximately 4.32 acres of riparian and 0.25 acres of alkali meadow habitats have dense infestations of exotic species that will be removed and the native habitats planted. Additionally, 4.43 acres of riparian woodland, scrub and mulefat and 0.16 acres of alkali meadow habitats with less dense infestations will have spot removal of exotic species with some replanting.

  Restoration of approximately 3.3 acres of coastal sage scrub habitat and enhancement of 2.31 acres of coastal sage scrub habitat will occur with implementation of the project. Approximately, 1.78 acres of fragments of coastal sage scrub will be permanently removed by the project.

- **On-Site BMPs** – Planned on-site best management practices (BMPs) include (1) sand/gravel filters applied to dry weather outflow through the lower freshwater pond and (2) end-of-pipe BMPs at the lateral storm drain outlets, including bioswales, energy dissipators (for erosion control) and sand/gravel filters. BMPs are an important part of the overall water quality improvement system.

- **Enhance Public Use and Provide Interpretive Opportunities** – The plan is intended to enhance public use and educational opportunities and provide coordinated trail access and interpretive signage. Included in the plan are trails, public vehicular areas, parking, interpretative areas and other facilities. The components of the plan were identified to meet public interpretation and education needs to the greatest extent

possible while not impacting restoration goals or practical considerations (*e.g.*, access to sewer line for necessary maintenance).

New minor trails are planned to connect existing trail systems within the canyon. The existing parking lot and restroom facilities will be moved out of the sensitive tidal wetlands area and relocated to an infertile area between existing coastal sage scrub and the degraded freshwater marsh. An amphitheater will be located in a central gathering area adjacent to the parking lot. Material excavated during tidal marsh restoration and other activities will be reused at the central gathering area to the maximum extent possible. Additionally, there are specific planned sites that will provide scenic overlooks to key natural features of the restored canyon, as well as excellent birdwatching locations.

- **Upper Canyon Manhole Maintenance Road** – The existing upper canyon sewer maintenance road will be preserved and provided with improved erosion controls. A new entrance from Jamboree Road to the existing maintenance road will be constructed. This is to facilitate sewer line maintenance that is coordinated and compatible with public use. Additionally, a maintenance road creek crossing will be constructed to allow routine access to the sewer manhole located on the north bank of the creek near Jamboree Road. The disturbance area for the new entrance, creek crossing and turnaround is estimated at 0.4 acres, including temporary grading daylight. There are no known sensitive species within and near the construction area and no mitigation is expected.

In addition to the proposed project elements summarized above, incidental repair and upgrade of existing facilities may be included in the project. As needed repair and upgrade will be determined based on safety requirements and code compliance.

# 1.0 INTRODUCTION

This section provides an introduction to the Big Canyon Creek Restoration Project Phase II Feasibility Study and is divided into three subsections, as follows: Section 1.1 provides a background of the Big Canyon Creek Restoration Project; Section 1.2 identifies the purpose of the feasibility study and the processes undertaken to complete it; and Section 1.3 discusses the organization of the remainder of the report.

## 1.1 Background

Big Canyon Creek Watershed covers approximately two square miles and drains directly into Upper Newport Bay. The majority of the watershed is urbanized. The 60-acre Big Canyon Creek Nature Park receives urban runoff and serves as a natural buffer zone between urbanized areas and Upper Newport Bay. The lower half of Big Canyon is within the Upper Newport Bay State Ecological Reserve.

Natural tidal flow into Big Canyon was impeded in the mid-1900's with the construction of Back Bay Drive and placement of dredged materials from Upper Newport Bay, both of which effectively created a barrier and eliminated more than five acres of tidal wetlands. There has been significant habitat degradation throughout the canyon due to decades of dredged fill, invasive non-native plants from surrounding developed areas, erosion, and lack of a comprehensive plan. Placed dredged materials in Big Canyon have resulted in large areas of saline and infertile soils, which cannot support native plant communities. A freshwater pond was constructed in the early 1980s but is now a very shallow marsh filled with sediment. The pond water is characterized by temperatures too high to support native populations.

Newport Bay is listed as an impaired water body under the federal Clean Water Act (CWA) due to the high levels of constituents of concern flowing into the Bay. Unfiltered urban runoff carried by Big Canyon Creek is a water quality issue having potential negative impacts on Upper Newport Bay and the nearly 500 species of animals, fish and plants that reside in the Bay.

With support from the Regional Water Quality Control Board (RWQCB) and State Coastal Conservancy, the Newport Beach City Council directed the City to move forward with an effort to restore the Creek within the Nature Park.

The Phase I study, initiated in 2003, is documented in the Big Canyon Creek Historic Tidal Wetland Conceptual Restoration Plan prepared by Community Conservancy International (CCI, 2004). The project intends to achieve the following objectives:

- Restore Tidal Marsh
- Improve Water Quality
- Enhance Riparian Habitat
- Reduce Flood/Erosion/ Sedimentation Damage
- Encourage Public Participation and Provide Education
- Provide Recreational Opportunities

## 1.2 Study Purpose and Process

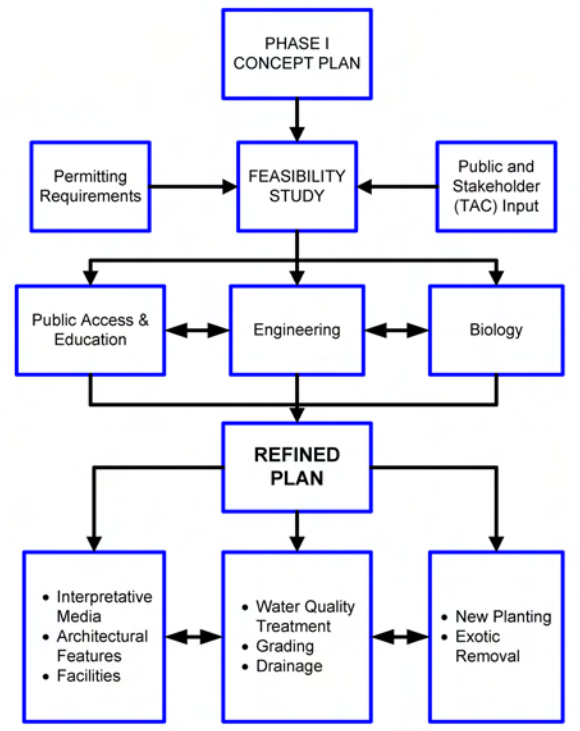
An important component of a successful study is to involve the public and key stakeholders at critical junctures in the study. For this reason, a Technical Advisory Committee (TAC) of key scientific and agency technical specialists was assembled to participate in final concept plan selection, development and feasibility evaluation. The general purpose of the feasibility study is to review the Phase I concept plan and confirm, refine, and modify the plan as appropriate to support detailed design, documentation and permitting.

It is intended that, following the feasibility study, the refined plan will serve as the basis for design without major modification. To ensure that the refined plan is technically

sound, preliminary design issues have been investigated and coordinated among the multidisciplinary design team members as shown in Figure 1.2-1.

**FIGURE 1.2-1**

**BIG CANYON RESTORATION PROJECT FEASIBILITY STUDY PROCESS**




The figure also shows that the refined plan work products are readily available for detailed design tasks, including the following major components:

- Concept Grading, Drainage and Utilities Plan – including erosion/sedimentation controls and water quality best management practices (BMPs).
- Concept Planting/Habitat Plan – including tidal marsh, freshwater ponds, freshwater marsh, riparian planting, upland planting and removal of invasive exotics.
- Concept Trail and Facility Plan – including trails, public vehicular areas, maintenance access, parking, interpretative areas and other facilities.

This comprehensive feasibility planning and design process is intended to ensure that the refined plan:

- Meets public and interpretive education needs to the greatest extent possible, while maximizing restoration opportunities.
- Minimizes the potential for environmental impacts, such as adverse impacts to wetlands or channel stability.
- Is technically feasible for detailed design, construction and maintenance.

Some of the specific issues that were evaluated and balanced in the feasibility study process include:

- Technical (physical, biological and engineering) issues, such as habitat restoration; protection and enhancement of endangered and threatened species; water quality improvement; drainage and erosion control; public access and education; infrastructure compatibility; and operation and maintenance requirements.
- Issues affecting integration into the adjacent communities, including identifying community interests and concerns, use of the site for water treatment and reuse, alignment of trails and other passive public uses, and integration with existing education centers.
- Governmental and regulatory issues that could affect project implementation, such as federal, state, and local regulations.
- Funding and administrative issues, including planning level estimates of construction and maintenance costs, sources of funding, and identification

of the entities responsible for the long term operation and maintenance of the site.

## 1.3 Report Organization

The main body of this report presents summaries of key findings, conclusions and methodologies. Supporting data and more detailed presentations of analysis are provided in the technical appendices.

## 2.0 PROBLEM STATEMENT AND RESTORATION PLAN

This section provides a summary description of existing project site conditions, issues and concerns regarding the existing condition, stakeholder input and the restoration plan. The restoration plan described in this section serves as the baseline for the subject feasibility study. The Phase I study report titled "Big Canyon Creek Historic Tidal Wetland Conceptual Restoration Plan" prepared by Community Conservancy International (CCI, 2004) was referenced in the preparation of this section.

### 2.1 Problem Statement

This section provides a description of the existing project site conditions, as well as issues and concerns associated with the existing conditions. The section includes descriptions of tidal wetlands; native habitats and endangered species; non-native habitats; water quality; roads, parking, trails and boardwalks; public access and interpretive use; views and aesthetics; and urban infrastructure. For general reference purposes, Figure 2.1-1 depicts the topography of Big Canyon, while Figure 2.1-2 depicts the existing vegetation conditions.

*TIDAL WETLANDS*

Currently the tidal inundation area of Big Canyon is limited to the bayside of Back Bay Drive. This scenic drive through the Upper Newport Bay Ecological Reserve follows the toe of the coastal bluffs on the east side of the estuary. Back Bay Drive was constructed across the mouth of Big Canyon through historic tidal wetlands, elevating the road ten feet above mean sea level, out of high tide range. Construction of Back Bay Drive cut off tidal flow destroying five acres of wetlands. A review of historic aerial photographs and maps of Big Canyon indicated that the historic range of the tidal wetlands once extended approximately 500 feet inland from Back Bay Drive and reached across the entire canyon mouth (see Figure 2.1-3). Big Canyon Creek currently drains through three 15-inch pipes under Back Bay Drive.

The isolated wetlands behind Back Bay Drive were then further degraded by the dumping of dredge spoils from the bay channel over many decades. Soil boring tests confirmed that the plateau on the south side of the freshwater pond is composed of approximately six feet of infertile and saline dredge spoils.

Construction of Back Bay Drive and deposition of the dredge spoils sufficiently modified the topographic features of Big Canyon to eliminate the natural transition between upland and freshwater habitats to brackish and tidal wetland habitats.

A freshwater pond was constructed in the lower portion of Big Canyon in the 1980s. To create the pond, a five-foot high, 500-foot long earth berm was constructed parallel to Back Bay Drive. There is now a twelve-foot drop in elevation from the water level in the pond to the mean sea level of the estuary. A concrete spillway directs overflow to culverts under Back Bay Drive.

Sediment eroding from the bluffs and the uncompacted dredge spoils has accumulated in the pond, diminishing its capacity to hold storm water during high flows. The water depth is now two feet. Cattails now dominate the warm shallow water of the pond, creating a flood hazard and further reducing the diversity of the aquatic environment.

A secondary drainage channel follows the toe of the northern bluffs and exits under a bridged portion of Back Bay Drive. This channel is active primarily during winter storms and high flows. With the elimination of natural tidal influence, riparian woodland has become established in this area of Big Canyon.

**Tidal Wetlands Issues of Concern**

- Loss of critical native habitat for endangered species

- Continuous flow of untreated contaminated water into Upper Newport Bay
- Loss of habitat diversity
- Degradation of freshwater pond
- Lack of flood management
- Infertile dredge materials
- Loss of natural transition from uplands to wetlands
- Destruction of historic tidal wetlands
- Poor drainage
- Infertile, saline and erosive soils due to dredge spoils

*NATIVE HABITATS AND ENDANGERED SPECIES*

There are 42 native plant communities identified in Big Canyon that attract an abundance of native birds, animals, reptiles and insects. Many of these communities are fragmented, discontinuous, and threatened by non-native plants. There are 86 native plant species, but 116 introduced non-native invasive species. Of the 86 native plant species occurring in Big Canyon, six have special status: Salt Marsh Bird's Beak; Southern Tar Plant; California Boxthorn; Southwestern Spiny Rush; Estuary Seablite; and Wooly Seablite. The Salt Marsh Bird's Beak is an endangered species on both federal and state lists; with 30,000 plants counted in 2003, Big Canyon has the most significant population in Southern California of this wetlands-dependent plant.

The native plant communities in the upper part of Big Canyon include arroyo willow scrub, alkali meadow, freshwater marsh, and sagebrush scrub. The lower portion (western) of the canyon is dominated by a large area of freshwater marsh, along with cottonwood-willow riparian forest, alkali meadow, brackish marsh, mulefat scrub, alkali grassland, chenopod scrub, coyote brush scrub, and sagebrush scrub. The canyon slopes contain areas of coastal bluff scrub and coyote brush scrub.

The tidal wetlands on the bayside of Back Bay Drive are dominated by saltmarsh, with smaller areas of alkali grassland, alkali meadow, alkali marsh, brackish marsh, mulefat scrub and sagebrush scrub along the edges of the roadway.

Ten bird species found in the project area are classified as endangered, threatened, or of special concern, including the Light-footed Clapper Rail, the California Gnatcatcher, California Brown Pelican, Belding's Savannah Sparrow, White-tailed Kite, Vaux's Swift, Cooper's Hawk, Sharp-shinned Hawk, Peregrine Falcon, and Northern Harrier.

The mudflats and shallow tidal channels at the mouth of Big Canyon, near the culvert under Back Bay Drive, support a range of native benthic invertebrates that are a critical food source for shorebirds and bottom-foraging fishes. These tidal-dependent organisms are integral to a healthy tidal ecosystem, but are currently limited to the estuarine area, mudflats and salt marsh area below Back Bay Drive.

**Native Habitats and Endangered Species Issues of Concern**

- Endangered and threatened species
- Continued loss and degradation of habitat
- Loss of wildlife diversity
- Impacts of contaminated urban runoff

*NON-NATIVE HABITATS*

Invasive, non-native species found throughout the site have reduced the quality of the native habitats. A total of 116 plant species in Big Canyon have been identified as non-native and invasive.

Areas of annual grassland found throughout the project area are dominated by non-native plants. Drought tolerant ornamental species used in residential landscaping have become established on the downhill

slopes. This is especially true of the Brazilian peeper tree and Myoporum laetum shrubs. Solid stands of Brazilian pepper tree have impacted the health of native plants in many areas and dominate in the riparian wetlands upstream of the service road crossing.

The freshwater pond, constructed downstream of the service road crossing in the 1980s, has lost its open water habitat due to sedimentation. The freshwater pond has been degraded and is now a freshwater marsh with cattails randomly established in shallow inundation areas.

The cattails found in the pond are a native plant species that has become invasive due to the high levels of sediment.

**Non-Native Habitats Issues of Concern**

- Degradation of native habitat due to non-native, invasive species
- Lack of eradication and management of highly invasive species
- Lack of fire management in restoration areas and on fragile bluffs

*WATER QUALITY*

Big Canyon Creek drains contaminated urban runoff and polluted storm water from the entire two square mile watershed directly into Upper Newport Bay. Water quality issues in Upper Newport Bay threaten the survival of hundreds of wetlands-dependent species and contribute to elevated bacterial counts at downstream beaches.

Portions of the Bay have been closed to water-contact recreation since 1974, and shellfish harvesting has been prohibited in the Ecological Reserve since 1978. Pesticides in the Upper Bay are now at levels toxic to aquatic life, and urban runoff continues to poison shellfish and invertebrates, the critical food source for shorebirds and fish.

**Water Quality Issues of Concern**

- Storm water run-off from surrounding streets and parking lots
- Fertilizer and pesticide contaminants from surrounding residential areas and the nearby golf course
- Sedimentation from bluffs and uncompacted dredge spoils
- Impact of pesticides, fertilizers and other toxins on water quality of Upper Newport Bay
- Algae blooms in stagnant water

*ROADS, PARKING, TRAILS & BOARDWALKS*

The primary access to Big Canyon is via Back Bay Drive, a one-way, single lane scenic drive with a class II bicycle lane and soft shoulders. Back Bay Drive cuts across the mouth of the canyon, through an area that was once tidal wetlands. An asphalt-paved parking lot is located on the western side of Back Bay Drive in the middle of existing tidal wetlands. Damage from recent storm surges is evident along the outer edges of the tarmac.

Maintenance roads traverse the site to access storm drains and sewer lines. Three controlled vehicle entrances are located on Back Bay Drive, Jamboree Road and Vista Bonita. The maintenance roads are surfaced in dirt, gravel and dredge material. Repairs to the roads in flood prone areas have been made by importing gravel and concrete construction debris to raise and armor the edges of the roadways. Over the years, resurfacing the roads has increased their width beyond the 11 feet necessary for maintenance vehicle access.

The maintenance road crosses the stream course in the middle of the canyon. Culverts under a concrete embankment constrict the winter flows, creating a riparian woodland and wet meadow upstream.

Currently, there is no trail access to the broad walk bridge and downstream trail

north of the creek from the service road crossing. The bridges and boardwalks adjacent to Back Bay Drive are deteriorated and flood-damaged and no longer provide the Americans with Disabilities Act (ADA) access to the area for which they were designed.

Unauthorized trails have been created on the fragile bluffs by local residents taking shortcuts into the canyon. These trails contribute to the erosion of the bluffs and intrude into sensitive habit areas.

**Roads, Parking, Trails & Boardwalks Issues of Concern**

- Poor staging circulation and coordination for public access and trails
- Lack of ADA access
- Location of parking lot in wetlands
- Constant maintenance and repair of parking lot and boardwalks close to water's edge
- Inappropriate use of gravel and asphalt as surfacing materials in wetland areas
- Size and proliferation of maintenance roads cutting through habitat areas
- Lack of trail linkage between the maintenance road crossing and the downstream trails
- Old and damaged boardwalks and public trails

*PUBLIC USE & INTERPRETIVE EDUCATION*

More than 750,000 visitors visit Upper Newport Bay annually. Big Canyon is one of the primary access points to the Bay. This unique estuary is heavily used by the public for recreation, wildlife observation and wetland-based educational activities.

Newport Bay Naturalists and Friends currently sponsors a wide range of programs and activities oriented around the estuary for all ages and interests, in partnership with the Newport Unified School District, local Scout troops, the California Department of Fish and Game (DFG) and the County of Orange. Big Canyon is the primary access point on the eastern side of the estuary.

The shallow waters of Upper Newport Bay limit recreational boating to small craft such as kayaks. There is no official water access in the Big Canyon Creek project area, but the proximity of the parking lot to the water's edge encourages boaters to land and visitors to wade into the estuary.

Hikers, joggers and bicyclists tend to concentrate their activities along Back Bay Drive. Due to the lack of identifiable trailheads or passable trails, many visitors never explore the interior of the canyon.

The parking lot can accommodate 35 cars and two buses. Two unattractive port-a-potties are provided at the edge of the parking lot. There are no bicycle racks available in the parking lot to encourage visitors to arrive via bicycle instead of car. Bicycles are not permitted on the trails or maintenance roads in Big Canyon.

A wood timber kiosk is located a short walk from the parking lot. Sun-faded displays provide interpretive information on the ecology of the Bay and its relationship to the Pacific Coast Flyway. A brochure rack offers activity information from California State Parks and the City of Newport Beach. The trails leading to the kiosk have been damaged by flooding and are not clearly marked.

Pedestrian access to Big Canyon from the parking lot area requires visitors to cross Back Bay Drive. The trail and interpretive facilities do not meet ADA requirements.

Old, damaged and deteriorating boardwalks, kiosks and interpretive signage have a negative impact on the visitor

experience and add to a feeling of isolation and neglect.

**Public Use & Interpretive Education Issues of Concern**

- Poor staging and circulation
- Poor quality of the interpretive experience
- Habitat damage due to public uses in sensitive areas
- Lack of scenic overlooks

*VIEWS & AESTHETICS*

Whether by car, foot or bicycle, visitors to Big Canyon come for the spectacular views of Upper Newport Bay and tidal flats, the freshwater marsh, and the coastal bluffs. Preservation of this unique setting is highly valued by communities. However, the presence of high berms and location of the existing staging/interpretive area do not allow visitors to observe the natural beauty of the Bay, canyon or tidal flats.

**Views & Aesthetics Issues of Concern**

- Raised terraces and dams interrupt views of the Bay and wetlands
- Poor staging and circulation
- Lack of scenic overlooks

*URBAN INFRASTRUCTURE*

Back Bay Drive is a levee roadbed with three 12" culverts underneath the road that drain fresh water from Big Canyon Creek into the estuary channel and into Upper Newport Bay. The constricted drainage at the creek mouth is a barrier to natural tidal flows, sediment movement, natural drainage patterns, and native plants and animals. Additionally, the constricted drainage has created serious flooding problems during winter storms, resulting in repeated and expensive damage to Back Bay Drive.

Information obtained from the City of Newport Beach indicates that there are a number of existing storm drains that channel runoff from adjacent neighborhood streets into the canyon. Outfalls are typically located at the base of the bluffs, contributing eroded sediments and polluted urban runoff to the creek.

A large culvert located beneath Jamboree Road drains the entire Big Canyon Creek watershed into Big Canyon Creek. Water quality is degraded due to fertilizers and pesticides from the golf course and other landscaped areas. In addition, oil, heavy metals and other contaminants drain into the creek from the watershed.

A county sewer line along the northern edge of the canyon joins a city-owned line that traverses the canyon and follows the southern edge. Maintenance of these lines is via manholes located throughout the project site. Furthermore, maintenance activities must be coordinated and compatible with public use.

No existing utilities are located within the Back Bay Drive right-of-way.

**Urban Infrastructure Issues of Concern**

Roads, infrastructure, and the existing utilities within Big Canyon are constraints to restoration efforts currently under consideration. Major issues include:

- Conflict between maintenance needs and public use needs
- Flood damage
- Water quality concerns
- Impact of Back Bay Drive on tidal flow

## 2.2 Plan Development and Stakeholder's Input

This section provides a background summary of stakeholder and public involvement in alternative selection, as well as subsequent refinements to the plan.

Plan Development

The 2004 study identified two viable alternatives to achieve restoration objectives:

I. Constructed tidal wetland with bridge opening at Back Bay Drive

II. Historical tidal wetland with Back Bay Drive realigned to extend the existing marshland with open tidal flushing.

Alternative II scored much higher in a public meeting vote and was jointly selected as the final alternative by the Phase I stakeholders, including regulatory agency representatives. To further confirm the viability of this alternative, a Technical Advisory Committee (TAC) was formed including representatives from agencies and interested groups listed in Table 2.2-1. This includes several stakeholders from the Phase I study.

Summary of Stakeholder Meetings

The first stakeholder meeting was held on September 28, 2006 at 2:00 PM in the City of Newport Beach Fire Conference Room. The stakeholders reconfirmed that Alternative II (Historical Tidal Wetlands) was the preferred alternative. This alternative was subsequently updated and refined through input from stakeholder meetings and additional follow-up interviews. The refined plan was supported by the technical feasibility analysis and evaluation presented in Section 3. The refined plan was presented at the second stakeholder meeting on December 14, 2006 at 1:00 PM in the City of Newport Beach Council Chambers. A description of the refined plan is included in Section 2.3.

Concise summaries of the first and second stakeholder meetings are provided below. The complete meeting minutes are provided in Appendix A.

*First Stakeholder Meeting, September 28, 2006*

Following the meeting introduction and summary presentation of Phase I results, attendees separated into three breakout groups. Breakout groups provided an opportunity for stakeholders to collaborate, discuss potential issues associated with the two restoration alternatives, raise questions

**TABLE 2.2-1**
**TECHNICAL ADVISORY COMMITTEE**

| Representative | Organization/Agency |
|---|---|
| Christine Medak | USFWS |
| Chuck Winsor | OCSD |
| Corice Farrar | United States Army Corps of Engineers (USACE) |
| Forrest Vanderbilt | USACE |
| Greg Gauthier | California Coastal Conservancy |
| Matt Yurko | California Coastal Commission |
| Michael O' Connell | Irvine Ranch Land Reserve Trust |
| David Raetz | Irvine Ranch Land Reserve Trust |
| John Graves | Irvine Ranch Land Reserve Trust |
| Jack Keating | Newport Bay Naturalists & Friends |
| Erik Katzmaier | Newport Bay Naturalists & Friends |
| Sue Stoffel | Upper Newport Bay Preserve |
| Wanda Cross | RWQCB – Santa Ana Region |
| Dave Kiff | City of Newport Beach |
| Tom Rossmiller | City of Newport Beach |
| Lloyd Dalton | City of Newport Beach |
| Christie Pearce | Orange County Dept. of Education (OCDE) |
| Sue McIntire | OCDE |

and discuss the feasibility of the project schedule from a regulatory and permitting perspective. The breakout groups were organized as follows:

- Biology, Ecology, and Water Quality
- Engineering and Maintenance
- Recreation, Education and Enhancement

Based on discussions from the three technical groups, the Historical Tidal Wetland Alternative was confirmed as the preferred alternative. However, it was also concluded that certain refinements to the Phase I preferred alternative were necessary to meet the concerns, goals and objectives of the stakeholders. These refinements are summarized below:

- Water Quality Pretreatment – the water quality pretreatment approach should be modified to reflect the available water quality monitoring results obtained prior to preliminary design.
- Boardwalk – the extension of the boardwalk into the tidal marsh areas should be reduced so that ADA requirements can be achieved.
- Trail Access – it may not be possible to provide a full circulation path due to grading issues and ADA access requirements. Maintenance access, however, will be maintained as identified in the Phase I concept plan if possible.
- Back Bay Drive Protection – negative impacts to Back Bay Drive during rainfall events have been historically severe due to drainage and erosion/sedimentation problems. The City has requested addressing this issue to be one of the high priority considerations of project design.
- Non-Native Plant Removal – current field observations showed more intrusion by non-native plants than identified in the Phase I efforts.
- Interpretation and Education – the site has been identified by both the City and the consultant team as one of the best locations for interpretation and education. The general public and students can view diversified biological resources and hydrological features in a relatively small area. The natural park experience should be enriched with interpretive and educational elements that provide an understanding of Big Canyon and Upper Newport Bay's natural systems. This design component will be coordinated with trail, landscape, and architectural design.

*Second Stakeholder Meeting, December 14, 2006*

The primary focus of the second stakeholder meeting was the presentation of preliminary feasibility study results for discussion and input by stakeholders. Following the welcome and introductory comments, a presentation began with an overview of the multidisciplinary feasibility study process. It was emphasized that the process is intended to result in a refined plan that maximizes restoration opportunities, provides for public interpretation as well as formal education needs, minimizes the potential for adverse environmental impacts, and ensures feasibility for detailed design, construction, operation and maintenance.

The presentation continued with a series of slides summarizing the draft feasibility study report, including the report contents, existing conditions, and refined grading/drainage/utilities, planting and public use plans.

Following the discussion of the draft feasibility study report, a series of consultant team technical experts presented the results of technical studies completed in support of the feasibility study process. The

study results presented were in the areas of:

- Park Use Studies
- Water Quality and Soils Studies
- Biology Studies
- Hydrology, Hydraulics, Geomorphology, and Engineering Studies

The meeting continued with attendees separating into three breakout groups. Breakout groups provided an opportunity for stakeholders to collaborate, discuss potential issues associated with the refined plan, raise questions and discuss the results of technical feasibility studies. The breakout groups were organized as follows:

- Biology, Ecology, and Permitting Group
- Water Quality, Soils, Engineering and Maintenance Group
- Recreation, Education and Enhancement Group

At the conclusion of the breakout group session, all attendees reassembled and discussed the findings of each group. Group recommendations for additional plan refinement were technical in nature and are described in detail in the meeting minutes (Appendix A).

Interview/Survey Summary

Information that is key to Big Canyon's interpretive plan was derived from three sources: the stakeholder meetings; an "interpretive needs" survey sent to all stakeholders; and interviews held with four education-focused stakeholders. A summary of the interpretive needs survey is provided as Appendix G.

In general, stakeholders concur that there are tremendous opportunities to broaden visitor awareness of the resources present at Big Canyon and their potential impact upon them. Directional signs, interpretive panels, interpretive nodes along the trails, viewing platforms, and boardwalks were identified repeatedly as amenities to consider. Their purpose is to maximize educational and interpretive opportunities with minimal disturbance to Big Canyon's wildlife and myriad habitats.

At the same time, stakeholders expressed concern over problems associated with picnic facilities, accumulation and disposal of trash, dogs (off leash), horses, pedestrian safety, unauthorized trails, durability of interpretive media, and lack of ADA access. These issues are consistent with those identified in the 2004 study and Section 2.1. The interpretive plan takes these issues into consideration.

## 2.3 Restoration Plan

The following subsections describe the elements which comprise the proposed restoration plan.

The Phase I Concept Plan (Historic Tidal Wetlands Concept Alternative for the Big Canyon Creek Restoration Project [CCI 2004]) is provided for reference as Figure 2.2-1. The restoration elements shown in the figure are reflected in the Phase II refined plan, except for some changes mentioned in the September, 2006 meeting summary (Section 2.2 and Appendix A). Additionally, the water quality diversion and filtration basin below the Jamboree Road culvert was removed. The implementation of this element was found not feasible due to high sub-surface water and relatively flat channel gradient. The water quality retention basin to be formed by a berm/weir located along the city sewer crossing was found not cost effective without major excavation and disturbance to the riparian wetland.

As mentioned in the introduction, the approach to the feasibility study has considered the needs for detailed design and permitting. The refined plans were prepared to include the major design components listed below. These plans can be further refined for construction documentation.

- Concept Grading, Drainage and Utilities Plan – including erosion/sedimentation controls and water quality BMPs.
- Concept Planting/Habitat Plan – including tidal marsh, freshwater ponds, freshwater marsh, riparian planting, upland planting and removal of invasive exotics.
- Concept Trail and Facility Plan – including trails, public vehicular areas, maintenance access, parking, interpretative areas and other facilities.

This section provides a general description of the restoration plan, presents each of the three plans identified above and provides descriptive details of each of the key elements of the restoration plan. The Grading, Drainage and Facilities Plan is presented as Figure 2.2-2; Planting/Habitat Plan is presented as Figure 2.2-3; and the Trail and Facility Plan is presented as Figure 2.2-4.

As depicted in Figures 2.2-2 through 2.2-4, the key elements of the restoration plan include the following:

- Upper Canyon Manhole Maintenance Road – provides access from Jamboree Road and facilitates sewer line maintenance that is coordinated and compatible with public use.
- End of Pipe BMPs – located at storm drain outlets, end-of-pipe BMPs are an important part of the overall water quality improvement system.
- Upper Freshwater Pond – provides a sediment management function as part of the overall water quality improvement system.
- Lower Freshwater Pond – primarily a habitat area, but will provide additional opportunities for sediment settlement and pollutant removal.
- Freshwater Marsh Modification – converts a mixed open water and cattail marsh complex, to a marsh complex that will support a more diverse community of native wetland plants. Also provides an important water quality improvement function.
- Back Bay Drive Realignment – realignment is critical to facilitate the mixing of salt and freshwater at the canyon mouth to allow a natural, gradual transition from salt marsh to riparian upland habitat.
- Tidal Marsh Modification – the historic tidal wetlands at the mouth of Big Canyon Creek will be restored by dredging and relocating the existing parking lot out of the tidal area.
- Interpretive Areas – designed to help the visitor understand and value the special land and waterscape of Big Canyon within the overall context of Upper Newport Bay.
- Other Facilities – the strategic placement of staging areas, parking lots, restrooms and trails will allow visitors to explore the canyon without degrading the very resources that attract them to the site.
- New Planting – facilitates restoration of tidal marsh, freshwater marsh, freshwater pond, riparian and upland habitats.
- Removal of Exotics – designed to reverse the degradation of native habitat due to non-native, invasive species.

**Grading and Drainage Plan**

This section describes the concept tidal marsh, freshwater marsh and freshwater pond grading plans.

Tidal Marsh Grading Plan

The tidal marsh grading plan was developed

using preliminary tidal elevations and plant survey data. Plant survey data conforms to the elevation ranges presented in the preliminary planting plan section and the preliminary tide elevations are as follows:

**Station:** Upper Newport Bay (Station 9410580)

**Datum:** National American Vertical Datum of 1988 (NAVD 88) – adjusted tide values for NAVD 88 listed below.

Mean Lower-Low Water (MLLW): 0.18 ft
Mean Low Water (MLW): 0.74 ft
Mean Tide Line (MTL): 2.62 ft
Mean High Water (MHW): 4.49 ft
Mean Higher-High Water (MHHW): 5.23 ft
Highest Observed Tide (HOT): 7.49 ft

Based on this tidal data and the plant survey elevation data discussed in the preliminary marsh planting plan section below, the marsh habitat types presented in Table 2.3-1 were determined.

**TABLE 2.3-1**
**GRADING OBJECTIVE FOR TIDAL MARSH HABITAT PLANTING**

| Habitat Type | Elevation Range |
|---|---|
| Mud Flat | 0 to 2.5 feet |
| Low Marsh | 2.5 to 4.5 feet |
| Mid Marsh | 4.5 to 5.25 feet |
| High Marsh | 5.25 to 6.5 feet |
| Marsh Transition | 6.5 to 8.5 feet |
| Upland Buffer | 8.5 feet and above |

Freshwater Marsh Grading Plan

The freshwater marsh restoration area grading converts a mixed open water and cattail marsh complex, to a marsh complex that will support a more diverse community of native wetland plants. The existing marsh area is relatively large; however, there is limited effectiveness of this wetland for water quality improvement. For the proposed condition, the freshwater marsh area will be significantly reduced to provide for tidal marsh restoration (the cattail marsh will be reduced to only one acre). The reduced marsh area will be modified with an open water zone for inflow distribution, regrading in the lower portion and outlet to provide more even flow distribution through the marsh to maximize the pollutant removal function per unit area.

The conversion to freshwater marsh through grading provides an opportunity to establish rush and bulrush species appropriate to freshwater marshes that are currently excluded by cattails in the current marsh area.

Freshwater Pond Grading Plan

The freshwater pond is designed to provide open water habitats and to replace the existing shallow pond between the service road crossing and Back Bay Drive. The new pond will be located immediately above the service road crossing within a large area of invasive pepper trees. The new pond will be split into two ponds in consideration of maintenance feasibility.

The pond will have a ten-foot wide, two-foot deep freshwater marsh bench that provides transitions from the pond edge to the bottom of the pond. At the edge of the freshwater marsh bench, the grade rapidly increases to create a water depth of up to five feet to discourage cattail invasion of the transition and open water area. This bench design will allow a relatively narrow band of diverse wetland plants, which will also support any mosquito abatement control measures that are necessary.

Water Quality Improvements

Most runoff from the two square mile Big Canyon Creek watershed enters the canyon via a 120” diameter pipe culvert under Jamboree Road.

As the water flows through the canyon, the natural meandering stream flow and system of riparian habitat, meadows, ponds, freshwater marsh and wetlands will act as natural filters, trapping pollutants, sediments, metals, bacteria and nutrients. The combined filtration and impoundment function of the freshwater pond, wetland and marsh system will help prevent these contaminants from reaching Upper Newport Bay.

Additionally, water quality improvements can be provided through sand/gravel filters, erosion control, and end-of-pipe treatment. The mid-canyon service road crossing area was identified as the most feasible location for placing water quality BMPs (see Section 3).

The erosion potential within the existing north riparian channel will be reduced during flood events due to reduction in split flow into this channel branch (see Section 3). The lower discharge and velocities will help prevent (1) damage to riparian habitats and (2) erosive sediments entering tidal marsh and Upper Newport Bay.

Drainage Plan

The proposed plan intends to maintain the existing drainage course and floodplain upstream of the proposed freshwater pond, particularly in areas where natural meandering patterns exist. The only modification planned upstream of the freshwater pond is to eliminate the stagnant water downstream of the Jamboree Road culvert as part of the upper canyon maintenance road improvement. Elimination of this area of stagnant water will improve water quality.

The low flow channel will be modified through the upper pond in order to provide more sediment deposition opportunities. Additionally, the lower pond outlet will be widened with multiple shallow pipes to avoid narrow choking at the deep crossing. Existing drainage at the service road crossing creates a major choking point for Big Canyon Creek. Under the proposed condition, the flow will be spread to a much wider area. A grade control pool made of stones or soil cement in a natural shape will be located downstream of the freshwater pond, as well as an open water zone for treatment wetland flow distribution.

Based on hydraulic and erosion/ sedimentation analyses (see Section 3), as well as field observation, the service road crossing immediately downstream of the proposed freshwater pond is marginally acting as a grade control for the upstream channel without a solid foundation and surface erosion control. The proposed plan will emphasize the stability of this structure as the embankment for the freshwater pond as well as grade stabilization for the upper reaches. The top of road will be designed as a wide crest for overflow to occur from frequent flow to high flows.

Split flow under the low flow condition (up to 1000 cfs) at the trail dike (Elevation 15) will be the same as under the existing condition (10 to 15% of flow goes to the north branch riparian channel). However, split flow into the same channel will be reduced from 45% to 20% under high flow conditions. This change is not caused by drainage structure modification; rather, it is caused by moving Back Bay Drive inward. This realignment of the road reduces the length of overtopping flow along the trail dike from the south channel (freshwater marsh) to the north channel (riparian channel).

The erosion potential within the existing north riparian channel will be reduced during flood events due to the reduction in split flow into this channel branch. The lower discharge and velocities will prevent (1) damage to riparian habitats and (2) erosive sediments entering tidal marsh and Upper Newport Bay.

To avoid flow concentration and provide better transition from tidal marsh to freshwater marsh, a series of shallow culverts is proposed under the realigned Back Bay Drive. In contrast to the mid-canyon service road crossing, this road will be designed to avoid flow overtopping and

consequently improve pavement stability. This is a significant improvement compared to the dam, drop structure, narrow outfall from marsh, and road dip crossing downstream of the freshwater marsh under current conditions.

**Planting Plan**

Plant species proposed for planting in the tidal and freshwater marsh restoration areas include native species found on-site. The selected species are either available commercially for planting or can be collected on-site for planting. In addition, existing wetland topsoil within the grading area with desirable native plants will be salvaged to provide a seed bank and plant propagules for the restored marsh areas. Preliminary plant elevations were established by comparing and balancing the following sources of information:

- Plant Elevation Survey Data for Upper Newport Bay
- NOAA Tidal Elevation Information for Upper Newport Bay (adjusted to the NAVD 88 Datum), obtained by WRA, Inc., 11/06 (Station ID 9410580)
- Marsh Vegetation Vertical Zonation Chart: typical tidal ranges for plant communities, compiled by WRA, Inc., 11/06

Plant elevation survey data for tidal marsh species was collected in Upper Newport Bay in November, 2006 by WRA, Inc. The survey data was taken near the southern edge of the proposed tidal marsh restoration site, and should therefore provide relatively accurate plant elevation ranges for the project. However, the amount of elevation data that was taken is limited, and was adjusted according to the NOAA Tidal Elevation information and typical tidal ranges described above.

Summary of Tidal Marsh Plant Elevation Survey Data (WRA, 11/06*)*

- *Spartina foliosa*: Two survey point elevations were taken for *Spartina foliosa* (cord grass). One of these elevations was taken along the upper edge of the observed cord grass, yielding a 'high' elevation of 4.20 feet. The other elevation was taken along the lower edge of the observed cord grass, yielding a 'low' elevation of 3.30 feet. Due to the limited amount of data, this initial range was then adjusted with the NOAA Tidal Elevation information and typical tidal ranges for cord grass, yielding a final planting elevation range of 3.5 to 4.5 feet, allowing cord grass to colonize down to 2.5 feet (approximately MTL to MHW).
- *Scirpus maritimus*: A total of seven survey point elevations were taken for *Scirpus maritimus* (alkali bulrush). One of these elevations was taken along the upper edge of the observed bulrush, yielding a 'high' elevation of 6.69 feet. Three additional elevations were taken in the middle of the observed bulrush, yielding an average 'mid' elevation of 5.16 feet. The final three elevations were taken along the lower edge of the observed bulrush, yielding an average 'low' elevation of 4.69 feet. Taken together, this data yields an initial average elevation range of 4.69 to 6.69 feet for bulrush. This initial range was then adjusted with the NOAA Tidal Elevation information, yielding a final planting elevation range of 4.5 to 5.25 feet (approximately MHW to MHHW). However, the observed bulrush was likely present to due to a nearby freshwater input, and planting is only recommended in similar brackish conditions.
- *Salicornia virginica*: A total of eleven survey point elevations were taken for *Salicornia virginica* (common pickleweed). Three of these elevations were taken along the upper edge of the

observed pickleweed, yielding an average 'high' elevation of 6.39 feet. Three additional elevations were taken in the middle of the observed pickleweed, yielding an average 'mid' elevation of 5.41 feet. The final four elevations were taken along the lower edge of the observed pickleweed, yielding an average 'low' elevation of 4.84 feet. Taken together, this data yields an initial average elevation range of 4.84 to 6.39 feet for pickleweed. This initial range was then adjusted with the NOAA Tidal Elevation information and typical tidal ranges for common pickleweed, yielding a final planting elevation range of 4.5 to 5.5 feet (approximately MHW to slightly above MHHW).

- *Frankenia salina*: A total of seven survey point elevations were taken for *Frankenia salina* (alkali heath). Three of these elevations were taken along the upper edge of the observed heath, yielding an average 'high' elevation of 10.56 feet. The other four elevations were taken along the lower edge of the observed heath, yielding an average 'low' elevation of 5.26 feet. This initial range was then adjusted with the NOAA Tidal Elevation information and typical tidal ranges for alkali heath, yielding a final planting elevation range of 5.25 feet to top of marsh (approximately MHHW to the top of High Marsh).
- *Limonium californicum*: Two survey point elevations were taken for *Limonium californicum* (marsh rosemary). One of these elevations was taken along the upper edge of the observed rosemary, yielding a 'high' elevation of 6.69 feet. The other elevation was taken along the lower edge of the observed rosemary, yielding a 'low' elevation of 5.44 feet. Due to the limited amount of data, this initial range was then adjusted with the NOAA Tidal Elevation information and other known marsh rosemary occurrences, yielding a final planting elevation range of 6.0 to 6.25 feet (approximately between MHHW to HOT).
- *Distichlis spicata*, *Jaumea carnosa*, and *Salicornia subterminalis*: No survey data was taken for *Distichlis spicata* (salt grass), *Jaumea carnosa* (fleshy jaumea), or *Salicornia subterminalis* (glasswort), so preliminary elevations for these species were established using the NOAA Tidal Elevation information and typical tidal ranges (approximately MHHW to the top of High Marsh for both salt grass and glasswort, and approximately MHW to MHHW for fleshy jaumea).

Proposed Tidal and Freshwater Marsh Planting Plan

During the detailed design phases of the project, more extensive survey of existing marsh plant species and their respective elevations will be performed, and these preliminary plant elevations will be adjusted as necessary for the final plan. An elevation survey of existing plants was performed to determine appropriate elevation ranges for the proposed plant species.

The table below identifies the plant species and elevation ranges proposed for planting as container stock and/or seeding in the freshwater and tidal marsh zones.

**TABLE 2.3-2**
**PROPOSED TIDAL AND FRESHWATER MARSH PLANTING PLAN**

| Plant Species/Zones | Elevation Ranges (feet) |
|---|---|
| Low Marsh | |
| *Spartina foliosa* | 3.5 – 4.5 |
| Mid Marsh | |
| *Distichlis spicata* | 4.5 – 5.25 |
| *Jaumea carnosa* | 4.5 – 5.25 |

| TABLE 2.3-2<br>PROPOSED TIDAL AND FRESHWATER MARSH PLANTING PLAN | |
|---|---|
| **Plant Species/Zones** | **Elevation Ranges (feet)** |
| *Salicornia virginica* | 4.5 – 5.25 |
| *Scirpus maritimus** | 4.5 – 5.25 |
| <u>High Marsh</u> | |
| *Distichlis spicata* | 5.25 – 8.5 |
| *Frankenia salina* | 5.25 – 8.5 |
| *Juncus acutus** | 6.0 – 6.25 |
| *Juncus acutus spp. leopoldii** | 6.0 – 6.25 |
| *Limonium californicum* | 6.0 – 6.25 |
| *Salicornia subterminalis* | 5.25 – 8.5 |
| *Salicornia virginica* | 5.25 – 5.5 |
| *Suaeda esteroa* | 5.25 – 6.5 |
| *Suaeda taxifolia* | 5.25 – 6.5 |
| <u>Marsh Transition</u> | |
| *Distichlis spicata* | 5.25 – 8.5 |
| *Frankenia salina* | 5.25 – 8.5 |
| *Salicornia subterminalis* | 5.25 – 8.5 |
| <u>Coastal Sage Scrub Upland Buffer</u> | |
| *Artemisia californica* | 8.5 and above |
| *Atriplex canescens* | 8.5 and above |
| *Baccharis pilularis* | 8.5 and above |
| *Isomeris arborea* | 8.5 and above |
| <u>Freshwater Marsh</u> | |
| *Eleocharis palustrus* | N/A |
| *Juncus balticus* | N/A |
| *Scirpus americanus* | N/A |
| *Scirpus californicus* | N/A |
| ***** Will be planted only in areas adjacent to freshwater inputs or brackish areas. | |

<u>Preliminary Riparian Woodland and Riparian Scrub Planting Plan</u>

Riparian woodland and riparian scrub habitats will be restored and enhanced with the removal of invasive exotic species. Native riparian species will be planted and seeded in areas that are opened up with the removal of exotic species. A mix of each canopy layer, tree, shrub, and herbaceous will be planted. Specific placement of species will depend on soil and hydrologic conditions. The following native species will be incorporated into areas where exotic species are removed in riparian areas.

- *Ambrosia psilostachya*
- *Artemisia douglasiana*
- *Baccharis salicifolia*
- *Hordeum brachyantherum*
- *Juncus acutus*
- *Juncus mexicanus*
- *Leymus triticoides*
- *Lonicera subspicata*
- *Platanus racemosa*
- *Salix lasiolepis*
- *Salix gooddingii*
- *Populus fremontii*
- *Pluchea odorata*
- *Rosa californica*
- *Urtica dioica*

Preliminary Alkali Meadow Planting Plan

Alkali meadow habitats within Big Canyon will be reclaimed and restored by removing invasive exotic species and planting appropriate native species. The following native species will be incorporated into areas where exotic species are removed.

- *Ambrosia psilostachya*
- *Distichlis spicata*
- *Centromadia parryi ssp. austarlis*
- *Frankenia salina*
- *Heliotropum currassavicum*
- *Pluchea odorata*
- *Urtica dioica*

Preliminary Coastal Sage Scrub Planting Plan

Coastal sage scrub habitat is proposed for steeper graded upland slopes along the edges of the parking area and public trails as well as on slopes currently dominated by exotic species along the slopes of Big Canyon. The following native plant species will be incorporated into each area depending on slope and soil types.

- *Artemisia californica*
- *Atriplex canescens*
- Atriplex lentiformis
- Baccharis pilularis
- Baccharis emoryi
- Encelia californica
- Eriogonum fasciculatum
- Datura meteloides
- Deiandra fasciculata
- Distichlis subspicata
- Frankenia salina
- Isocoma menziesii
- Isomeris arborea
- Nassella lepida
- Lupinus succulentus
- Verbena lasiostachya

**Trail and Facility Plan**

The Trail and Facility Plan (Figure 2.2-4) includes trails, public vehicular areas, maintenance access, parking, interpretative areas and other facilities. The components of the plan were identified to meet the needs of the visiting public and schools to the greatest extent possible while not detracting from important restoration goals or practical considerations (*e.g*., access to sewer lines for necessary maintenance). Because there are many potential users, from organized groups to casual families, the plan has been designed to accommodate them all.

Vehicular and Bicycle Access & Parking

Vehicular access to Big Canyon will continue to be via Back Bay Drive. Back Bay Drive will continue to function as a throughway along this edge of the Upper Newport Bay Ecological Preserve, with one-way vehicular traffic and a dedicated bicycle lane on the bay side of the road. The scenic quality of the relocated, elevated Back Bay Drive will be enhanced. Road closures and associated maintenance and reconstruction costs should be reduced with the proposed road realignment and culverts.

The parking lot and restroom facilities will be moved out of the sensitive tidal wetlands area and relocated to an infertile barren area between existing coastal sage scrub and the degraded freshwater marsh. This new location will prevent damage to the parking area from the tidal surges associated with winter storms, prevent costly maintenance, and avoid disturbance and pollution to the tidal marsh.

The parking area will be constructed from compacted infertile soils recycled from other areas of the canyon. A loop road will be provided for ingress and egress from Back Bay Drive. Buffer areas will be incorporated into the edges of the parking area to keep foot traffic and vehicles away from the adjacent restored plant communities. Native trees will be planted adjacent to the parking area to provide shade and screening. There will be space for 35 cars and two school buses. Additionally, bicycle racks will be provided.

Relocation of the parking lot will allow school groups to assemble safely away

from traffic on Back Bay Drive. Restroom facilities, consisting of screened portable restrooms, will be provided adjacent to the parking area.

The existing upper canyon sewer maintenance road will be preserved and provided with improved erosion controls. A new entrance from Jamboree Road to the existing maintenance road will be constructed. This is to facilitate sewer line maintenance that is coordinated and compatible with public use. Additionally, a maintenance road creek crossing will be constructed to allow routine access to the sewer manhole located on the north bank of the creek near Jamboree Road.

The existing gate of Back Bay Drive will be relocated to the western edge of the existing sewer maintenance road within the new interpretative area. Handicapped parking will be provided at the central gathering area and near the Back Bay Drive overlook location where possible.

Back Bay Drive, the loop road and handicapped parking areas will be paved with a hard surface; the remaining parking and vehicle access will have a pervious decomposed granite surface.

Public Trails

The trail network in Big Canyon will be improved to provide continuous ADA access within the central gathering area and for public viewing of the freshwater pond and wetlands.

In addition to ADA trails, two-way bike trails along Back Bay Drive and the loop road (connecting to parking and the central gathering area) will also function as hiking and jogging trails for physical fitness.

The existing trail connection from Back Bay Drive to the existing boardwalk bridge (crossing the north riparian channel) will be extended to the service road crossing below the proposed freshwater pond. The boardwalk trail will also connect the north channel trail to the realigned Back Bay Drive. This will provide complete foot access surrounding the lower canyon.

The existing maintenance road from the mid-canyon service road crossing to Jamboree Road along the south side of the canyon will be maintained as an emergency foot access. Its use as a public access will be determined by the City in conjunction with security considerations.

Other unauthorized erosive and hazardous trails on the canyon slopes will be blocked to discourage future use and prevent erosion damages.

Overlooks, Boardwalks and Interpretive Area

The proposed plan identifies trailheads, parking, restrooms, and interpretive media. Most of the surface area will be planted with native species compatible with the existing habitats. All proposed facilities will be designed to blend well with the surrounding habitats. An amphitheater (designated “B” on the plan) will serve as (1) an orientation and special presentation area and (2) a safe place for student lunch[1] where students can comfortably sit in the shade and trash disposal can be controlled.

The amphitheater will be designed to accommodate the existing visitor counts (approximately 100). A series of hand-retractable canvas cloths will provide overhead shade during use, and convenient, low profile storage during nonuse. Access is provided to the amphitheater from the arrival/dropoff area (designated “A”) by a loop trial which also provides access to other facilities in the central gathering area. The arrival area will include informational and directional signage. Parking (designated “F”) is provided adjacent to the arrival/dropoff area, as will be portable chemical restroom

[1] Many stakeholders are adamantly opposed to having formal picnic facilities at Big Canyon. The dual purpose amphitheater provides students with a safe place to eat lunch without having it appear as a picnic area.

facilities (designated "D"). Four portable chemical unisex toilets, including an ADA accessible facility, will be housed in a trellis-covered masonry enclosure which blends well with surrounding habitats. A message board will be included on one side of the masonry enclosure, providing a current listing of programs and events occurring throughout the Upper Newport Bay.

The loop trail will be constructed to meet ADA standards. At the westernmost section of the loop trial is an observation deck for viewing the tidal marsh, freshwater marsh, and riparian wetlands (designated "C").

In addition to the central gathering area, there are specific identified sites with flat pads that will provide overlooks to key natural features of the restored canyon, as well as excellent birdwatching and rest locations (marked as "E"). These sites include the following:

- *Riparian Boardwalk* – The existing boardwalk trail crossing the north riparian channel will provide visitors with the experience of riparian woodlands and birdwatching opportunities.
- *Back Bay Drive* – Located near the junctions of the existing roads and new Back Bay Drive. These overlooks will provide visitors with a close look at the tidal wetlands of Upper Newport Bay and Big Canyon and serve as rest stop for hikers and bikers.
- *Creek Crossing Overlook* – Located at the downstream end of the new freshwater pond, this overlook will provide views upstream of the new freshwater pond, and downstream of riparian areas and freshwater marsh.
- *Pond Overlook* – This overlook near the upper end of the freshwater pond will provide birdwatchers opportunities to watch winged visitors to the pond and adjacent riparian wetlands.

Other interpretive nodes throughout the canyon will be incorporated into the new trail system, and will present colorful and user-friendly information on the diverse habitats and native plants and wildlife of Big Canyon, restoration of tidal wetlands and other native habitats, water quality improvements in Big Canyon Creek, use of natural filtration systems to clean up contaminated urban runoff, removal of invasive non-native plants and other important information about Upper Newport Bay.

Proposed Interpretive Media

The interpretive media proposed in this plan are designed to help the visitor understand and value this special land and waterscape. Because of its connection to the Newport Bay, its role within a watershed, and the ecological restoration taking place here, Big Canyon has an opportunity to enhance the visitor's awareness and understanding of the functionality of riparian and wetland ecosystems, the dependence of wildlife on these ecosystems, the structure and function of the Big Canyon Creek watershed, the integrity of the land and waterways, and water quality problems and management. Access to engaging and relevant interpretive media, new trail amenities, and enhanced wildlife viewing opportunities will help visitors explore Big Canyon with minimal disturbance to the resources.

Interpretive panels are signs that move beyond facts to tell a story that connects the audience and the resource. Text development for interpretive panels usually follows a hierarchy. It begins with a title that captures the essence of the panel's message, a subtitle that elaborates on the title, and a main body of text with a word count of less than 100 words. Callouts are also useful elements in an interpretive panel, providing insight into an interesting concept or detailed explanation of an illustration or photograph. A design template will be developed as part of the design phase of the restoration project.

The following are proposed topics for panel content:

Natural History –

- Rarity of coastal sage scrub and the life forms it supports
- Bird life in Big Canyon's uplands
- Ebb and flow in tidal wetlands
- Bird life in tidal wetlands
- Big Canyon's role in the Pacific Flyway
- Life (including invertebrate life forms) in the mud
- Big Canyon in the context of the Bay
- Life (including invertebrate life forms) in a freshwater pond

Human History –

- Human history of the area: use by Tongva
- Human history of the area: recent history in the 20th century
- Watershed woes (upstream and downstream connections)
- The restoration of Big Canyon
- Ecosystem services of Big Canyon and Upper Newport Bay

Flip books are "larger than life" field guides that are created with the use of digital imagery that is screened onto multiple sheets of phenolic resin. The three-ring format allows the reader to turn the "pages" in search of information, creating a larger-than-life, extremely useful field guide that is capable of withstanding the elements as well as handling by visitors.

Three different flip books are recommended for Big Canyon, as listed below:

- Dominant coastal sage scrub plants and animals
- Dominant tidal wetland plants and animals
- Dominant freshwater pond plants and animals

Additional proposed interpretive media include the following:

- Regulatory Signs – signs with clearly stated rules and regulations, with explanations presented in an interpretive tone.
- Orientation Panel – welcome panel with overview statement and a map of Big Canyon Creek within the context of the Newport Bay and the other education-focused institutions.
- Orientation Brochure – multi-facility brochure that highlights education and interpretive (wildlife watching) opportunities at the Newport Bay, including Big Canyon, Back Bay Science Center, the Muth Center, and the Aquatic Center.
- Observation Deck with Scope – higher elevation architectural feature that serves as an interpretive node, or wildlife watching deck, positioned as a pullout along the trail. Here, a permanently mounted viewscope and flipbook field guide enhance wildlife watching experiences.

## 3.0 SUMMARY OF PHASE II TECHNICAL STUDIES

To support feasibility analysis and refinement of the Phase I concept plan, various technical studies were performed. These studies are multidisciplinary in nature, but are organized as biology; hydrology; hydraulics and geomorphology; water quality; soils; and recreation/educational public use in the following subsections.

### 3.1 Biology

Biological studies were conducted during Phase II to update and provide more detail on current baseline site conditions and to initiate the permit application process. Phase II studies included an assessment of affected biological resources including special status plant and wildlife species and a jurisdictional delineation of wetlands and other sensitive habitats in the project vicinity. Areas of invasive exotic species were mapped for removal and restoration as part of the Phase II studies. Many of the native areas mapped in the Detailed Vegetation Map from Phase I (see Figure 2.1-2, Existing Vegetation) have significant exotic species within the understory of each habitat and/or have high numbers of invasive exotic species.

Detailed biological surveys for special status plants and animals were conducted during Phase I (CCI 2004) and were not repeated as they followed state and federal protocols and provided sufficient information on location for California Environmental Quality Act (CEQA) review and permit applications.

#### 3.1.1 Wetland and "Waters of the US" Delineation for Existing Conditions

Federal and state jurisdictional determinations were undertaken in order to streamline the analysis of environmental effects, permit processing, and restoration project planning. Maps were produced to depict existing wetland and water boundaries defined under local, state, and federal wetland policies. Wetlands were classified by habitat type to determine the type and extent of specific habitats that may be affected by the proposed project for site planning, permit processing, and mitigation planning purposes.

**USACE/RWQCB Wetland Delineation**

A delineation of jurisdictional wetland and "waters of the United States" was conducted during October 2006 to determine the extent of "Waters of the U.S." and "Waters of the State" within Big Canyon. Fill in "Waters of the U.S." under USACE jurisdiction is regulated by Section 404 of the CWA and under Section 10 of the Rivers and Harbors Act; fills placed in "Waters of the State" are regulated by the RWQCB under Section 401 of the CWA and the State Porter-Cologne Act.

The delineation was completed in conformance with the routine methods described in the 1987 USACE Manual (Corps Manual 1987). The USACE has published guidance on the indicators that are used to determine the presence of wetlands, including wetland plants, hydrology, and hydric soils. Wetland biologists reviewed United States Geological Survey (USGS) maps, United States Fish and Wildlife Service (USFWS) Wetland Inventory Maps, and Natural Resources Conservation Service (NRCS) soil maps prior to conducting a site inspection. An on-site inspection was then conducted to evaluate the presence of the indicators used by USACE to determine wetland presence. Detailed soil, plant, and hydrologic data were collected at discrete locations to evaluate the presence of wetland areas. Paired sample points (one wetland and one upland) were collected at selected locations sufficient to document the extent of the wetlands on-site. Soil inspections consisted of digging shallow (16-inch) pits at a number of locations at the site to inspect for hydric soil characteristics. Vegetation and hydrology indicators were observed on the soil surface.

For non-wetland tidal "waters" (*i.e.,* Newport Bay), the extent of jurisdiction was determined by the High Tide Line (HTL). The Los Angeles District interprets the HTL as the upper extent of tidal marsh vegetation. For non-wetland areas (*i.e.,* streams, lakes and channels), the location of the ordinary high water mark (OHWM) was determined and identified on a map. All data was entered on standard USACE data forms. Stream width was defined by the OHWM, characterized as well-defined bed-and-bank topography and scouring and shelving along banks; stream width and area calculations were based on an average of dimensions for these features. Project team members mapped the boundaries of the wetlands and "waters" using global positioning system (GPS) equipment with 1-meter resolution and plotted their boundaries and sample point locations on an aerial photograph and topographic base map. A final report has been prepared and was submitted to the USACE with a wetland delineation map and field datasheets for verification of their jurisdiction on February 22, 2007.

Based on the studies conducted by the project team, the Project Area contains approximately 13.81 acres of potential Section 404 jurisdictional wetlands and 5.78 acres of "other waters". As proposed, the project has potential to affect federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means. The project proposes to dredge or fill potentially jurisdictional wetlands and waters as shown in Figure 3.1-1. Specifically, the project would fill 0.91 acres of wetlands and 0.13 acre of waters as a result of the Back Bay Road realignment, potential impacts to stream channels as a result of non-native plant removal, and grading in stream, pond and marsh areas for their conversion to salt marsh or pond habitat. However, a net gain of 2.98 acres of potentially jurisdictional wetlands is expected to occur as a result of the project. In addition, the functions and values associated with these restored wetlands should be improved. A summary of impacts to Section 404/401 wetlands and waters is provided in Table 3.1-1.

### Coastal Commission Habitat Delineation

The project team conducted a second delineation study to determine those areas that meet the California Coastal Commission (CCC) wetland definition or support other Environmentally Sensitive Habitat Area (ESHA).

### Wetlands

In contrast to the USACE definition of wetlands, which requires that all three parameters be found, the Coastal Act requires only one wetland parameter to be present and relies on the presence of hydrophytic vegetation or hydric soils as the primary indicators. Therefore, additional field data were collected and additional boundary determinations were made for the CCC jurisdictional wetland areas. Wetland data were collected on CCC data sheets to describe any areas that have potential to be considered wetlands under the Coastal Act. The project team mapped the boundaries of these wetlands using GPS with sub-meter resolution and plotted them on a base map consisting of an aerial photograph and topographic layer. A final report is in preparation and will be submitted to the CCC for their review and verification.

Based on the preliminary mapping, the extent of Coastal Commission wetlands on the site is approximately 25.33 acres. As proposed, the project has potential to affect Coastal Commission wetlands through direct removal, filling, hydrological interruption, or other means. The project proposes to dredge or fill potentially CCC wetlands and waters as shown in Figure 3.1-2. Specifically, the project would permanently fill 1.27 acres of wetlands (including non-vegetated wetlands) as a result of the Back Bay Drive realignment, potential impacts to stream channels, as a

**TABLE 3.1-1**
**SUMMARY OF PROJECT-RELATED IMPACTS AND BENEFITS TO FEATURES POTENTIALLY UNDER CORPS JURISDICTION**

| Jurisdictional Feature | # Acres: Existing | # Acres: Potentially Impacted | | # Acres to be Created | Net Gain or Loss |
|---|---|---|---|---|---|
| | | Temporary | Permanent | | |
| Freshwater Marsh | 7.39 | 2.32 | 0.84 | 0.74 | -2.36 |
| Coastal Salt Marsh | 5.93 | 1.26 | 0 | 7.88 | +6.62 |
| Seasonal Alkali Wetland | 0.54 | 0.23 | 0.07 | 0 | -0.3 |
| Waters | 5.78 | 2.33 | 0.13 | 1.48 | -0.98 |
| **Totals** | **19.59** | **6.08** | **1.04** | **10.1** | **+2.98** |

result of non-native plant removal, and grading in stream, pond and marsh areas for their conversion to salt marsh or pond habitat. These activities would result in an overall reduction of 0.29 acres of seasonal alkali wetland, 2.4 acres of freshwater marsh wetlands, and 0.98 acres of open water areas. However, the project would result in an overall net gain of 6.62 acres of coastal salt marsh habitat, and an overall 2.08 acres of wetland features under CCC jurisdiction. A summary table of project impacts and benefits to CCC jurisdictional areas is provided in Table 3.1-2.

### 3.1.2 Riparian Habitat Delineation

Project staff also determined the location and extent of riparian habitat that is subject to DFG and CCC jurisdiction. A review of aerial and site photographs, and on-site inspection of drainages and aquatic features, was conducted to determine if the banks of drainages, streams, and other aquatic features within Big Canyon supported hydrophytic or stream-dependent woody plant species (riparian species). A map was produced showing the approximate extent of these habitats (Figure 2.1-2).

Construction of the relocated Back Bay Drive, vegetation clearing and excavation activities to create the open water pond above the new road, and construction of a diversion berm and new infiltration system at the east end of the canyon will likely result in the removal of riparian trees. It is anticipated that approximately 0.87 acre of riparian habitat will be affected by the project, primarily through creation of the freshwater pond and sediment retention basin.

However, riparian habitat throughout Big Canyon will be enhanced through removal of non-native invasive species such as Brazilian pepper tree and lollipop tree. Approximately 1.29 acres of riparian willow woodland will be restored adjacent to the new fresh water marsh and pond where ornamental pepper trees now exclude native species. Mapping of invasive exotic species within native habitats resulted in four general zones for exotic removal with two general densities of invasive species, including large-to-small trees/shrubs at high density and medium-to-small trees/shrubs at medium-to-low density (see Figure 3.1-3, Invasive Exotic Removal Zones). Based on mapping of exotic species densities, approximately 4.32 acres of riparian and 0.25 acre alkali meadow habitats have dense infestations of exotic species that will be removed and the native habitats planted. Additionally, 4.43 acres of riparian woodland, scrub and mulefat and 0.16 acres alkali meadow habitats with less dense infestations will have spot removal of exotic species with some replanting. Table 3.1-3 shows the acreage of riparian and upland habitats that will be restored and enhanced with project implementation.

### 3.1.3 Coastal Sage Scrub Delineation for Existing Conditions

Coastal sage scrub (CSS) habitat has been identified throughout Big Canyon. The Phase I study identified 14.7 acres of CSS within the Project Area (Figure 2.1-1). Big Canyon supports several subtypes of coastal sage scrub, including:

- Southern coastal bluff scrub
- Southern coastal bluff scrub/chenopod scrub
- Sagebrush scrub
- Sagebrush scrub/chenopod scrub
- Coyote brush scrub
- California bush sunflower scrub
- California bush sunflower scrub/chenopod scrub
- Salt-bush or chenopod scrub
- Chenopod scrub/alkali meadow
- Sagebrush sage scrub/grassland ecotone

**TABLE 3.1-2**

**SUMMARY OF PROJECT-RELATED IMPACTS AND BENEFITS TO FEATURES POTENTIALLY UNDER CCC JURISDICTION**

| Jurisdictional Feature | # Acres: Existing | # Acres: Potentially Impacted | | # Acres to be Created | Net Gain or Loss |
|---|---|---|---|---|---|
| | | Temporary | Permanent | | |
| Freshwater Marsh | 7.39 | 2.32 | 0.82 | 0.74 | -2.4 |
| Riparian | 11.2 | 0.54 | 0.33 | 1.29 | +0.42 |
| Coastal Salt Marsh | 5.93 | 1.26 | 0 | 7.88 | +6.62 |
| Seasonal Alkali Wetland | 0.91 | 0.17 | 0.12 | 0 | -0.29 |
| Open Waters | 5.78 | 2.33 | 0.13 | 1.48 | -0.98 |
| **Totals** | **33.21** | **6.62** | **1.4** | **10.1** | **+2.08** |

## TABLE 3.1-3

## RIPARIAN, ALKALI MEADOW, AND COASTAL SAGE SCRUB HABITAT RESTORATION

**Restoration Action – Replant Areas Dominated by Exotic Species and Areas of Project Grading**

| Existing Habitat | Acres | Restored Habitat* | Acres |
|---|---|---|---|
| Ornamental (Pepper Tree Woodland) | 1.29 | Willow Riparian Woodland | 1.29 |
| Annual grassland | 0.08 | Mulefat Scrub | 0.08 |
| Annual grassland | 0.67 | Alkali Forb/Meadow | 1.43 |
| Alkali forb/exotic forbs | 0.76 | | |
| Ornamental (Pepper tree) | 0.24 | Coastal Sage Scrub | 2.43 |
| Alkali forb/exotic forbs | 0.64 | | |
| Annual grass/exotic forbs | 0.78 | | |
| Annual grass/ Ornamental | 0.78 | | |
| Various Habitats (marsh, pond and paved) | 0.87 | Upland Buffer/ Coastal Sage Scrub | 0.87 |

*See Planting/Habitat Plan for location of each habitat type.

**Enhancement Action –**
**Invasive Exotic Species Removal and Planting with Native Species**

| Existing Habitat | Removal Zones* | Acres |
|---|---|---|
| Riparian Scrub | C1, C2, C6 | 4.32 |
| Alkali Forb/Meadow | C5 | 0.25 |
| Coastal Sage Scrub | C6 | 0.99 |

**Enhancement Action –**
**Spot Removal of Invasive Exotic Species and Seeding with Native Species**

| Existing Habitat | Removal Zones* | Acres |
|---|---|---|
| Willow Riparian Woodland | D2 | 0.67 |
| Willow Riparian Scrub | D1, D3 | 3.19 |
| Mulefat Scrub | D1, D2, D3 | 0.37 |
| Alkali Forb/Meadow | D1, D4 | 0.16 |
| Coastal Sage Scrub | A, D1 | 1.32 |

*See Invasive Exotic Removal Plan

- Chenopod scrub/alkali meadow
- Sagebrush sage scrub/grassland ecotone
- Mixed sage scrub/grassland ecotone
- Mixed sage scrub/grassland ecotone/alkali meadow

Each of these subtypes is described in detail in the Phase I report (CCI 2004). Generally, these scrub types are dominated by California bush sunflower (Encelia californica), California buckwheat (Eriogonum fasciculatum), California sagebrush (Artemisia californica), bladderpod (Isomeris arborea), and coastal prickly pear (*Opuntia littoralis*). Other shrubs include four-wing saltbush (*Atriplex canescens*), quail bush (*Atriplex lentiformis*), Mexican elderberry (*Sambucus mexicana*), coyote brush (*Baccharis pilularis*), Emory's baccharis (*Baccharis emoryi*), coastal isocoma (*Isocoma menziesii*), and an exotic saltbush shrub (*Atriplex sp.*). Typical understory species include black mustard (*Brassica nigra*), red brome (*Bromus madritensis* ssp. *rubens*), summer mustard (*Hirschfeldia incana*), Russian thistle *(Salsola tragus*), soft chess (*Bromus hordeaceus*), tocalote (*Centaurea melitensis*), and yellow sweet clover (*Melilotus indica*).

Approximately, 1.78 acres of fragments of coastal sage scrub will be permanently removed by the project. Restoration of approximately 3.3 acres of coastal sage scrub habitat and enhancement of 2.31 acres of coastal sage scrub habitat will occur with implementation of the project.

### 3.1.4 Endangered and Sensitive Species Issues

Detailed biological studies were conducted at Big Canyon between May and July of 2003 for the Phase I plan. These surveys determined presence of special status vegetation communities, plants, invertebrates, birds and mammals in aquatic, wetland and terrestrial habitats. The following sections summarize federal- and state-listed plant and animal species known to occur within Big Canyon and those that have been observed within the proposed project vicinity.

#### Terrestrial Species

Focused surveys for three special-status bird species, the least Bell's vireo (*Vireo belli pusillus*), and California gnatcatcher were conducted in the Big Canyon Study Area in 2003. No least Bell's vireos were observed, and potential habitat in Big Canyon in its current condition is unlikely to support the species. One pair of federally listed threatened Coastal California gnatcatcher (*Polioptila californica californica*) was observed in the saltbush scrub in the Big Canyon Project Area during biological surveys in 2003. This species forages and nests in coastal sage scrub in the Project Area vicinity.

No federal- or state-listed plant, insect, herpetological or mammalian species were observed during the 2003 surveys nor are expected to occur within the project vicinity.

#### Wetland Species

Several federally listed plant and avian species associated with wetland and salt marsh habitat were observed or have a high potential to occur in or near Big Canyon. Several patches of federal-listed endangered salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*) have been observed in salt marsh habitat at the mouth of Big Canyon. Two listed birds were observed in the salt marsh at the mouth of Big Canyon including several pairs of Light-footed Clapper Rail (*Rallus longirostris levipes*; FE,SE) in cordgrass dominated habitats and Beldings Savannah Sparrow (*Passerculus sandwichensis beldingi*; ST) in pickleweed habitat.

The California brown pelican (*Pelicanus occidentalis,* FE, SE) was observed foraging in channels west of the salt marsh in Upper Newport Bay. No California brown pelicans were observed within the Project Area. The California least tern (*Sterna antilarum*

*browni*) is federal listed threatened, prefers sandy beaches and salt flats for nesting and forages in ocean, freshwater and estuarine areas. No potential nesting habitat exists in the Project Area, although individuals were observed foraging in tidal water areas near Big Canyon.

**Aquatic Species**

Mudflats and shallow tidal channels near Big Canyon support an estuarine invertebrate fauna not unlike those occurring throughout the rest of Upper Newport Bay (Coastal Resources Management 2003, MBC and SCCWRP 1981; Daugherty 1978; Seapy 1981). These organisms exist in a seasonally euryhaline and eurythermal environment. Currently, Big Canyon Pond is species poor and dominated by relatively low numbers of freshwater insects. However, all of these organisms are integral in the local food web by consuming detritus and releasing nutrients back into the ecosystem. In turn, the benthic invertebrate population is a critical food source for shorebirds and bottom-foraging fishes.

Several species of bottom-dwelling and water column fishes are present near the mouth of Big Canyon (Coastal Resources Management 2003) and all are known from other regions of Upper Newport Bay. The most abundant fishes in the nearby channels and shallow water habitats are topsmelt and yellow fin gobies.

No state- or federal-listed species of invertebrates currently are known from Upper Newport Bay. However, one Federal Species of Concern (FSC) is present – the California brackish water snail (*Tryonia imitator*). This snail inhabits permanently submerged areas within coastal lagoons, estuaries, and salt marshes. Its known range is from Sonoma County to San Diego County. In Upper Newport Bay, its primary habitat is coarse sediments in low salinity (brackish) areas at the mouth of the Santa Ana-Delhi channel and the San Diego Creek. It is also recorded from the main channel near Shellmaker Island, but in significantly lower densities and mostly during winter and spring when storm water run-off reduces the salinity in the main channel (USACE, 2000; MBC and SCCWRP 1980). No *Tryonia*, either live specimens, or shells of dead *Tryonia* were found in the focused sampling around the mouth of Big Canyon, a low-salinity and coarse sediment habitat during the summer 2003 CRM investigation (CRM 2003).

No state- or federal-listed species of fish are found in Upper Newport Bay. However, the California halibut (*Paralichthys californicus*), a species of local and regional sports fish and commercial importance, regularly uses the Upper Bay as a nursery area (Allen 1988, Horn and Allen 1981, USACE 2000). California halibut spawn at sea and the larval stages are planktonic. After several months, the larval fish settle to the bottom, and migrate into shallow coastal waters, including Newport Bay. Halibut are distributed throughout the waters of Lower and Upper Newport Bay, primarily as juveniles, although larger individuals are caught near the ocean entrance and offshore. Young-of-the-Year (YOTY) prefer shallow waters between about –0.45 meters (1.5 ft) and –1.0 meter (3.5 ft) Mean Lower-Low Water (MLLW), whereas juveniles prefer deeper channel bottoms to a maximum depth of approximately 4.5 meters (15 ft) MLLW. After spending nearly nine months in Newport Bay, juveniles will move out into the open coastal environment. This species is known from the main channel of Upper Newport Bay, in waters near the Big Canyon area.

Restoration of five acres of historical coastal salt marsh at the mouth of Big Canyon will substantially increase benthic biological productivity as a consequence of the introduction of tidal creeks, mudflats, salt marsh habitat and the transitional brackish water ecotone connecting the tidal habitats and the freshwater marsh and restored ponds. Invertebrate species likely to colonize the area will be similar in species composition to that which occurs along the

existing mudflats and tidal channels in the vicinity of Big Canyon. These species are likely to include opportunistic species such as the polychaetes *Polydora nuchalis*, *Streblospio benedicti* and *Polydora cornuta*, oligochaetes, and amphipods *(Grandidierella japonica* and *Monocorophium acherusicum*. Larger tidal marsh and mudflat marsh invertebrates will include California horn snails (*Cerithidea californica*), yellow shore crabs (*Hemigrapsus oregonensis*), and fiddler crabs (*Uca crenulata*).

## 3.2 Geomorphology and Hydrology

This section provides a summary analysis of the geomorphology, hydraulics and erosion/sedimentation characteristics of the project area under existing and proposed conditions. More detailed analysis of both hydraulics and erosion/sedimentation is provided in Appendix B. More detailed water supply information is provided in Appendix C (Geotechnical Feasibility Report) and Appendix D (Water Supply Measurements).

### 3.2.1 Geomorphology

Big Canyon Creek drains a highly urbanized watershed of approximately 1,300 acres (two square miles) directly into Upper Newport Bay. The headwaters are located near the San Joaquin Reservoir east of MacArthur Boulevard.

The Big Canyon watershed can be divided into three segments, as follows:

- Headwaters to MacArthur Boulevard.
- MacArthur Boulevard to Jamboree Road
- Jamboree Road to Upper Newport Bay (the project reach)

Upstream of MacArthur Boulevard, the channel is unlined, very short and is controlled by the culverts present under MacArthur Boulevard.

From MacArthur Boulevard to Jamboree Road, Big Canyon Creek flows through the Big Canyon Golf Course with a relatively mild slope of 0.5%. The golf course includes several lakes, grade control structures, and grassy ditches/fairways. The presence of the golf course – and other anthropogenic features – has significantly altered the natural canyon from historical times and controlled the channel characteristics of these segments.

Except for a short unlined channel segment between the most downstream grade control and Jamboree Road culvert, the entire upstream reach is controlled horizontally and vertically. Based on field observation, some local bank erosion materials may be present at this segment. However, it is not expected that significant river bed materials are transported to the lower canyon even under major storm conditions. Most sediment flows are expected to be dominantly silt and clay, a condition which has been verified by soil/sediment sampling and analysis results.

Although the inflows may be relatively clear (in terms of bed materials transport), it is unlikely that the upstream reach could be affected by the erosion in the lower reach. This is due to the elevation control offered by Jamboree Road, including the culverts under the road surface. As a result of upstream control, the geomorphology of the lower canyon has been effectively isolated from the upstream reaches. In fact, the culvert under Jamboree Road receives more than 90% of the upstream flow volume which supplies a water source to the lower canyon. Unless the urban features change dramatically in the future, this inflow condition will remain as estimated in the current study.

Since most development in the Big Canyon watershed was completed prior to 1965 (based on 1964 historical aerial photography), it is expected that the upstream control impact has been reflected in the existing channel geomorphology and that the lower canyon has stabilized during

the past decades. The lower canyon geomorphology, however, has been subject to dramatic changes due to significant dredge and fill activities, as described below.

### Historical Dredge and Fill Analysis

The Newport Bay once contained 13,500 acres of estuary and marsh. The lower bay was dredged during the 1940s to create Newport Harbor. The Upper Bay was diked off as salt evaporation ponds, but the ponds were destroyed in 1969 by a flood. Large volumes of sediment (primarily from San Diego Creek) were deposited in the bay as a result of the 1969 flood. Salt marsh areas filled in with sediments during successive storm seasons and tidal action was diminished. By Resolution 69 - 1389 dated December 16, 1969, the Orange County Harbors District was permitted to contract for the removal of 250,000 cubic yards of silt from Upper Newport Bay. Approximately 110,000 cubic yards of the dredged materials were stockpiled at the Big Canyon site to dry, so that it might be used for future landfill.

The 1969 dredge fill was not the first material to be stockpiled at this location. Previous use of the canyon for stockpiling is documented in a 1969 study by Moore and Taber. During the 1950s and 1960s, dredge material that originated from Upper Newport Bay dredging operations was placed in Big Canyon. The earlier stockpiled material was placed over the tidal marsh which at one time occupied the canyon. This earlier fill appears to have been partially removed prior to the placement of the 1969 fill material on the site.

The stockpile of 1969 dredge fill was placed at the mouth of Big Canyon, beyond the tidal influence of Upper Newport Bay. The perennial Big Canyon Creek flowed past the stockpile to the north. The fill stockpile raised the elevation of the canyon, thereby rechanneling the creek to the position to the north. The area of dredge fill extends to the reach where existing Brazilian pepper trees are dominant (as discussed in Section 3.1).

The history of dredge fill placement at the mouth of Big Canyon can be depicted graphically using historical topographic maps. The topography around 1945 is provided as Figure 3.2-1; topography prior to placement of the 1969 dredge fill is shown in Figure 3.2-2; and the topography in 1974, which includes the 1969 stockpile, is depicted in Figure 3.2-3.

The post-1969 topography was altered by a combination of dredge fill removal and recontouring in the 1980s as a restoration condition for an Orange County Sanitation District trunk line sewer project. The 7-acre freshwater marsh at the foot of Big Canyon is a constructed wetland that was part of a mitigation/restoration program completed in 1982 as part of the original Back Bay trunk sewer project.

The construction of the freshwater marsh within the stockpile area resulted in the existing south channel being elevated relative to the north (riparian) channel. The elevation range of the south channel is approximately elevation 12-13, as compared to that of the north channel of approximately elevation 2-13. As shown in the existing conditions topographic map, the existing trail dike and berm along the north and south boundaries of the freshwater marsh are similar to the stockpile boundary shown in Figure 3.2-3. The northern dike and southern berm are both actively affecting the hydraulic and erosion/sedimentation features of the existing Big Canyon Creek.

### Current Lower Canyon Conditions

As discussed in the preceding section, the geomorphology of the Big Canyon project area has been significantly influenced by historical placement of dredge fill and subsequent restoration efforts. The upper project reach has a dominant main channel meandering around the narrow canyon and the historical fill formed a narrow outlet (approximately 25 feet wide) at the service road. The lower project reach is comprised

of two main channels: (1) to the north is the riparian channel and (2) to the south is the freshwater marsh. The south bank of the lower reach is confined by the maintenance road and the constructed fill slope to the south over the OCSD sewer line.

Except for the areas downstream of the Jamboree Road culvert and the service road, the channel gradient is relatively uniform in the upper study reach at 0.85% (Elevation 41 at Station 2555 to Elevation 20 at Station 63). The Jamboree Road culvert outlet is shown at Elevation 38 feet based on the OCSD Plan. This local area has a negative slope based on field observations (depicted on the low flow invert profile as the water surface of the outlet pond). The negative slope has resulted in water ponding. This stagnant water is likely to have created algae bloom conditions that impact water quality.

The channel near the service road provides a transition from the upper reach to the lower reach at a significantly steeper slope of 2.4% (the channel drops from Elevation 25 at Station 556 to approximately Elevation 13 feet immediately downstream of the service road at Station 63). The stability of this transition area must be maintained in order to avoid the gross instability issue of the upper reach. Based on the understanding of historical fill and field observation of existing control, the channel may be vulnerable to major headcut erosion once the service road fails to control the elevation.

The riparian channel (north branch) invert quickly drops to Elevation 2 at the Back Bay Drive culvert (from Elevation 10) within a short reach of approximately 300 feet (approximately 2.7% slope).

The historical dredge and fill, as well as other anthropogenic activities, has significantly affected the existing channel geomorphology, hydraulic and erosion/ sedimentation features. The south branch is a freshwater marsh and will remain as such under the proposed condition. This marsh is self sustaining and has the ability to withstand some degree of geomorphologic and hydraulic changes, given a needed inundation depth control. Conversely, the north branch is subject to erosion and the riparian habitats are vulnerable to changes in hydrology (flow ratios for various flows and soils moisture content) and hydraulic features (velocity, depth, and width).

Care must be taken in the planning and design process to ensure that the split flow condition is not significantly altered and the flood stage and channel stability can be maintained in order to (1) preserve the environmentally sensitive habitats in the north branch and (2) maintain the shallow inundation of the freshwater marsh.

**Water Supply**

Habitat restoration and preservation requires adequate water supply to support the specific plants involved. The following paragraphs describe the nature of water supply in Big Canyon as related to habitat restoration and preservation. The results of field measurements conducted to support the feasibility study are included in Appendices C and D.

Surface Water

The Big Canyon Creek watershed contains golf courses, parks, and large landscaped residential yards. Irrigation runoff from these landscaped areas makes up the base flow in Big Canyon Creek. Because the Big Canyon watershed has been completely developed since the 1990s (including the landscaped areas) it is generally anticipated that the resulting irrigation runoff will continue and be available as dry season water supply for restored habitat.

Dry weather flow monitoring data were collected by project team staff during November 15 through 18, 2006. Both morning (approximately 9:00 AM) and afternoon (approximately 3:00 PM) measurements were obtained. Results are summarized in Table 3.2-1 below. Note

that, in general, dry weather flows are less than 1 cfs.

**TABLE 3.2-1**
**DRY WEATHER FLOW DATA**
**(cfs)**

| Date/Time | Station 2 | Station 3 | Station 4 |
|---|---|---|---|
| 11/15/06 | 0.57 | - | 0.48 |
| 11/16/06 AM | 0.315 | 0.477 | 0.169 |
| 11/16/06 PM | 0.494 | 0.499 | 0.272 |
| 11/17/06 AM | 0.927 | 0.790 | 0.249 |
| 11/17/06 PM | 0.370 | 0.473 | 0.281 |
| 11/18/06 AM | 0.374 | 0.691 | 0.257 |

Wet weather flow monitoring data will be required to support the design phase and is currently planned.

Groundwater

Based on the Geotechnical Feasibility Report (Appendix C), groundwater is within 2 to 10 feet of existing grade throughout the site. It varies somewhat along Back Bay Drive probably due to tidal changes, and may be slightly deeper than 10 feet due to higher surface elevations in remaining areas of historical fill.

The slowed flow of water through the upper portion of the canyon under project conditions is expected to increase the amount of available ground water, as infiltration into the soil will be increased. This increased soil moisture will be crucial to the establishment of native plant communities adjacent to and above the riparian habitat in this area of the canyon.

Due to the presence of shallow groundwater, dewatering may be necessary during the planned road re-alignment, particularly where it crosses the wetlands.

It should be noted that no aspect of groundwater contamination investigation and/or remediation associated with known urban sites located upgradient of the project site was part of the scope of this feasibility study. A soils contamination test for the current study did not find associated contaminants (see Section 3.5.4); therefore, contamination was not assumed for disposal consideration.

Tidal Flow

The reintroduction of tidal flow to areas within the Canyon that historically were subjected to tidal influence will result from the realignment of Back Bay Drive. Tidal inundation and fluctuation of tidal range are critical to the restoration of salt marsh.

The existing tidal inundation area and the topographic features at the outlet of Big Canyon Creek are not typical of the morphological pattern of a small coastal stream. Research of historic aerial photographs and maps revealed that, historically, the full range of the tidal zone extended as far as 500 feet north of Back Bay Drive. Since then, Big Canyon's tidal flow was blocked with construction of the roadway embankment for Back Bay Drive, and additional fill was added on the canyon side of the road. The result is an abrupt change in elevation from the Bay to the roadway, completely blocking tidal flow.

Tidal fluctuation and elevation ranges are also critical to tidal habitat restoration. In support of Phase I of the project, a study by USACE and Coastal Frontiers, Inc., in 1992 was reviewed pertaining to the project site. This study shows that there is negligible change in tidal attenuation between the harbor mouth and Upper Newport Bay. Based on this study, there is sufficient tidal inundation and fluctuation in Upper Newport Bay to permit restoration of the historic tidal flow and re-establishment of tidal wetland habitats in Big Canyon, if existing barriers to tidal flow in Big Canyon are removed and current sedimentation control efforts in the Bay continue.

Stormwater

Urban runoff resulting from rainfall events constitutes seasonal water supply for surface water as well as subsurface flow and groundwater. Big Canyon drains a watershed of two square miles. Most flows enter the project reach via the 72-inch diameter culvert under Jamboree Road. The remaining flows discharge to the project reach through lateral drains as shown in Figure 2.2-2. The stormwater flow rates were obtained from the Phase I study and are summarized in Table 3.2-2. The flow rates at the creek outlet (combined creek flows crossing Back Bay Drive) were applied to the entire study reach for conservative estimates of hydraulic and erosion parameters.

**TABLE 3.2-2**
**STORMWATER FLOW DATA**

| Return Period (year) | Jamboree Road Culvert | Back Bay Drive |
|---|---|---|
| 2 | 1,260 | 1,390 |
| 10 | 1,680 | 1,860 |
| 100 | 2,510 | 2,770 |

Note: Values for other return periods (*e.g.*, 25-year flood) were interpolated or extrapolated based on these data.

### 3.2.2 Hydraulic Analysis

The hydraulic characteristics of the project reach of Big Canyon were evaluated using the HEC-RAS computational model developed by the Hydrologic Engineering Center of the USACE. This model was developed to support three key elements of the Big Canyon feasibility study:

- Investigate the split flow conditions for the north (riparian) channel and south (freshwater marsh) channel. Split flow occurs near the boardwalk bridge downstream of the service road crossing.
- Support sediment transport calculations for water quality improvement and other analyses.
- Evaluation of project impacts.

The HEC-RAS model was applied to simulate Big Canyon Creek flood events for high flows from 2-years to 100-years, as well as for low flows (1,000 cfs and lower). The high flow analysis was performed to assess potential flood hazard and channel stability problems. The low flow analysis provides critical data for evaluation of the water supply available in the riparian channel (north branch). Model sections for high and low flows are shown in Figure 3.2-4, Hydraulic Flow Model. More detailed model output data are provided in Appendix B.

**Split Flow Analysis**

Downstream of the service road crossing, the channel is relatively flat (near elevation of 13 feet) and features a spilt flow among the north and south branches.

As previously stated, the riparian channel (north branch) invert quickly drops to Elevation 2 at the Back Bay Drive culvert (from Elevation 10) within a short reach of approximately 300 feet (approximately 2.7% slope).

Conversely, the south branch remains relatively flat (at 0.1% slope) from Elevation 13 below the service road to Elevation 12.1 at the existing weir structure within the 900 foot length of the marsh. The weir structure serves as another discontinuity and provides a drop from Elevation 12.1 feet to Elevation 7.8 at Back Bay Drive (or near Elevation 6 at the culvert invert). Below the road, the channel drops to the tidal marsh elevation.

As stated above, the existing trail dike divides Big Canyon Creek into two distinct feature branches and creates complicated split flow conditions for various flow ranges as summarized in Table 3.2-3 based on the HEC-RAS model results (see Appendix B).

| TABLE 3.2-3<br>SPLIT FLOW ANALYSIS | | |
|---|---|---|
| **Reach** | **Flow Range 0 - 1,000 cfs** | **Flow Range 1,000 cfs – 100-year flood** |
| Service Road downstream to Boardwalk Bridge | No Split Flow | No Split Flow |
| 100' reach below Boardwalk Bridge | Split Flow | No Split Flow |
| Downstream to Back Bay Drive | Split Flow | Split Flow |
| At Back Bay Drive | Split Flow | Split Flow |
| At Tidal Marsh | Split Flow | No Split Flow |

Figure 3.2-5 further illustrates the approximate flow ratios for the north (riparian) channel branch under various flow ranges for the existing and proposed project conditions. Based on the hydraulic analysis, only 10 to 15% of the low flow up to 1,000 cfs will enter the north branch. The remaining portion of flow will remain in the south branch. This applies to both existing and proposed project conditions.

The existing trail road (Elevation 15) serves as a divide until the flood stage exceeds this elevation (when the total flow exceeds approximately 1,000 cfs). The flow ratio rapidly increases for the north channel downstream of the boardwalk bridge as part of the divided flow entering the south channel will return to the north channel via overtopping the dividing dike. Note that the south channel is wide, shallow, flat in gradient, and high in invert elevations.

The return flow is much more significant under the existing condition as compared to the proposed condition, primarily due to the difference in the dividing dike length. The proposed Back Bay Drive will eliminate a large section of the overtopping flow and reduce significantly the flow ratio in the north channel. For a given high flow, up to 60% of the total upstream flow will occur in the north channel under the existing condition, which is nearly 200% compared to the proposed condition.

### Hydraulic Characteristics

Channel inverts, flow velocity variations and water surface profiles for existing and proposed conditions are shown in Figures 3.2-6 through 3.2-9. Generally speaking, the existing channel is relatively stable within the floodplain, although natural alluvial processes do occur in the forms of flow migration and local erosion and sedimentation. In most cases the flow velocities are within a manageable level of 5 feet per second (fps). This is favorable for riparian growth and will be maintained under the proposed condition. One of the primary areas of concern is the riparian channel west of the mid-canyon service road crossing (on the north branch). Flow velocity can be high during major floods under the existing condition. For the proposed condition, this area will be significantly improved as discussed below.

Figures 3.2-6 through 3.2-9 show that proposed grading changes that affect the water surface profiles and hydraulic parameters are limited to mid- and lower canyon reaches where restoration opportunities were identified. Tidal marsh construction would involve the realignment of Back Bay Drive and the trail dike will be shortened. This would reduce water surface elevation and overtopping flows into the riparian channel during high flows through the existing trail dike. Lower flow velocities within the riparian (north) channel will also benefit from the proposed change in Back Bay Drive alignment.

Construction of the freshwater pond area would involve raising the elevations of the service road and low flow inverts, as well as lowering the channel within the upper and lower ponds. Comparison of water surface elevations and flow velocities of the existing and proposed conditions indicate that the new ponds would not cause major changes to the existing hydraulic characteristics.

**Average Hydraulic Parameters**

The average hydraulic parameters for each sediment transport reach are provided in Appendix B, for both the existing and project conditions. These parameters, as well as soils gradation data, were used to support sediment transport calculations.

### 3.2.3 Erosion/Sedimentation

For the purposes of erosion/sedimentation analysis, the entire study reach was divided into nine reaches. These reaches and representative cross sections were identified (see Figure 3.2-4 and Appendix B) based on hydraulic, soil and channel features for sediment transport and erosion/sedimentation analyses.

The location of each reach is described below in the order from upstream to downstream.

- Reach 9: From the Jamboree Road culvert to the meander bend where the creek turns toward west. This is effectively the supply reach due to artificial control in the golf course reach upstream of Jamboree Road.
- Reach 8: Upper natural meander bend with little anthropogenic influence. The reach is located between two large channel bends and is confined by natural banks.
- Reach 7: Lower natural meander bend with little anthropogenic influence. The reach is located above the proposed freshwater ponds where the low flow channel shifted from the south bank to the north bank.
- Reach 6: This reach is located at the proposed freshwater pond area.
- Reach 5: The existing service road crossing and drop structure below the proposed freshwater pond. This reach is currently controlled by the asphalt paved road and a grouted riprap drop structure below the triple 24 inch culvert.

  Reach 4: Near the boardwalk bridge (north channel) from the proposed open water zone downstream edge to the split flow location (extends to approximately an elevation of 11 feet).
- Reach 3: Lateral storm drain confluence reach.
- Reach 2: From upstream of Back Bay Drive to the tributary confluence. This reach involves a steep channel.
- Reach 1: Back Bay Drive crossing.

The SAM model developed by the USACE was applied in this study for sediment transport and erosion/sedimentation analysis. The model utilizes hydraulic and bed material gradation information to compute the sediment transport capacity for each representative reach shown on the cross section map (Figure 3.2-4).

Unlike detailed sediment routing models that consider the river bank and invert movement during storm events, the degradation and aggradation estimates were calculated using the average hydraulic data from the HEC-RAS model under the assumption of a rigid boundary condition (see Appendix B). This method has been confirmed to be adequate for Big Canyon Creek since the sediment transport capacity in the creek is not sufficient to cause dramatic changes in channel geomorphology (lateral/vertical movement).

The sediment transport yields (volume for each storm) for the nine reaches defined above are summarized in Tables 3.2-4 and 3.2-5 for the existing and proposed conditions, respectively. Because of the uniformity of soils gradation, the sediment transport capacity variation primarily depends on hydraulic parameters, particularly the flow velocity (see Appendix B for representative soil gradation and average reach hydraulic data under the existing condition). Lower velocities indicate lower sediment transport (*e.g.*, Reach 6 compared to the upper reaches).

Comparison of the total event yield (*i.e.*, potential volume of sediment transport) indicates the potential of each reach to experience aggradation or degradation. If the potential sediment yield within a particular reach is less than the sediment inflow volume from the reach immediately upstream, then aggradation is expected. If the potential sediment yield within a particular reach is greater than the sediment inflow volume from the reach immediately upstream, then degradation is expected. If the both are equal the reaches are in equilibrium with respect to each other (the equilibrium condition has the potential to change during flood occurrences).

It should be noted, however, that actual sediment movement can be limited due to erosion control, natural geology features, or creek adjustment resulting from the erosion/sedimentation process.

For example, the high sediment transport capacities estimated for Reach 5 will be limited to zero by the stabilization measures assumed for the service road embankment and drop structure under both existing and proposed conditions. If the service road and drop structure fails to control the grade, the high sediment transport capacity would cause major impacts on the stability of the upstream reaches.

Tables 3.2-6 and 3.2-7 provide the degradation and aggradation depths estimated using SAM for the 2- to 100-year events under existing and proposed conditions, respectively. The probability-weighted annual average sediment transport volume and degradation or aggradation depths for each reach are presented in Table 3.2-8 for future maintenance reference.

As mentioned above, Reach 5 is assumed to be stable and will serve only to pass the inflow sediments regardless of its high sediment transport capacity for both existing and proposed conditions. Reach 6 (proposed freshwater pond) and Reaches 4 and 3 (mild slope area of the north channel from split flow to Elevation 10) have deposition potential. The upper reaches, Reaches 7 and 8, are relatively stable. Sediment outflows from these reaches will be deposited in the aggradational reaches (Reaches 3 to 6), resulting in high degradation potential (annual average of 3 feet) within the steep Reach 2 above the Back Bay Drive crossing.

This pattern is similar under the proposed condition. The freshwater pond is to be located in Reach 6. Since it has high depositional potential under existing conditions, the expected sediment trapping within the proposed pond would not cause substantially higher impact to the downstream freshwater marsh and riparian channel (as compared to the existing condition). Further, the lower flow magnitudes in the steep channel reach (Reach 2) of the north channel (under the proposed condition) will result in significantly less erosion potential than the existing condition (annual average of 2 feet under the existing condition versus 0.4 feet under the proposed condition for an annual average flood). Detailed model output and sediment yield calculations obtained from application of SAM for the 2- to 100-year events are included in Appendix B.

## 3.3 Water Quality

This section provides a discussion of technical studies related to water quality improvement elements of the Big Canyon Restoration Project. Section 3.3.1 provides the results of previous water quality

## TABLE 3.2-4
## SEDIMENT TRANSPORT CAPACITIES – EXISTING CONDITIONS

**Existing Conditions - Event Sediment Amount (tons)**

| Reach | Length | 2yr | | 5yr | | 10yr | | 25yr | | 50yr | | 100yr | | Avg Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) |
| R9 | 760 | 4319 | 82.2 | 5359 | 88.8 | 6125 | 98.9 | 7499 | 113.9 | 8780 | 126.3 | 9975 | 134.9 | 3571 |
| R8 | 575 | 3352 | 296.2 | 4141 | 300.3 | 4719 | 302.5 | 5754 | 303.5 | 6715 | 307.7 | 7608 | 308.6 | 2762 |
| R7 | 500 | 3591 | 296.7 | 4394 | 302.1 | 4979 | 304.9 | 6018 | 307.7 | 6975 | 312.4 | 7859 | 313.7 | 2936 |
| R6 | 275 | 14 | 286.0 | 22 | 289.8 | 29 | 294.0 | 44 | 299.4 | 61 | 303.2 | 80 | 305.3 | 15 |
| R5 | 75 | 7529 | 127.4 | 12115 | 152.0 | 16250 | 166.7 | 25121 | 181.9 | 35518 | 188.2 | 47063 | 194.4 | 7973 |
| R4 | 390 | 914 | 71.5 | 1487 | 74.0 | 2120 | 75.2 | 3023 | 77.9 | 4068 | 80.0 | 5239 | 81.6 | 972 |
| R3 | 290 | 1795 | 63.7 | 2445 | 69.0 | 3060 | 73.7 | 3831 | 78.9 | 4626 | 83.5 | 5428 | 87.9 | 1603 |
| R2 | 110 | 3707 | 88.4 | 5006 | 97.0 | 6265 | 295.2 | 7811 | 294.7 | 9396 | 295.5 | 10986 | 296.7 | 3291 |

## TABLE 3.2-5
## SEDIMENT TRANSPORT CAPACITIES – PROPOSED CONDITIONS

**Project Conditions - Event Sediment Amount (tons)**

| Reach | Length | 2yr | | 5yr | | 10yr | | 25yr | | 50yr | | 100yr | | Avg Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) | Width (ft) | Qs (tons) |
| R9 | 760 | 4335 | 123.8 | 5396 | 129.0 | 6181 | 133.5 | 7592 | 154.1 | 8912 | 162.1 | 10145 | 166.4 | 3593 |
| R8 | 575 | 4384 | 288.8 | 5228 | 291.4 | 5830 | 293.3 | 6877 | 294.8 | 7822 | 295.8 | 8680 | 297.0 | 3513 |
| R7 | 500 | 3083 | 295.3 | 3796 | 302.3 | 4317 | 305.3 | 5248 | 309.6 | 6111 | 312.2 | 6910 | 314.7 | 2533 |
| R6 | 275 | 0 | 300.3 | 0 | 310.8 | 0 | 315.7 | 1 | 323.5 | 1 | 333.2 | 3 | 336.1 | 0 |
| R5 | 75 | 5083 | 175.9 | 6143 | 180.0 | 6906 | 182.4 | 8209 | 186.8 | 9422 | 190.5 | 10538 | 193.4 | 4114 |
| R4 | 390 | 443 | 73.6 | 672 | 77.7 | 875 | 80.1 | 1307 | 82.5 | 1810 | 84.2 | 2370 | 86.1 | 444 |
| R3 | 290 | 41 | 127.7 | 70 | 132.3 | 99 | 135.4 | 167 | 143.1 | 256 | 150.8 | 363 | 189.4 | 48 |
| R2 | 110 | 802 | 316.7 | 1045 | 321.4 | 1249 | 325.3 | 1614 | 339.1 | 1989 | 349.6 | 2360 | 351.8 | 695 |

## TABLE 3.2-6
## DEGRADATION/AGGRADATION ANALYSIS – EXISTING CONDITIONS

**Existing Conditions - Event Degradation /Aggradation**

| Reach | Length | 2yr | | 5yr | | 10yr | | 25yr | | 50yr | | 100yr | | Avg Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | Depth (ft) |
| R9 | 760 | | | | | | | | | | | | | |
| R8 | 575 | 967 | 0.1 | 1218 | 0.1 | 1405 | 0.1 | 1745 | 0.2 | 2065 | 0.2 | 2366 | 0.2 | 0.1 |
| R7 | 500 | -239 | 0.0 | -254 | 0.0 | -260 | 0.0 | -264 | 0.0 | -260 | 0.0 | -251 | 0.0 | 0.0 |
| R6 | 275 | 3577 | 0.6 | 4372 | 0.8 | 4950 | 0.8 | 5973 | 1.0 | 6914 | 1.1 | 7780 | 1.2 | 0.5 |
| R5 | 75 | -7514 | N/A | -12093 | N/A | -16220 | N/A | -25077 | N/A | -35457 | N/A | -46983 | N/A | N/A |
| R4 | 390 | -909 | -0.8 | -1478 | -1.2 | -2107 | -1.6 | -3001 | -2.1 | -4036 | -2.8 | -5196 | -3.5 | -0.9 |
| R3 | 290 | -882 | -0.6 | -958 | -0.6 | -940 | -0.4 | -808 | -0.3 | -558 | -0.2 | -188 | -0.1 | -0.4 |
| R2 | 110 | -1912 | -2.7 | -2561 | -3.4 | -3204 | -1.7 | -3981 | -2.1 | -4770 | -2.4 | -5558 | -2.8 | -2.1 |

Notes:

Soil unit weight of 115.75 lbs/cf is used (assuming a porosity of 0.3).
R5 – Grade Control/Drop Structure stability under the existing condition is not warranted.
R6 – Backwater upstream of the service road crossing.
+ denotes aggradation
- denotes degradation

## TABLE 3.2-7
## DEGRADATION/AGGRADATION ANALYSIS – PROPOSED CONDITIONS

**Project Conditions - Event Degradation /Aggradation**

| Reach | Length | 2yr | | 5yr | | 10yr | | 25yr | | 50yr | | 100yr | | Avg Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | dQs (tons) | Depth (ft) | Depth (ft) |
| R9 | 760 | | | | | | | | | | | | | |
| R8 | 575 | -49 | 0.0 | 169 | 0.0 | 351 | 0.0 | 716 | 0.1 | 1090 | 0.1 | 1465 | 0.1 | 0.0 |
| R7 | 500 | 1301 | 0.1 | 1432 | 0.2 | 1512 | 0.2 | 1628 | 0.2 | 1711 | 0.2 | 1770 | 0.2 | 0.1 |
| R6 | 275 | 3083 | 0.5 | 3795 | 0.6 | 4317 | 0.7 | 5248 | 0.8 | 6110 | 0.9 | 6908 | 1.0 | 0.4 |
| R5 | 75 | -5083 | N/A | -6143 | N/A | -6906 | N/A | -8209 | N/A | -9421 | N/A | -10536 | N/A | N/A |
| R4 | 390 | -443 | -0.3 | -672 | -0.4 | -875 | -0.5 | -1307 | -0.8 | -1810 | -1.1 | -2369 | -1.3 | -0.3 |
| R3 | 290 | 402 | 0.1 | 602 | 0.2 | 776 | 0.2 | 1140 | 0.3 | 1554 | 0.4 | 2006 | 0.5 | 0.1 |
| R2 | 110 | -761 | -0.3 | -975 | -0.4 | -1149 | -0.5 | -1447 | -0.6 | -1734 | -0.7 | -1997 | -0.8 | -0.3 |

Notes:

Soil unit weight of 115.75 lbs/cf is used (assuming a porosity of 0.3).
R5 – Grade Control/Drop Structure to be designed to provide stability under flood condition.
R6 – Proposed freshwater pond.
+ denotes aggradation
- denotes degradation

**TABLE 3.2-8**
**EROSION/SEDIMENTATION ANNUAL LOAD**

| Section | Length (ft) | Avg Annual Qs (tons) | | Avg Annual Qs (CY) | | Avg Annual Deoth (ft) | |
|---|---|---|---|---|---|---|---|
| | | Existing | Project | Existing | Project | Existing | Project |
| R9 | 760 | 3571 | 3593 | 2285 | 2300 | | |
| R8 | 575 | 2762 | 3513 | 1768 | 2248 | 0.1 | 0.0 |
| R7 | 500 | 2936 | 2533 | 1879 | 1621 | 0.0 | 0.1 |
| R6 | 275 | 15 | 0 | 10 | 0 | 0.5 | 0.4 |
| R5 | 75 | 7973 | 4114 | 5102 | 2633 | N/A | N/A |
| R4 | 390 | 972 | 444 | 622 | 284 | -0.9 | -0.3 |
| R3 | 290 | 1603 | 48 | 1026 | 30 | -0.4 | 0.1 |
| R2 | 110 | 3291 | 695 | 2106 | 445 | -2.1 | -0.3 |

Notes:

Soil unit weight of 115.75 lbs/cf is used (assuming a porosity of 0.3).
R5 – Grade Control/Drop Structure may not be stable under the existing condition. Design to achieve stability under the proposed condition
R6 – Existing backwater zone upstream of the service road crossing.
+ denotes aggradation
- denotes degradation

sampling and analysis. Section 3.3.2 provides a summary of the treatment wetland feasibility analysis. Section 3.3.3 describes the design approach for the proposed water quality improvement system. Finally, Section 3.3.4 describes the plan for future water quality sampling and analysis.

### 3.3.1 Water Quality Improvement and BMP Design Strategy

Big Canyon Watershed water quality and bacteriological data were collected during two sampling events: (1) a dry weather sampling event on August 10, 2004 and (2) a wet weather sampling event on October 20, 2004.

Four locations within the watershed were sampled, three of which were within the restoration project area (as shown in Appendix H). The locations of the sampling stations were as follows:

- Station 1 – Big Canyon Creek open channel above MacArthur Boulevard
- Station 2 – downstream of the RCB culvert outfall from under Jamboree Road
- Station 3 – pond inflow south of Maintenance Road
- Station 4 – outflow to Upper Newport Bay downstream of freshwater pond

The results of both sampling events are summarized in the following table:

**TABLE 3.3-1**
**SUMMARY RESULTS OF PAST WATER QUALITY SAMPLING**

| Analyte | Dry Event | Wet Event |
|---|---|---|
| Total Coliforms and Enterococci | Detected | Detected |
| Fecal Coliforms | Detected above WQO | Detected above WQO |

**TABLE 3.3-1**
**SUMMARY RESULTS OF PAST WATER QUALITY SAMPLING**

| Analyte | Dry Event | Wet Event |
|---|---|---|
| Surfactants (MBAS) | Detected above WQO | Detected above WQO |
| Total dissolved solids (TDS) | Detected | Detected |
| Turbidity | Detected | Detected above WQO |
| Pesticides | Not Detected | Not Detected |
| Dissolved Copper* | Detected above WQO | Detected above WQO |
| Dissolved Silver* | Detected above WQO | Not Detected |
| Dissolved Zinc* | Detected | Detected above WQO |

WQO – Water Quality Objectives
MBAS – Methylene Blue Active Substances
*Estimated hardness values used to calculate WQO

Key water quality improvement strategies, based on the sampling results, are summarized below.

**Fecal Coliform**

The exceedance of fecal coliform in both dry and wet weather samples present more an issue with human health risk than the long-term sustainability of the wetland. Although restoration of the riparian wetland involves no expansion of the riparian area, fecal coliform input from birds and mammals is inevitable from the riparian wetlands. Treatment of fecal coliform at the Jamboree Road culvert outlet may not be effective in reducing indicator bacteria at the discharge to Upper Newport Bay. Fecal coliform problems caused by the upstream urban watershed, and within the riparian wetlands, may be best addressed using source control and pollution prevention measures (along with BMPs located downstream of the

primary riparian wetland areas) to minimize impacts to the wetland habitats.

**Surfactants**

Surfactants are usually an indicator of high phosphate concentrations which can lead to nutrient enrichment in receiving waters. Phosphate or organo-phosphate concentrations were not reported in water quality sampling. Riparian and freshwater treatment wetlands are, however, known to reduce nutrient loads through up-take in plants within the wetland. Additional treatment, specific to load reductions for this constituent, is not critically needed as the wetland will likely reduce the concentrations prior to discharge to the Bay.

**Metals (Copper, Zinc and Silver)**

Metals concentrations exceeded the water quality objectives (WQOs) in both wet and dry flows. The comparisons to the WQO require the estimation of total hardness, which was not reported. Based on a hardness of 400 mg/l, copper exceeded WQO in all the samples. Based on this analysis, metals may be an issue in stormwater that flows into the wetland.

No toxicity data is available to assess the long-term potential impact to the wetland. The proposed sampling program will include toxicity testing and measurement of hardness.

Metals are likely associated with suspended solids/turbidity, which can be effectively managed by retention and filtration. BMP must consider sediment and metal removal. The sizing of the retention and filtration BMPs will depend on the hydraulic conditions and metal loading throughout the storm event. The retention and filtration function must be ensured with a reliable maintenance program.

The planned, future sampling program includes the development of a pollutagraph for metals to assess the metals loading over the storm hydrograph. The BMPs should be designed to cost effectively remove the largest practical portion of the metals loading. The design of the BMPs may be flow or total volume based depending on the configuration of the BMP and the results for the pollutagraph data.

**Turbidity**

Turbidity is an indicator of suspended sediment loading. Excess sediment loading can adversely impact the wetlands by covering macroinvertebrates and changing water levels and thus vegetation types. The up-stream storm water BMP is recommended to be designed to reduce sediment loading in storm water.

Exceedances of turbidity over the WQO were observed in the wet weather samples only. The BMPs should therefore be designed to retain and remove sediments from storm flows.

The planned sampling event will collect grab samples over the storm period to develop a pollutagraph from which a design storm can be estimated. The design storm shall treat up to the portion that captures a large percentage of the sediment load to the extent practicable. This will include the initial first flush and the higher flow portion of the storm.

The treatment design principles stated above for sediments and metals are applicable to turbidity reduction. These BMPs are recommended to be placed prior to the discharge into the treatment wetland and Upper Newport Bay.

### 3.3.2 Treatment Wetland Evaluation

There are two general types of constructed wetland designs for water quality treatment purposes: (1) free water surface (FWS) systems with emergent plants and (2) sub-surface flow systems with emergent plants. For Big Canyon Creek, the FWS system with emergent plants is most consistent with overall restoration project goals.

FWS wetlands are defined as wetland systems where the water surface is exposed to the atmosphere. In FWS treatment wetlands, water flows over a

vegetated soil surface from an inlet point to an outlet point.

The treatment function of a FWS wetland can be evaluated based on the following factors:

- Target Pollutants and Inflow Pollutant Concentration: Pollutant type and load to match the function and size of the wetland.
- Soil Permeability: Relatively low or lined with sandy clay.
- Hydrological and Hydraulic Condition: Shallow inundation, uniform flow distribution, sufficient retention time (without stagnant flow causing vector and other problems).
- Wetland Cell Physical Properties including Configuration, Dimension and Inlet/Outlet Control: Suitable to create favorable hydrologic and hydraulic conditions for treatment.
- Types of Vegetation: Compatible to site setting and restoration planting goals.

**Evaluation of Existing Condition**

The existing freshwater marsh was evaluated for its treatment function based on the factors identified above. It was concluded that the existing marsh has proper underlying soils and acceptable wetland size (see Treatment Wetland Sizing below). However, the existing marsh has very low efficiency in water quality treatment since a majority of dry and wet weather flows can concentrate and be conveyed to the outlet weir through the narrow channel (2 to 5 feet) and bypass the shallow areas along the bank where wetland plants are located. This "short circuit" effect does not provide uniform flow distribution and hydraulic retention for the benefit of water quality treatment.

**Evaluation of Proposed Condition**

Under the proposed condition, the upper portion of the treatment marsh will remain to provide treatment function with minor modifications to the grading, drainage, and planting to achieve a higher efficiency. The size of the treatment wetland, however, is limited due to proposed tidal restoration within this historical fill area. If only water quality treatment via FWS wetland is provided, the existing freshwater marsh size (approximately 6 acres) must be maintained as estimated below.

**Treatment Wetland Sizing**

General EPA wetland design rules were followed to estimate the wetland size for Big Canyon Creek. Maximum allowable influent pollutant loads and EPA-defined effluent variables were considered to estimate wetland size based on the following design factors:

- Biochemical oxygen demand, as measured using the standard five-day test ($BOD_5$)
- Total suspended solids (TSS)
- Fecal coliform
- Total nitrogen and phosphorus
- Design for removal of metals

Table 3.3-2 shows typical treatment wetland size estimated based on general guidelines in the EPA design manual and observed values of TSS, $BOD_5$, and fecal coliform at Station #2 (downstream of Jamboree Road) from the August 2004 dry weather measurements (see Appendix H). This table indicates that a size of approximately 5 to 10 acres is desirable to reduce the targeted dry weather pollutants (TSS, fecal coliform, and $BOD_5$) based on the August, 2004 dry weather measurements as influent concentrations and a design discharge of 0.5 cfs.

It should be noted that the site-specific design of wetlands may vary significantly compared to design by general rules or guidelines. Site-specific design depends largely on influent load characteristics. For stormwater treatment, the area desired

| TABLE 3.3-2<br>WETLAND SIZING ANALYSIS BASED ON DRY WEATHER FLOW OF 2004 | | |
|---|---|---|
| **Design Parameter** | **Implied Size of Wetland based on Each Design Parameter (acre)** | **Size of Wetland Considering Dikes and Buffer Area – Increased by 25% (acre)** |
| General Rule | 6.4 | 8 |
| $BOD_5$ | 7.72 | 9.65 |
| Fecal coliform | 4.60 | 5.75 |
| TSS | 0.70 | 0.88 |

increases to an order of 20 to 25 acres for the same design discharge, using the October 2004 measurements as influent levels (see Table 3.3-3). This was the first flash flood of the winter of 2004 and is associated with elevated pollutant levels.

Although the Big Canyon project area includes approximately 60 acres, this area is comprised primarily of sewer maintenance areas that will be retained; riparian and wetland areas that will be restored; and previous habitat mitigation areas that can not be disturbed. The actual restoration area currently proposed is limited to the degraded freshwater marsh area and the area dominated by exotic invasive Brazilian pepper trees (10-12 acres total). This limited area precludes design of the treatment wetland based on the measured concentration of the first flash flood of 2004.

Based on the restoration concept developed in Phase I and confirmed during the first stakeholder meeting, the actual restoration area mentioned above will be applied largely to tidal wetland and freshwater pond restoration. The water quality wetland sizes estimated in Table 3.3-2 for dry weather pollutant concentrations are within the area sizes available for actual restoration. However, the restoration goals for tidal marsh and freshwater pond areas will be jeopardized if a larger treatment wetland is designed. It is imperative to emphasize that the variation of design input parameters may be very high depending upon the human, as well as animal, activities in the reaches of Big Canyon Creek upstream of the project. To optimize the multiple objectives of the project within the available project area, it is recommended that the water quality improvement design include a system of treatment measures in lieu of a single multiple-cell treatment wetland. This can be achieved with the proposed restoration plan and on-site BMPs (as discussed below). In addition, upstream source control, street cleaning, storm drain stenciling, fertilizer management and other BMPs can be applied in conjunction with the current water quality improvement design to effectively reduce pollutants of concern.

| TABLE 3.3-3<br>WETLAND SIZING ANALYSIS BASED ON FIRST FLASH FLOOD OF 2004 | | |
|---|---|---|
| **Design Parameter** | **Implied Size of Wetland based on Each Design Parameter (acre)** | **Size of Wetland Considering Dikes and Buffer Area – Increased by 25% (acre)** |
| General Rule | 12.80 | 16 |
| $BOD_5$ | 7.06 | 8.83 |
| Fecal coliform | 19.5 | 24.4 |
| TSS | 1.33 | 1.70 |

### 3.3.3 Water Quality Improvement Design

The project intends to reduce potential pollutant contribution from Big Canyon using the restored wetlands as a buffer and detention ponds for settlement, as well

erosion control and other BMPs for site source control and filtration. It is important to view the proposed water quality improvement for Big Canyon as a system, including the following activities:

- Eliminate stagnant water at the Jamboree Road pipe outlet.
- Upper freshwater pond will provide a sediment management function.
- Lower freshwater pond is primarily a habitat area, but will provide additional opportunities for sediment settlement and pollutant removal.
- Freshwater marsh will be modified to provide uniform flow distribution for treatment function and with diversified wetland plants.
- A favorable location for optional sand/gravel filtration is the freshwater marsh entry (freshwater pond outlet).
- End-of-pipe BMPs at storm drain outlets (*e.g.*, energy dissipaters, sand/gravel filter, and/or bioswales) provide additional water quality improvement.
- Optional berm and weir can be added at city sewer crossing for impoundment of non-storm water with impaired water quality.
- The existing erosion potential in the north branch of split flow (riparian channel) will be significantly reduced with the proposed Back Bay Drive realignment.
- Increased native groundcover in the riparian exotic removal zones will also help uptake excess nutrients and sediment before they reach the Bay.
- By dredging the degraded marsh for tidal flushing, algae growth can be controlled.
- Native grassland and bioswales will be provided along the parking, staging and interpretive areas to trap waste, grease, and other contaminants.
- Proper grading, drainage, and vegetation will protect the toe of the bluff and reduce slope erosion.

Collectively, these proposed restoration activities and elements will filter/trap pollutants (including sediments, metals, pesticides, fecal coliform, and nutrients) and keep them from entering Upper Newport Bay.

**Freshwater Ponds**

In addition to meeting needs for open water habitat, a series of two freshwater ponds are proposed as elements of the water quality improvement design. The upper pond will provide a sediment management function.

Based on the sediment transport analysis, it is expected that primary sedimentation problems will be related to fine materials (the velocity of the creek is not sufficient to cause major sand or gravel movement and the existing creek bed contains significant fines as the sources of siltation). Sediment settling will provide reduction benefits for other constituents, including TSS, fecal coliform, and metals.

It is expected that the lower pond will be a primary open water habitat area with relatively clean water. This pond will also provide additional opportunities for sediment settlement and pollutant removal. The City will maintain the pond to reduce siltation, algae bloom, and mosquitoes.

**Modification to Existing Freshwater Marsh**

As discussed previously, the existing freshwater marsh is not effective for providing pollutant reduction due to a variety of existing conditions, as follows:

- Siltation

- Non-uniform flow distribution
- Large area of inundation greater than 2 feet.
- Deep water channel short circuit effects
- Narrow outlet at the deep water zone which further enhances the short circuit effects.

The existing marsh area is relatively large (nearly 5 acres); however, there is limited effectiveness of this wetland for water quality treatment as stated above. For the proposed condition, this area will be significantly reduced to provide for tidal marsh restoration (the cattail marsh will be reduced to only one acre). The reduced marsh area will be modified with (1) open water zone for inflow distribution, (2) regrading for uniform shallow flow inundation, (3) multiple outlets to prevent flow concentration, and (4) plant diversity. The proposed design is intended to maximize the pollutant removal function per unit area.

**On-Site BMPs**

For additional water quality BMPs, a sand and gravel filter was previously proposed immediately downstream of the Jamboree culvert for dry weather diversion. However, further investigation of site conditions and topographic features suggest that (1) the area is too flat for effective design of gravity inflow and outflow and (2) the filter may be saturated with subsurface flows. Therefore, it has been determined that the Jamboree culvert location is not a preferred location for BMPs. A better location for BMPs is the freshwater marsh entry. This area can be designed with a sand and gravel filtering system at the freshwater pond outlet, in lieu of open pipe drains.

Additional on-site BMPs proposed include (1) sand/gravel filters applied to dry weather outflow through the freshwater pond and (2) end-of-pipe BMPs at the lateral storm drain outlets, including bioswales, energy dissipators (for erosion control) and sand/gravel filters.

An optional water quality improvement measure is an earthen berm with weir and low flow pipe control. This measure can be constructed along or near the city sewer crossing and used to retain non-storm polluted runoff as needed. However, this measure will require operation and maintenance and will not have significant capacity without significant grading and disturbance of the riparian habitat.

## 3.4 Flow and Water Quality Assessment Monitoring Program

The primary purpose of the planned Big Canyon Creek flow and water quality assessment monitoring program is to assess and characterize wet and dry weather flows in the Big Canyon Creek Restoration Project area to further address the key objectives of water quality in relation to the restoration program. The key objectives of the water quality assessment are to provide baseline data for pre- and post-construction comparisons of flows and concentration characteristics of constituents of concern as well as provide flow and loading data to determine the effectiveness of the restoration project post-construction. The Final Monitoring Plan and Quality Assurance Project Plan for Big Canyon Creek Flow and Water Quality Assessment is incorporated by reference to this report. As of the date of this report, the plan has been approved by the Water Quality Control Board QAPP Review Team and the City is expecting to receive formal approval by the Santa Ana Regional Water Quality Control Board.

The planned program will provide key data on wet and dry weather flow, loading and pollutant constituents entering and in the Big Canyon Restoration Project area. The monitoring program has been developed to address these objectives as well as the following questions:

- What are the baseline water quality conditions in Big Canyon Creek?

- What is the extent and magnitude of the current or potential problems in Big Canyon Creek runoff to the restoration project and to Upper Newport Bay?
- What are potential storm water quality issues that may impact the long-term sustainability of the restoration project?
- What are the expected pollutant loads from Big Canyon Creek that will be needed for storm water management controls prior to its discharge into the restoration project?

The focus of the monitoring program will be to assess flow characteristics and concentrations of constituents of concern so that estimated loads can be calculated. Dry weather and wet weather sampling will be done to get a complete baseline assessment. Ultimately, the concentrations of pollutants and the flow of the creek will be used to calculate the estimated load of pollutants entering the receiving water.

Comparison of concentrations and estimated loadings from Big Canyon both pre- and post-project is also important. The monitoring program will collect baseline wet and dry weather samples within the canyon upstream of tidal influence of Upper Newport Bay to obtain data on the reference or "background" site conditions. Additional wet weather samples will be collected at this station during the storm event in order to assess constituent concentrations throughout a storm hydrograph.

Understanding the conditions and loads of constituents of concern in Big Canyon is crucial for evaluating the "background" and the effectiveness of the restoration project post-construction.

The results will provide a better baseline of water quality data (compared to those derived only from the 2004 measurements). This will be used to confirm the design criteria and for future assessments of restoration success.

For convenience, the sampling regime described in the Monitoring Plan and Quality Assurance Project Plan is summarized below.

**Sampling Stations**

The upstream station in Big Canyon (Station #2) is located to identify where flows enter the restoration project area and loading is potentially greatest. Station #4 is located downstream of the existing freshwater pond and is located to allow future sampling efforts to be compared to baseline data in order to provide an estimate of restoration success. These proposed stations have been located based on the review of existing data and the site reconnaissance survey. These locations may be modified based on additional information collected during the course of the subsequent sampling and project construction.

**Dry Weather Sampling**

To accurately assess loads during dry weather runoff, four dry weather sampling events for Big Canyon will be sampled during four consecutive days at Station #4. At Station #2, one dry weather sampling event will be sampled on one day only. This sampling strategy will allow better assessment of this urbanized watershed where dry weather flows are dominated by irrigation. Water samples collected during the dry weather events will be sent to the appropriate analytical laboratory within the holding time specified in the Final Monitoring Plan and Quality Assurance Project Plan.

**Wet Weather Sampling**

To accurately assess loads during wet weather runoff, one wet weather sampling event for Big Canyon will be sampled. This sampling strategy will allow better assessment of this urbanized watershed where wet weather flows receive stormwater. Water samples collected during the wet weather event will be sent to the appropriate analytical laboratory within the holding time specified in the Final

Monitoring Plan and Quality Assurance Project Plan.

**Constituent Lists**

Three constituent lists will be monitored for Big Canyon samples. At Big Canyon Stations #2 and #4, samples from the first dry weather event and the wet weather event will be analyzed for the full list of constituents summarized below (see the Final Monitoring Plan and Quality Assurance Project Plan for a detailed list).

- Total and Dissolved Metals
- Organochlorine Pesticides
- Organophosporous Pesticides
- Synthetic Pyrethroid Pesticides
- Biochemical Oxygen Demand
- Boron in Water Determination
- Chloride in Water Determination
- Nitrate in Water Determination
- Nitrite in Water Determination
- pH in Water Determination
- Settleable Solids in Water Determination
- Sulfate in Water Determination
- MBAS in Water Determination
- Total Dissolved Solids in Water Determination
- Total Hardness as $CaCO_3$ in Water Determination
- Total Orthophosphate (as P) in Water Determination
- Total Sulfides in Water Determination
- Total Suspended Solids in Water Determination
- Coliform Bacteria
- Fecal Streptococcus/Enterococcus
- Oil & Grease in Water Determination
- Acute Toxicity Test (Wet Weather Flow)
- Chronic Toxicity Test (Dry Weather Flow)
- Volumetric flow rate & Velocity
- pH
- Conductivity
- Temperature
- Dissolved Oxygen

The full analyte list will allow for loading estimates for a variety of constituents that can be used for load allocations and assessment of potential constituents of concern for the Upper Newport Bay.

A modified version of the full list (wet weather focused list) will be used to analyze the additional samples collected during the wet weather event at the initial runoff, rise of runoff, and post-peak runoff periods based on the storm hydrograph. The wet weather focused list is summarized below (see the Final Monitoring Plan and Quality Assurance Project Plan for a detailed list).

- Total and Dissolved Metals
- Boron in Water Determination
- Chloride in Water Determination
- Nitrate in Water Determination
- Nitrite in Water Determination
- pH in Water Determination
- Settleable Solids in Water Determination
- Sulfate in Water Determination
- MBAS in Water Determination
- Total Dissolved Solids in Water Determination
- Total Hardness as $CaCO_3$ in Water Determination
- Total Orthophosphate (as P) in Water Determination
- Total Sulfides in Water Determination
- Total Suspended Solids in Water Determination
- Coliform Bacteria
- Fecal Streptococcus/Enterococcus
- Volumetric flow rate & Velocity
- pH
- Conductivity
- Temperature
- Dissolved Oxygen

A second modified version of the constituent list (dry weather focus list) will be used to analyze the samples from consecutive dry weather sampling days. The dry weather focused list is summarized below (see the Final Monitoring Plan and Quality Assurance Project Plan for a detailed list).

- Total and Dissolved Metals
- Organochlorine Pesticides
- Synthetic Pyrethroid Pesticides
- Boron in Water Determination
- Chloride in Water Determination
- Nitrate in Water Determination
- Nitrite in Water Determination
- pH in Water Determination
- Settleable Solids in Water Determination
- Sulfate in Water Determination
- MBAS in Water Determination
- Total Dissolved Solids in Water Determination
- Total Hardness as $CaCO_3$ in Water Determination
- Total Orthophosphate (as P) in Water Determination
- Total Suspended Solids in Water Determination
- Coliform Bacteria
- Fecal Streptococcus/Enterococcus
- pH
- Conductivity
- Temperature
- Dissolved Oxygen

## 3.5 Soils and Geotechnical Analysis

In November, 2006, extensive field exploration was conducted at the project site to support the following feasibility study objectives: (1) sediment transport analysis; (2) disposal site evaluation, including toxicity testing; (3) groundwater depth determination; (4) facility foundation evaluation; (5) road pavement analysis; and (6) permeability analysis for pond and water quality wetland design.

Additionally, several soil samples were obtained in May, 2003 (CCI, 2004). These samples were collected to evaluate the general distribution of soils and suitability for planting. Figure 3.5-1 depicts all soil sampling locations and identifies both date of collection and sampling method (hollow stem boring, hand auger or surface grab sample). Each sample was analyzed based on the specific needs of restoration project components.

As described in Appendix C, samples collected throughout the project site showed some consistency in soil characteristics based on the source areas sampled. For example:

- Subsurface samples tested from alluvial deposits within the project area were typically characterized as clayey sand to sandy clay. On average, these samples were approximately 44% sand, 22% silt and 32% clay.
- Samples tested in dredged fill were typically characterized as silty to sandy clay. On average, these samples were approximately 31% sand, 28% silt and 41% clay.
- Surface samples tested from alluvial deposits were typically clayey sand or sandy slit in nature. On average, these samples were approximately 55% sand, 24% silt and 22% clay.

Note that, in the list above, the sum of percentages indicated may not equal 100 percent due to rounding.

### 3.5.1 Soil Fertility

**Tidal Marsh Restoration Area**

Soil Texture

A primary objective for tidal marsh restoration areas will be to utilize wetland soils with a texture and physical/ chemical properties similar to the naturally occurring tidal marsh soils of the Southern California region. Such soils are usually high in clay and silt content, with a typical ratio of approximately 5 - 30% sand, 25 - 60% silt, 20 - 35% clay, and less than 1% gravel. In addition, typical marsh soils have approximately 1.5 - 3% organic matter, a pH between 6 and 7.5, and salinity levels less than 50 PPT (78.1 Ece).

To control costs, another objective is to limit the amount of soil import by utilizing soils

from on-site to formulate the wetland soils. Opportunities for generating suitable soils on-site include the tidal marsh excavation area and the freshwater pond modification area.

Soil Samples #1/2, collected in 2003 to the west of Back Bay Drive near the southern edge of the proposed tidal marsh restoration area, found native sandy loam soils at depth of approximately 4.5 feet. Soil Sample #5, collected in 2003 adjacent to the existing freshwater pond near the eastern edge of the proposed tidal marsh restoration area, found layers of sand and sandy clay loam at depth of approximately 12 inches. Soil Sample #9, collected in 2003 to the east of Back Bay Drive (near the northern edge of the proposed tidal marsh restoration area), found silt / loam to a depth of approximately 18 inches. Surface sample S-1 collected near Sample #9 was characterized as sandy silt.

Hand auger borings HA-1 and HA-2 were both collected in 2006 along the east side of Back Bay Drive (within the tidal marsh restoration grading area – see Figures 3.5-1 and 2.2-2). HA-1 was advanced to a depth of 10 feet. The first 4.5 feet of the boring was advanced primarily through silty sand, whereas the lower 5.5 feet showed increased clay content (primarily silty clay and sandy silty clay). HA-2 was also advanced to a depth of 10 feet. Clayey material was first encountered at 3.5 feet, underlying silty sand. Both borings encountered various amounts of decaying organic material.

Based on these samples, it appears that the clay and silt content typical of existing marshes in the region is present in the tidal marsh restoration area. Materials containing the highest observed clay and silt content appear to be overlain by several feet of more sandy soils. Based on the sampling results outlined in Appendix C, it is not expected that additional clay will be required to amend soils in the tidal marsh restoration areas. However, the need for clay amendment to ensure suitability as wetland soils can not be completely ruled out at this time. The best time to determine clay amendment needs will be after dredging and when soils are exposed to surface runoff and tidal flushing for a sufficient time period.

Soil Physical / Chemical Properties

Organic matter content at the majority of the 2004 soil sample locations was relatively high (*e.g.* 3.3% at Samples #3/4), and may therefore prove adequate for the restoration project. However, additional soils amendment is recommended to ensure that the organic content is sufficient for new plant establishment. Additional organic matter, such as a decomposed kelp by-product, Biosol, or green-waste compost may be suitable for amendment. In such applications, approximately 3 cubic yards of green-waste are typically required to amend 1,000 square feet of soil to a depth of 6 inches.

The pH levels at these locations were also relatively high, in the range of pH 7 to 8.8. If these conditions prove to be too basic for adequate plant establishment, elemental sulfur may be used as an additional soil amendment to reduce pH. In such applications, approximately 10 to 15 pounds of sulfur are typically required to amend 1,000 square feet of soil to a depth of 6 inches. However, in order to avoid the undesirable odors associated with sulfur, this process requires adequate aeration of the soils, which can be difficult to control in marsh situations.

Salinity levels and Sodium Absorption Ratio's (SAR) at the majority of these locations were also high, which may require amending the soils with gypsum. In such applications, approximately 100 pounds of gypsum are typically required to amend 1,000 square feet of soil to a depth of 6 inches. This process requires leaching the soil after the gypsum has been added through exposure to tidal inundation, temporary irrigation, or leaching of stockpiled soil prior to placement. Another option to reduce the effect of salinity on the

restoration planting, primarily in the freshwater marsh area, is to cap saline soils with a layer of soils with acceptable levels of salinity acquired on-site.

Additional tests will be required during the construction phase of the project on the newly excavated soil surface. Additional soil borings should primarily be taken in the following locations:

- Within the existing tidal marsh to the west of the existing Back Bay Drive, where species proposed for planting are know to thrive. Such data would help to establish a site-specific specification for soil texture, organic matter, pH, and salinity.
- Within the footprint of the proposed tidal marsh restoration, which should confirm the depth to native tidal marsh soils, as well as their texture and other properties.

The construction phase soils analysis should consider potential changes in soil characteristics as a result of an extended period of tidal inundation.

**Riparian Wetland Areas**

Riparian wetland planting suitability analysis was performed in Phase I of the project and is summarized below. A more detailed description is provided in Section 7 of the Phase I report (CCI, 2004).

Soil profiles were examined in keys areas throughout Big Canyon, using a 6-inch bucket auger for extraction. Soil color, texture, and horizon development were recorded, as well as other physical or chemical properties such as mottling or reducing conditions. Grab samples of the extracted soils were collected for laboratory analysis at one or two depths for each soil. Laboratory analysis included cation exchange capacity (CEC), base saturation, soil texture, soil organic matter analyzed by combustion, nitrate-nitrogen, total nitrogen, total carbon, carbon to nitrogen ratio, SAR, and the standard agriculture suitability analysis which included pH, and an array of macro and micronutrients.

As shown in Figure 3.5-1, soil sampling locations #6 and #9 are representative of riparian wetland areas. The results and conclusions of soil sampling at these two locations are summarized below.

Sample Location #6

The three profiles examined in this area all exhibited hydric soil characteristics at or near the surface. Mottles, reduced soil matrix and/or gleyed soil color were observed in all three sampling locations. Consistent gleyed soil color was observed between 14 and 18 inches below the soil surface, indicating the level where water is consistently found. In July of 2003, when samples 6a and 6b were taken, the water table was between 21 and 24 inches below the surface. Soil texture varied throughout the profile from loam to sandy clay. The top 18 inches appeared to be alluvium carried in from upstream sources. The remaining profile appeared to be formed in place.

The sample taken from the top 12 inches of the soil had high salt content, in addition to an extremely high sulfate level. The sulfate may be a result of fertilizer practices from upstream sources that settle out at this point. The phosphorus level was considered low, but other minor elements are well within the acceptable range for agronomic purposes. The SAR was 12.3, and could potentially pose a problem for plant establishment.

Sample Location #9

A heavy root mass was encountered approximately 3 inches deep on the surface of the soil. This root mass was formed primarily by the shallow roots of the surrounding willow trees. The soil horizon directly below the root mass was gleyed with both brownish yellow and yellowish red mottles, indicating saturated and reducing soil conditions. This soil would be considered hydric based upon the Field Indicators developed by the USDA. Soils were examined to only 18 inches in depth. Silts dominated the soil texture, and are

considered to be loam at the surface. The slightly higher loam content in the soil (45.9% loam versus 38.6% sand) may be the result of lighter soil particles being deposited from upstream sources, rather than a tie over of tidal influence. The dominant vegetation of this area is willow, which tolerate moderate amounts of salinity. The creek that runs through this area is fresh water, and thus sediments may be deposited in this area during flood events.

The pH of this soil was unusually high (8.83) in comparison with the other soils, which were in the 7 range. It is unknown what has caused this increase in pH, but it does not appear to be affecting plant health. Total carbon and total nitrogen were higher than other samples collected. This may be due to the shallowness of the soil sample collected. Although the sodium levels found within the soil were high, the SAR was low. This perhaps indicates the dominance of calcium and magnesium in the soil, which could also regulate pH. Overall, the nutrient levels were consistent with other samples taken from within the study area.

**Freshwater Marsh Restoration Area**

The existing freshwater marsh appears to perform well under dry weather flows and no major soils amendment is expected to be necessary for the proposed modifications. The source of the fill material used to modify the freshwater marsh area will likely be the tidal marsh excavation area, and these soils may require clay amendment to be suitable as wetland soils as discussed above.

**Freshwater Pond Restoration Area**

Hollow stem boring B-1 was advanced in the vicinity of the proposed freshwater pond to evaluate the lining requirements of the pond. The log for boring B-1 indicates that silty clay is present at a depth of 18 feet to at least the termination of the boring at 21.5 feet. This clay layer is overlain by more sandy materials.

The surface at boring B-1 is approximately Elevation 25, so the clay layer is present at approximately Elevation 7, which is 11 feet below the pond invert (Elevation 18) and 19 feet below the top of the berm and bank (Elevation 26). However, groundwater or subsurface flow depth is generally shallow (2-10 feet) throughout the canyon floor, so lining of the pond bottom may not be needed. Lining is required at the downstream slopes of the upper and lower ponds to the depth of subsurface flow.

No lining is proposed for the pond banking slope since the pond is located at the low point of the canyon slope and the canyon invert drops dramatically downstream of the pond. More detailed investigation can be completed after the area is dredged and soils are exposed (current boring site is located outside of the pepper tree forest and hand auger within the forest is limited in the exploration depth).

### 3.5.2 Preliminary Soil Contaminant Analysis

Prior to utilizing any potential on-site sources of wetland base soils in the restoration areas, environmental safety tests should be performed by a qualified soil test laboratory. These tests should analyze petroleum hydrocarbons, CAM 17 metals, VOC's, and the pesticide/herbicide levels within the soils which would impact the plant restoration efforts. Similarly, in the event that off-site wetland base soils are to be imported, such environmental safety tests should be conducted before the soils are transported to the site to ensure suitability for use in the restoration areas.

Preliminary soil contaminant analysis was performed in 2006 on a grab sample of dredged material from hollow stem boring B-1 (located near existing freshwater pond, see Figure 3.5-1). The analytical results from the sample are summarized in Table 3.5-1. Note that all values of detected metals are below the effects range-low (ERL) for marine sediment and within background levels for soil established by NOAA.

This suggests that the dredged soils in the tidal marsh and freshwater ponds areas are not considered "contaminated." Therefore, these soils are likely to be suitable for on-site fill, provided certain requirements (*i.e.*, geotechnical requirement for compaction or organic content for restoration planting) are met. Further, off-site disposal of these soils is not expected to require additional costs due to the presence of soil contaminants. However, these preliminary conclusions are based on a single sample which may not be representative of general site conditions and will need to be verified during the construction phase.

**TABLE 3.5-1**
**SOIL CONTAMINANT ANALYSIS**

| Analyte | Sample B1 |
|---|---|
| Metals<br>Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver | Cadmium Detected<br>(all values below ERL for marine sediment and within background levels for soil established by NOAA) |
| Organochlorine pesticides and PCBs | Not Detected |
| Organotins | Not Detected |

### 3.5.3 Preliminary Geotechnical Recommendations

Based on the review of the available data, field exploration, laboratory testing, and geologic and engineering analysis, the proposed Big Canyon restoration project appears to be feasible from a geotechnical viewpoint, provided the recommendations presented Appendix C of this report are properly incorporated into the design and construction of the project.

The most significant elements of the geotechnical study are summarized below:

- The existing dredged fill previously placed at the site is typically clayey in nature, and demonstrates high moisture content in its current state. They can be reused as fill, provided that they are dried back to near optimum moisture content prior to placement as fill. Also, they should be free from organic materials, with organic content of less than 1 percent.
- Due to the presence of surface and shallow groundwater, dewatering during grading would be required, particularly during the planned Back Bay Drive realignment where it crosses the wetlands.
- The encountered soils material within the project site are very fine to coarse grained, and the expansion potential of these materials are anticipated to be in range of low to high. Post-tension or mat foundations may be necessary for low, medium, or highly expansive soils.
- Planned fills and cuts should not exceed about 15 and 10 feet, respectively.
- All vegetation and/or deleterious materials should be removed from the site and properly disposed of where settlement-sensitive improvements (facilities) are proposed within their influence. Removals of compressible artificial fill and soft alluvial deposits will be necessary prior to fill placement in areas for proposed settlement-sensitive facilities. In general, removals will be on the order of about 3 to 10 feet where hard surface pavement or structure facilities are planned. However, localized deeper removals cannot be precluded, and should be anticipated.

### 3.5.4 Preliminary Evaluation of Beneficial Reuse or Disposal for Dredged Materials

The identification of the engineering properties and concentration of constituents in dredged material is essential in the determination of beneficial use or disposal. Appendix I presents a summary of previous and current soil analysis data for the Big Canyon Creek Restoration Project and provides a discussion of the assessment of dredge material within the project site to be used for site grading and possible off-site beneficial use. The requirements for sampling and a summary of regulatory issues related to beneficial use of dredged materials are also presented in the Appendix.

As indicated in Section 3.5.2, soils from the proposed dredging area seem to be free of contaminants (this will require future confirmation during the construction phase). These soils may be reused if off-site beneficial use opportunities arise during construction. On-site reuse is permitted; however, is extremely limited due to the requirement of preservation of existing habitats outside of the proposed grading areas shown in Figure 2.2-2.

An evaluation of specific potential beneficial uses is provided below.

**Beach Nourishment**

The City of Newport Beach has a Regional General Permit to utilize dredged materials in beach nourishment projects provided that the material consists of greater than 80% sand. The City has also negotiated the General Permit to allow material classified as 75% sand in beach nourishment if the dredged material has physical characteristics similar to the native beach material of the target beach.

Recently, sediment nourishment has gone beyond beach applications of coarse-grained sediment to the placement of finer-grained sediments into areas that feed finer grained submerged aquatic systems. Sediment placement off Santa Cruz, California is an example of the use of fine grained sediment to nourish deeper areas. In this case, the sediment was shown to not have any deleterious biological effects and was found to be acceptable for use in the marine environment.

The general advantages of the beneficial use of dredged material for beach nourishment include:

- High public appeal.
- Potential for large volumes of dredged material placement.
- Restoration of recreational shorelines utilized by the public.
- May enhance local economy due to increased tourism.

The general disadvantages of beach nourishment include:

- Unavailability of appropriate sites.
- Dredged material characteristics may not be compatible with native beach sediments.
- Not a suitable beneficial use for contaminated sediments.

Based on the grain size results of the sample collected as part of this project, the dredge material sampled would not be eligible to be used in a beach nourishment program under the City of Newport Beach General Permit. However, due to the fragmented placement and excavation of dredge material in Big Canyon, other areas of material may have physical characteristics suitable for this use.

**Material Transfer or Construction Materials**

The use of dewatered dredged material as construction fill for roads, dikes or other construction projects is a practical beneficial use. Local construction companies often use dredged material for backfill or grading processes. A local example of this process was the use of dredged material from Newport Bay in the 1990s during the construction of State Route 73 led by the

Kiewit Pacific Company. However, opportunities to utilize fill are irregular and specific projects are difficult to identify in advance. Large construction companies typically will commit to accepting appropriate dredge material weeks in advance of material delivery. As dredge material in Big Canyon becomes available for potential beneficial uses, an inventory of specific construction projects requiring fill material should be identified.

General advantages of utilizing dewatered dredged material for the beneficial use of material transfer for fill include the following:

- Provides a recycled material source to replace standard construction fill materials. This is beneficial from both a cost and resource management perspective.
- Some large public projects require large quantities of fill material and could accommodate large quantities of dredged material.
- Favorable to the public and local officials due to economic benefits.
- Use of dewatered dredge material from a nearby storage facility can offset the increased transportation costs associated with hauling material from a conventional source.

The general disadvantages of utilizing dewatered dredged material for the beneficial use of material transfer for fill include the following:

- Availability of this beneficial use option depends upon the need and timing of development projects requiring fill material.
- Bearing capacity of unamended dredged material may not meet requirements of the proposed development and amendment of dredged material may increase project costs.
- Rehandling and movement of dredged material over long distances could make the use of dredged material impractical for some projects.

Specific conclusions on soils reuse can not be made until more data become available during construction. Note that soils use may significantly affect the construction costs. To account for the potential of off-site disposal without beneficial use, hauling and disposal charges were considered as part of the construction costs shown in Section 7, based on the best estimated unit cost.

## 3.6 Public Use: Recreation and Education

Once restored, Big Canyon will be a functioning complex of native wetland and upland habitats. Tidal wetlands, freshwater marsh, riparian areas, open ponds, meadows, and coastal sage scrub will replace non-native invasive plant species and fill the currently barren areas resulting from the disposal of saline dredge spoil. This new mosaic of habitats will attract and sustain diverse wildlife including migratory waterfowl, rare songbirds, small mammals, invertebrates, and a host of other animals. It will also continue to serve as habitat for several rare plant species, including the endangered salt marsh bird's beak.

At the same time Big Canyon's biological resources are restored, best management practices will be employed to control erosion, sedimentation, flooding, and the flow of contaminated urban runoff into Big Canyon Creek. The canyon will become a fully functioning complex that beckons both wildlife and visitors.

Accommodating the needs of visitors must be balanced against protecting fragile habitats. The strategic placement of trails, boardwalks, and observation decks will allow visitors to explore the canyon without degrading the very resources that attract them to this site. The interpretive media will be designed as low-profile installations that inform with minimal interruption to the awe-inspiring views of the bay. Construction materials, including sign materials that are

resistant to vandalism, ultraviolet radiation, and moisture, will hold up to the forces of nature and foot traffic. Given the current condition of panels that appear in the kiosk by the parking lot, it is critical to use materials that will resist fading and inadvertently convey a message of neglect.

**Interpretive Themes and Sub-themes**

The following framework is based upon input provided by stakeholders during the September 28, 2006 meeting and through the interpretive needs survey; review of existing documents, including the Big Canyon Creek Historic Tidal Wetlands Conceptual Restoration Plan (April 2004) and Big Canyon Creek Restoration Project Phase II Overview; observations of The Acorn Group; ongoing dialogue with the project architecture and landscape architect; and, results of interviews with staff of the Orange County Department of Education (Inside the Outdoors), California Coastal Commission, County of Orange (Peter and Mary Muth Interpretive Center), and Irvine Ranch Land Reserve Trust.

The following theme, sub-themes, goals, and objectives provide the foundation for interpretation at Big Canyon. To some degree, all media need to reflect the theme stated below. This ultimately becomes the one "take home" message for the visitor. Although this message may or may not be articulated verbatim in media or programs, it is the conclusion that we hope visitors will reach on their own after experiencing Big Canyon, and the impression that will linger long after the details of the visit have been forgotten. Theme-based interpretation is easier to comprehend and recall at a later point. It serves as an "advance organizer," giving the visitor a sense of where the interpretive media and experiences are going and making it easier to connect their content to other information.

Media need to be developed in a manner that advances sub-themes. These further develop the central theme, allowing for a logical progression into storylines. Typically there are three to five sub-themes, all of which are subordinate, but directly related, to the central theme. Media are also guided by the goals and objectives that resource managers wish to accomplish. Done effectively, interpretation works in service of both the program mission and the visitor.

**Proposed Overarching Theme**

Big Canyon is a microcosm of Southern California's diverse ecosystems. Though small, it plays a critical role in the enhancement of wildlife habitat and water quality in the Upper Newport Bay.

- Sub-theme: Big Canyon is a mosaic of habitats that includes tidal wetlands, mudflats, freshwater marsh, riparian woodland, wet meadow, grassland, and coastal sage scrub.
- Sub-theme: The diversity of habitats attracts equally diverse wildlife, including migratory waterfowl and songbirds, small mammals, amphibians and reptiles, fish, and terrestrial, aquatic, and marine invertebrates.
- Sub-theme: Big Canyon drains wet weather and dry weather flow from an urbanized watershed. The quality of water in Big Canyon Creek directly affects the quality of water in Upper Newport Bay.
- Sub-theme: Human behavior profoundly influences the quality of the "upstream water," and "downstream flow" into the Upper Newport Bay.
- Sub-theme: After years of degradation, the native wetland and upland habitats of Big Canyon are being restored.

To reflect the interpretive theme and provide for a more informed and engaged visiting public, new interpretive media are called for. In particular, new gateway, orientation and regulatory signs; interpretive panels; observation platforms; wildlife viewing tools;

and small-scale discovery areas are proposed.

Given the environmental conditions of the site, we recommend use of ¾" exterior grade phenolic resin or porcelain enamel for sign media. Both materials are resistant to vandalism and ultraviolet radiation; however, porcelain enamel has a longer lifespan and its cost is reflective of this.

## 4.0 PRELIMINARY ASSESSMENT OF PROJECT IMPACTS AND BENEFITS

Linking with the other ongoing watershed management efforts for Upper Newport Bay, the Big Canyon Restoration Project is essential to maintain the vitality of the Big Canyon ecosystem and to achieve the water quality standards for beneficial use of Upper Newport Bay. In addition, it will benefit flood protection and erosion/ sediment control of the project area.

Big Canyon Creek carries trash, grease, oil, metals, nutrients, pathogens, and TSS from urban runoff and non-storm water pollutants that drain from the Big Canyon watershed into the creek and through three 12-inch pipes at the creek's mouth directly into the Upper Newport Bay Ecological Reserve. The Upper Newport Bay Ecological Reserve is a 303(d) listed impaired water body and has been closed to water-contact recreation since 1974. Shellfish harvesting has been prohibited in the Ecological Reserve since 1978.

The Big Canyon Creek Restoration Project will restore a natural drainage system and a healthy ecosystem including transition from mudflat, salt marsh, freshwater marsh, riparian, to upland habitats. The restoration activities and elements will collectively provide impoundment and filtration which will reduce pollutant loads into the Upper Newport Bay and help to achieve the TMDL goals defined by the Water Quality Control Board. In addition, chronic flooding and erosion problems will be controlled by proper grading, drainage, detention, and planting.

The proposed plan is to restore historic tidal influence by realigning Back Bay Drive. At least six acres of tidal wetlands would be created as a result of the project. The plan would also re-establish a brackish water transitional habitat between the tidal marsh and the upstream freshwater habitats. Slopes of the new tidal marsh would be gradual between tidal marsh and high marsh habitat. Once the new Back Bay Drive road is completed, the old road will be removed, allowing natural tidal flushing action to re-carve tidal channels and enhance the distribution of wetland plant and animal species. Included in the plan is the restoration and enhancement of riparian woodland, riparian scrub and alkali meadows, as well as upland coastal sage scrub habitats.

The anticipated project-related benefits are summarized below.

### Restore Tidal Marsh

The historic tidal wetlands at the mouth of Big Canyon Creek will be restored by dredging and relocating the existing parking lot out of the tidal area. The plan will result in the addition of 6.62 acres of coastal salt marsh. The restored tidal marsh will improve the transition between fresh and saltwater habitat, enhance habitat for benthic invertebrates, and increase habitat diversity and complexity. This restoration effort will result in an overall positive project impact on wetlands as shown in Tables 3.1-1 and 3.1-2.

### Improve Water Quality

As the water flows through the canyon, the natural meandering stream flow and system of riparian habitat, meadows, ponds, freshwater marsh and wetlands will act as natural filters, trapping pollutants, sediments, metals, bacteria and nutrients. The combined filtration and impoundment function of the freshwater pond, wetland and marsh system will prevent these contaminants from reaching Upper Newport Bay.

Additionally, water quality improvements will be provided through sand/gravel filters, erosion control, and end-of-pipe treatment at the lateral storm drain outlets (including bioswales, energy dissipators, and sand/gravel filters). The mid-canyon service road crossing area was identified as the most feasible location for placing additional water quality BMPs.

### Enhance Riparian Habitat

Riparian habitat throughout Big Canyon will be enhanced through removal of non-native invasive species such as Brazilian pepper tree and lollipop tree. Approximately 1.29 acres of riparian willow woodland will be restored adjacent to the new fresh water marsh and pond where ornamental pepper trees now exclude native species.

Mapping of invasive exotic species within native habitats resulted in four general zones for exotic removal with two general densities of invasive species, including large-to-small trees/shrubs at high density and medium-to-small trees/shrubs at medium-to-low density. Based on mapping of exotic species densities, approximately 4.32 acres of riparian and 0.25 acres of alkali meadow habitats have dense infestations of exotic species that will be removed and the native habitats planted. Additionally, 4.43 acres of riparian woodland, scrub and mulefat and 0.16 acres of alkali meadow habitats with less dense infestations will have spot removal of exotic species with some replanting.

### Enhance Coastal Sage Scrub Habitat

Restoration of approximately 3.3 acres of coastal sage scrub habitat and enhancement of 2.31 acres of coastal sage scrub habitat will occur with implementation of the project. Approximately, 1.78 acres of fragments of coastal sage scrub will be permanently removed by the project.

### Improve Drainage, Reduce Erosion and Sedimentation

The plan is intended to maintain the existing drainage course and floodplain upstream of the proposed freshwater pond, particularly in areas where natural meandering patterns exist. The only modification planned upstream of the freshwater pond is to eliminate the stagnant water downstream of the Jamboree Road culvert as part of the upper canyon maintenance road improvement. Elimination of this area of stagnant water will improve water quality. Additionally, the upper canyon maintenance road will be provided with improved erosion controls.

The low flow channel will be modified through the upper pond in order to provide more sediment deposition opportunities. Additionally, the lower pond outlet will be widened with multiple shallow pipes. Existing drainage at the service road crossing creates a major choking point for Big Canyon Creek. Under the proposed condition, the flow will be spread to a much wider area. A grade control pool made of stones or soil cement in a natural shape will be located downstream of the freshwater pond, as well as an open water zone for treatment wetland flow distribution.

Split flow under the low flow condition (up to 1000 cfs) at the trail dike will be the same as under the existing condition (10 to 15% of flow goes to the north branch riparian channel). However, split flow into the same channel will be reduced from 45% to 20% under high flow conditions. This change is not caused by drainage structure modification; rather, it is caused by moving Back Bay Drive inward. This realignment of the road reduces the length of overtopping flow along the trail dike from the south channel (freshwater marsh) to the north channel (riparian channel).

The erosion potential within the existing north riparian channel will be reduced during flood events due to the reduction in split flow into this channel branch. The lower discharge and velocities will prevent damages to riparian habitats and erosive sediments entering the tidal marsh and Upper Newport Bay.

To avoid flow concentration and provide better transition from tidal marsh to the freshwater marsh, a series of shallow culverts is proposed under the realigned Back Bay Drive. This is a significant improvement compared to the dam, drop structure and narrow outlet downstream of the freshwater marsh under current conditions.

### Enhance Public Use and Provide Interpretive Education

The plan is intended to enhance public use and educational opportunities and provide coordinated trail access and interpretive signage. Included in the plan are trails, public vehicular areas, parking, interpretative areas and other facilities. The components of the plan were identified to meet public and interpretive education needs to the greatest extent possible while not impacting restoration goals or practical considerations (*e.g.*, access to sewer line for necessary maintenance). Because there are many potential users, from organized groups to casual families, the plan was designed to accommodate them all.

The strategic placement of trails, boardwalks, and observation decks will allow visitors to explore the canyon without degrading the very resources that attract them to this site. The interpretive media will be designed as low-profile installations that inform with minimal interruption to the awe-inspiring views of the bay. Construction materials, including sign materials that are resistant to vandalism, ultraviolet radiation, and moisture, will hold up to the forces of nature and foot traffic.

# 5.0 CONSTRUCTION PHASING AND MAINTENANCE REQUIREMENTS

This section provides a description of both construction phasing and maintenance requirements. Section 5.1 discusses construction phasing and is organized into subsections related to invasive exotic species removal; native plant and topsoil salvage; and tidal marsh and Back Bay Drive construction. Section 5.2 identifies maintenance requirements and is organized into water quality and drainage system maintenance; weed abatement; freshwater marsh maintenance; and vector control and management.

## 5.1 Construction Phasing

The following subsections discuss construction phasing opportunities and requirements related to:

- Invasive exotic species removal
- Native plant and topsoil salvage
- Tidal marsh and Back Bay Drive construction

### 5.1.1 Invasive Exotic Species Removal

Certain areas of invasive Brazilian pepper trees and myoporum shrubs along the upper northern slopes of Big Canyon and on private property should be removed at the first opportunity (see Figure 3.1-3 Zones A and B). These trees and shrubs likely are the source of seed that have led to the invasion of native habitats within Big Canyon. Removal of these invasive species can start with a minimum of funding, and should proceed prior to grading. The removal of these trees and shrubs is essential to the long-term function of the proposed restoration of the riparian habitats and alkali meadow habitat within Big Canyon. An outreach program to landowners where these species are growing adjacent to Big Canyon should be implemented explaining the need to remove the plants, and a list of replacement plants that are attractive but not invasive should be part of the program.

Other areas of invasive exotic removal will be tied to the overall construction of the new ponds, followed by removal of exotics within existing habitats (see Figure 3.1-3, Zones C and D, and Figure 2.2-2 grading plans). Planting of native species appropriate to each habitat would follow removal of exotic species.

### 5.1.2 Native Plant and Topsoil Salvage

Prior to construction, salvage of native plants and topsoil will be implemented in the freshwater marsh, alkali meadow and costal sage scrub habitats. Salvaged materials can be stockpiled and stored in the upper area of the project. As areas are graded and constructed, appropriate salvaged topsoil can be replaced and salvaged plants can be planted in each habitat. Salvaged topsoil and plants speed the recovery of restoration by contributing soil organisms and seed sources native to Big Canyon.

### 5.1.3 Tidal Marsh and Back Bay Drive Construction Phasing

The majority of the restored tidal marsh will be constructed prior to the removal of the existing section of Back Bay Drive that will be realigned and any water control structures that currently control tidal water movement into the canyon. Existing wetland communities will be protected by leaving the existing Back Bay Drive as a barrier during construction of the new berm and roadway. Grading will restore a gradual slope up to the new roadway. Once the new road is completed, the existing road will be removed, allowing the natural flush of the daily tide to re-carve natural drainage patterns and re-distribute tidal wetland species into the newly graded areas.

## 5.2 Maintenance

The following subsections discuss maintenance requirements related to:

- Water quality and drainage system maintenance
- Weed abatement
- Freshwater marsh maintenance
- Vector control and management

### 5.2.1 Water Quality and Drainage System Maintenance

Maintenance for the tidal marsh, freshwater marsh, and freshwater pond areas is expected to be limited, involving only minor erosion repairs and monitoring for plant establishment for five years after construction. Areas that will be monitored for erosion include inlets and outlets into the freshwater pond and marsh areas. The outlet for the multiple culverts that enter the restored tidal marsh areas will likely require some maintenance to adjust to minor erosion events as the vegetation is established around the outlets. The wetland vegetation is expected to adequately establish as the hydrology establishes and not require maintenance, though replanting is expected in areas of erosion repair.

### 5.2.2 Weed Abatement

Restored riparian woodland, riparian scrub, alkali meadow, and coastal sage scrub habitats will require weed maintenance for approximately three years after the initial removal of invasive exotic species and subsequent planting and seeding of the habitats. This level of maintenance will be required because there is a certain amount of exotic plant seeds in the soil. As the native habitats develop, regular maintenance requirements will become less frequent. However, it is likely that over the long term some ongoing maintenance will be required every three to five years to monitor and control invasive exotic species that can invade Big Canyon from the surrounding urban development.

### 5.2.3 Freshwater Marsh Maintenance

The routine operation and maintenance (O&M) requirements for FWS wetlands are similar to those for facultative lagoons. They include hydraulic and water depth control, inlet/outlet structure cleaning, grass mowing on berms, inspection of berm integrity, wetland vegetation management, mosquito and vector control, and routine monitoring.

The water depth in the wetland may need adjustment on a seasonal basis or in response to increased resistance from the accumulating plant litter in the wetland channel.

Vegetation management in FWS wetlands does not include the routine harvest and removal of the harvested material. Plant uptake of pollutants represents a relatively minor pathway, so harvest and removal on a routine basis does not provide a significant treatment benefit. Removal of accumulated litter may become necessary if there are severe restrictions to flow. Generally, this will only occur if the wetland channels have been constructed with very high aspect ratios (>10:1).

### 5.2.4 Vector Control and Management

The mosquito population in the treatment wetland should be no greater than in adjacent natural wetlands. The following sections provide a description of proposed vector control and management activities recommended for the selected alternative. Surveillance and monitoring, as well as operations and management, activities are identified.

#### Surveillance and Monitoring

A two-phase surveillance and monitoring program is recommended. Each phase is defined by the level of vegetation growth established, rather than a predetermined time interval.

Phase 1 – Until Dense Vegetation is Established

- Adults: 5 traps placed once per month; year-round
- Larval Dipping: As needed where mosquito breeding habitat is present within wetland cells

Phase 2 – After Dense Vegetation is Established

- Adults: 5 traps placed once per week; year-round
- Larval Dipping: As needed where mosquito breeding habitat is present (*e.g.*, densely vegetated areas or areas with significant litter/detritus).

**Operations and Management**

The following operations and management recommendations apply to both Phase 1 and 2 (*i.e.*, both prior to and after vegetation is established).

*Source Reduction:* On each visit, observation of all areas within and adjacent to the wetlands should be made with the intent of identifying potential breeding sites including but not necessarily limited to: over-irrigated turf, lodged aquatic vegetation, and excessive litter buildup. Such conditions should be eliminated as soon as practical.

*Vegetation and Floating Debris:* All cut or free floating vegetative material and debris should be removed from wetland cells as soon as possible.

*Initial Mosquito Fish Stocking***:** If allowable by California Fish and Game, Mosquito fish (*Gambusia affinis*) rate of 200 fish (combination of male and female) per basin should be accomplished no later than March 15th of each year. California Fish and Game should be contacted to see if native fish species are available to assist in the control of mosquitoes.

*Fish Maintenance:* During the months of March through October, *Gambusia* "Mosquito Fish" should be stocked in each basin such that individuals are readily observed on a monthly basis in and around all vegetated areas of each wetland cell. Should the mosquito fish population decline to the point where they are not readily observable, maintenance stocking of 200 fish should be conducted as soon as possible.

*Treatment Capability:* It is recommended that the City of Newport Beach staff complete the necessary training to become State Certified to apply aquatic pesticides and herbicides. Further, if not already accomplished, the City of Newport Beach should seek to develop an employee capable of serving as a State of California Certified Qualifying Party with the necessary licenses to directly manage Certified Applicators in carrying out the activities associated with the integrated pest management program. If the City does not have individuals with the required licensing and certifications currently available, it is recommended that they contract with the appropriate resources until in-house capabilities are developed.

*Mosquito Larvicides*

Mosquito control should focus on larval control. Two *Bacilli* (*Bacillus thuringiensis* variety *israelensis* (*Bti*) and *B. sphaericus* (*Bs*)), which are microbial agents formulated as crystalline bacterial spores that are ingested by mosquito larvae and cause the cell walls of the larval digestive system to burst (VCD, 2002), are currently registered for use against mosquitoes in much of the United States. *Bs* is more effective against mosquitoes in organically enriched waters such as wastewater effluents but has a narrower host range. *Bs* is very effective in controlling *Culex sp*. mosquitoes and according to the product label is reported to control several other mosquito species including *Aedes vexans, Aedes melanimon, Aedes stimulans, Aedes nigromaculis, Aedes triseriatus, Aedes solilicitans,*

*Anopheles quadrimaculatus,* and *Coquillettidia perturbans*. *Bti* controls a broader spectrum of mosquito species and can be used to control chironomids such as midge fly larvae.

*Bacillus* toxins are target specific and are safe to humans and other nontarget organisms under current application rates and modes of contact (Walton and Mulla, 1992). A possible pitfall of *Bs* is the potential for mosquito targets to develop immunity to the mosquitocidal toxins. *Bti* contains multiple toxins whereas *Bs* contains only one. To mitigate the possibility of developing a resistance to *Bs*, *Bti* may be applied in lieu of, or in combination with *Bs* once a month during peak mosquito seasons. On the forefront is the development of an agent that combines the *Bs* mosquitocidal toxin with those of *Bti* (Federici et al., 2003). Since both agents are currently registered with the EPA, it is thought that regulatory approval will be expedited and the new agent will be introduced on the commercial market in the near future (Walton, 2002).

Application of the granular larvicides in a slurry form is often done mechanically from truck-mounted equipment or can be applied aerially over larger sites. Both methods allow more complete basin coverage and enhanced penetration of densely vegetated areas, which will result in significantly reduced larval counts. Currently available land-based broadcast equipment can effectively reach approximately 175-ft. If emergent zones occur at a greater distance from shore, application can be effected from a boat or aircraft. It typically takes 24 - 72 hours after treatment for complete larval mortality and the residual appears to control larval development for a period of 3 to 25 days post application, with less rapid mortality rates and longer residual control associated with *Bs*.

Another type of larvicide uses a juvenile hormone, methoprene, to prevent maturation of mosquito larvae. The chemical prevents the mosquito from maturing beyond the pupa stage; the time in its development when it ceases to feed. Ultimately the larva starves and dies. The material does not need to be consumed. If properly dosed and applied, the chemical is directly absorbed by larvae present in the environment.

Methoprene has a very low toxicity to non-target organisms and is toxic to fly (Dipteran) larvae. Thus, the material will also help manage midgefly and blackfly larvae. Commercial products come in both liquid and solid (granule or briquet) formulations.

One of the advantages of methoprene is its ability to maintain efficacy over a long period of time. Methoprene is very resistant to photo- and thermal degradation. Granular products remain effective up to 30 days, and 30-and 150-day efficacy briquets are available. Because of these characteristics, methoprene is an excellent choice for semi-permanent pools or ponds, and areas or structures frequently wetted by storm waters or other runoff. Pellets or briquets can be placed in these areas where the larvicide will remain inactive until wetted. If the area dries rapidly, the remaining material does not decompose readily and will be reactivated when re-wetted.

## 6.0 PERMITTING AND CEQA COMPLIANCE

The following resource agency permits will be required for this project:

- Section 404 of the CWA: Nationwide Permit (NWP) 27 application to be submitted to the USACE.
- Section 7 of the Endangered Species Act (ESA): If the USACE determines that the project may affect a federally listed species, it may request Section 7 consultation from the USFWS to comply with the ESA.
- Section 401 of the CWA: Water Quality Certification application to be submitted to the RWQCB.
- Section 2801 of the California Endangered Species Act: A consistency determination from the state will be sought after any USFWS Biological Opinion is issued.
- Section 1600 of the Fish and Game Code: A Lake or Streambed Alteration Agreement will be sought from the DFG.
- California Coastal Act: Because portions of Big Canyon are considered ESHAs, a Coastal Development Permit application will be submitted to the City of Newport Beach under its local coastal program (LCP).

### 6.1 CEQA Compliance

A Draft Initial Study/Mitigated Negative Declaration (IS/MND) has been prepared by the City of Newport Beach to evaluate the potential environmental effects of the proposed project. The IS/MND is included as Appendix K. It was prepared in accordance with CEQA, Public Resources Code §21000 et seq., and the State CEQA Guidelines, California Code of Regulations (CCR) §15000 et seq.

Based on the IS and supporting environmental analysis, the proposed Big Canyon Creek Restoration Project would result in less-than-significant impacts for the following issues: aesthetics, agricultural resources, air quality, biological resources, cultural resources, geology and soils, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation/traffic, and utilities and service systems.

In accordance with §15064(f) of the CEQA Guidelines, a MND shall be prepared if the proposed project will not have a significant effect on the environment after the inclusion of mitigation measures in the project. Based on the available project information, and the environmental analysis presented in the MND/IS, there is no substantial evidence that, after the incorporation of mitigation measures, the proposed project would have a significant effect on the environment. It is proposed that a Mitigation Negative Declaration be adopted in accordance with the CEQA Guidelines.

### 6.2 Permitting Compliance Issues

Permitting compliance issue discussions in Section 6.2 are organized into four subsections, as follows:

- USACE (Section 404)
- DFG
- Coastal Commission Development Permit
- City Permits

#### 6.2.1 Corps of Engineers (Section 404)

Section 404 of the CWA gives EPA and USACE regulatory and permitting authority regarding the discharge of dredged or fill material into “navigable waters of the United States.” The USACE also has jurisdiction over “navigable waters” under Section 10 of the Rivers and Harbors Act of 1899.

"Navigable waters of the U.S.", as defined in 33 CFR Part 329, are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.

USACE regulations set forth that certain dredging and filling activities within Section 404 jurisdiction are authorized on a NWP basis and will not require a detailed individual permit review process. The Big Canyon project will involve creation of tidal wetlands and waters and enhancement of riparian, open water, and freshwater marsh areas. These activities are expected to be authorized under NWP 27, which covers wetland restoration projects.

The USACE will likely require mitigation for impacts to jurisdictional wetlands and waters. The proposed project is intended to be self-mitigating, with a project goal of creating and restoring sensitive habitats onsite. The conditions within NWP 27 allow for some impacts to wetlands and "waters of the United States" as long as there is a net benefit to wetlands and natural resources. Because the project will result in an overall improvement of wetland functions and values, as well as a net gain in 2.98 acres of jurisdictional area, the project is in compliance with USACE policy of no net loss of wetland habitat as a result of the project.

A detailed project description must be submitted to the USACE as part of the NWP 27 including a "Habitat Mitigation and Monitoring Plan" in a format acceptable to the USACE. The monitoring plan must contain performance standards that will be used to judge the success of the project and a detailed monitoring program to be implemented by the applicant. The USACE will also require that the mitigation required by other agencies such as the RWQCB, the CCC, and the USFWS be implemented by the project.

Additionally, an essential fish habitat (EFH) assessment will be necessary during the USACE permitting process and, therefore, will be performed. However, the EFH assessment is outside the scope of this feasibility study.

**Regional Water Quality Control Board (Section 401)**

Section 401 of the CWA and EPA Section 404(b)(1) Guidelines require that the discharge of dredged or fill material into "Waters of the State" does not violate state water quality control standards. The term "Waters of the State" is defined by the Porter-Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state." "Waters of the State" are regulated by the RWQCB under the State Water Quality Certification Program which regulates discharges of fill and dredged material under Section 401 of the CWA and the Porter-Cologne Water Quality Control Act. The RWQCB protects all waters in its regulatory scope, but has special responsibility for wetlands, riparian areas, and headwaters. RWQCB jurisdiction also includes hydrologically "isolated" wetlands and waters that may not be regulated by the USACE under Section 404.

Projects that require a USACE permit, or fall under other federal jurisdiction, and have the potential to impact "Waters of the State" (excavation, dredging, or fill in these areas) will require submission of a Section 401 water quality certification from the RWQCB. An application package will be prepared and submitted to the RWQCB for their review and approval. State law requires that a final environmental document developed under CEQA must be reviewed before certification can be issued. The 401 application may be submitted before the draft and final Mitigated Negative Declaration is complete for this project; however the final and certified CEQA document must be submitted as soon as possible following application submission. If the CEQA document will not be finalized for some time, the State or Regional Board may deny

the project to comply with a mandated time frame to act on a complete application.

As previously discussed in 6.2.1, on-site wetland mitigation has been incorporated into the project design. A Habitat Mitigation and Monitoring Plan will be submitted with the Section 401 Water Quality Certification application. The plan will be prepared in a format that is acceptable to the RWQCB and will address impact protection measures and a monitoring program to ensure that placement of fill material into on-site "Waters of the State" does not violate state water quality control standards.

**Section 7 Consultation Issues**

Section 7 consultation issues related to the USFWS and National Marine Fisheries Services (NMFS) are identified in the following paragraphs.

USFWS

Permit decisions of the USACE under Section 404 of the CWA require compliance with other federal laws, including the ESA. The federal ESA requires that all federal agencies ensure that their actions do not jeopardize the continued existence of listed species or adversely modify the species' critical habitat. Therefore, the ESA may be an issue for project activities disturbing wetlands or other habitats only when the property contains a federally listed threatened or endangered species that may be adversely affected by a permit decision. In that event, the USACE must initiate consultation with USFWS (or NMFS) pursuant to Section 7 of the federal ESA. The USACE is required to provide to the USFWS all available information regarding the potential effect of the permit action on the listed species. This procedure may require the USACE to prepare a biological assessment of the effect of the permit action (but not necessarily the effect of the entire project) on the listed species. If formal consultation is required, USFWS or NMFS will issue a biological opinion stating whether the permit action is likely to jeopardize the continued existence of the listed species.

Project construction in the existing tidal marsh habitat may result in impacts to federally listed endangered salt marsh bird's beak (Cordylanthus maritimus ssp. maritimus) if individuals are present during the construction phase of the project. Specific project elements that have potential to affect this species include removal of Back Bay Drive, grading in the marsh to achieve a gradual elevation transition, and operation of heavy machinery to achieve the removal of the existing parking lot and interpretive center.

In addition, there may be potential impacts to the California gnatcatcher associated with construction of the parking lot and public use areas. The Service will likely require some additional buffers for habitat occupied by the gnatcatcher.

NMFS

No impacts are expected to the tidewater goby (*Eucyclogobius newberryi*), although this species is listed with the California Natural Diversity Database (CNDDB) as potentially occurring in the area. If the goby is not expected to occur, and if no other federally listed marine species have the potential to occur in Big Canyon, then consultation with the NMFS is not required. In comments to the draft version of this report, NMFS indicated that it does not have responsibility for the tidewater goby, but that it is under the purview of the U. S. Fish and Wildlife Service.

### 6.2.2. California Department of Fish and Game

The DFG has jurisdictional authority over riparian and habitat associated with rivers, streams, and lakes under California Fish and Game Code Sections 1600-1607. DFG has authority to regulate work that will substantially divert, obstruct, or change natural flow of a river, stream, or lake; substantially change the bed, channel, or

bank or a river, stream or lake; or use material from a streambed. The project proponent will enter into a DFG Section 1602 Streambed Alteration Agreement for all work that will modify existing stream channels and ponds onsite. DFG can impose conditions on the agreement to ensure no net loss of wetland values or acreage. Because DFG includes under its jurisdiction streamside habitats that under the federal definition may not qualify as wetlands on a particular site, their jurisdiction may be broader than that of the USACE. Riparian forests located outside of the plain of the ordinary high water mark of streams did not exhibit all three parameters to be regulated as wetlands, but may be regulated by DFG.

The restoration plan proposes preserving the existing upper canyon sewer maintenance road and providing improved erosion controls. A new entrance from Jamboree Road to the existing maintenance road will be constructed (Figure 2.2-2). Additionally, a maintenance road creek crossing will be constructed to allow routine access to the sewer manhole located on the north bank of the creek near Jamboree Road. There are no known sensitive species within the creek and no mitigation is expected.

Impacts to the creek may occur if the optional water quality berm is placed near the City sewer crossing. The stream and riparian area will be modified to construct the freshwater pond and its embankment (which is the service road crossing). Finally, the existing pond habitat to the east of Back Bay Road will be modified with the realignment of the road and conversion to salt marsh habitat.

A formal application for the notification for streambed alteration will be submitted to DFG prior to project construction. The application will include information about site location and conditions, a description of the proposed project, the type and quantity of material to be removed, displaced, or added, construction methods proposed, impacts to vegetation, fish, and wildlife resources, and proposed mitigation measures for these impacts.

Required mitigation for anticipated 0.87 acre of impact to riparian habitat may include habitat enhancement or creation measures. Currently, proposed mitigation for project impacts to riparian areas is onsite riparian habitat includes enhancement of existing riparian areas through the removal of non-native Brazilian pepper tree (*Shinus terebinthifolius*), and planting native riparian species such as willows (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*). Pockets of newly created riparian habitat have been identified in three additional areas.

An estimated 5.16 acres of riparian woodland, riparian scrub and alkali meadow will be restored by the removal of high densities of invasive exotic species followed by planting and seeding. An additional 4.43 acres of riparian woodland, riparian scrub and alkali meadow will be enhanced by spot removal of invasive exotic species.

### 6.2.3 Coastal Commission Development Permit

The California Coastal Commission (CCC) has jurisdiction over wetlands and other ESHAs in the coastal zone under both state legislation (California Coastal Act of 1976) and federal legislation (Coastal Zone Management Act or CZMA). Under the Coastal Act, local agencies within the coastal zone must develop a LCP for Coastal Commission certification. All of the Big Canyon Site is included in the coastal zone and regulated under the City of Newport Beach LCP. The federal CZMA requires federal permit applicants to obtain a certification that activities proposed within the coastal zone are consistent with state coastal zone management programs.

For projects affecting wetlands or ESHAs within the coastal zone, permit applicants must demonstrate that the proposed activity will be conducted in a manner consistent the CZMA, California Coastal Act, and the

LCP before a coastal development permit is issued. Other ESHAs on the Project Area include riparian habitat and native California Coastal Sagebrush scrub. These habitats, as well as suitable buffers from their upland edge, are regulated under the LCP.

### 6.2.4 City Permits

Construction plans and specifications will require review approval by the Public Works Department of the City of Newport Beach. The plans and specifications will be prepared according to the public works standards of the City of Newport Beach, Orange County Public Facilities & Resources Department, and American Public Works Association, as well as supplemental statements of Caltrans and the USACE. Submittals will be made at the 35, 75, 90 and 100% design levels. Design backup data will be submitted with the 90% plan.

The final design drawings and design specifications will conform to Standard *Specifications for Public Works Construction,* ADA requirements, and requirements of the City of Newport Beach *Design Criteria, Special Provisions and Standard Drawings for Public Works Construction,* 2004 Edition, which augments the *Standard Specifications for Public Works Construction,* latest revision.

## 7.0 PROJECT COST ESTIMATES

Table 7.0-1 provides preliminary cost estimates for the refined plan.

Cost estimates presented in this section are preliminary based on conceptual designs, and should only be used for planning-level purposes; they should be refined once final designs are developed.

**TABLE 7.0-1**
**Concept Plan Probable Construction Cost Estimates**

| | |
|---|---|
| Riparian/Upland Restoration | $254,600 |
| Upper Canyon Manhole Maintenance Road | $350,000 |
| Riparian/Upland Habitat Enhancement | $197,700 |
| Freshwater Pond (Upper) | $331,700 |
| Freshwater Pond (Lower) | $650,000 |
| Freshwater Marsh Modification | $55,600 |
| New Back Bay Drive | $1,000,000 |
| Tidal Marsh | $700,000 |
| Interpretive Area | $806,000 |
| Other Facilities | $160,000 |
| Subtotal Construction | $4,506,000 |
| Construction Contingency (40%) | $1,802,400 |
| TOTAL CONSTRUCTION | $6,308,400 |

## 8.0 CONSTRUCTION FUNDING

This section provides a discussion of potential sources of funding for the Big Canyon Restoration Project and should be considered within the context of the preliminary costs for the preferred project that were identified in Section 7, Project Costs. Section 8.1 identifies potential sources of grant funding and is organized in two subsections – Section 8.1.1, Potential State and Federal Funding Sources; and Section 8.1.2, Potential Local and Private Funding Sources.

### 8.1 Sources of Potential Grant Funding

This section is intended to provide a survey of available grant funding opportunities, and associated funding cycles, that are specific to the preferred project type. Both the level of available funding, and the requirements for a project to be funded, are subject to change over both short- and longer-term time horizons. Therefore, the information presented in the following sections should be revisited prior to future discussions with funding source representatives or formal submission of proposals.

#### 8.1.1 Potential State and Federal Funding Sources

A key source of state funding and state-administered Federal appropriations is the ongoing Consolidated Grants Program. The most recent program, the 2005-06 Consolidated Grants, integrated and coordinated related grant programs for watershed protection, water management, agricultural water quality, drinking water, urban storm water, and non-point source pollution control. Approximately $143 million was expected to be made available from six interrelated grant programs administered by the State Water Board's Division of Financial Assistance. Because there is some consistency in year-to-year priorities, the most recent funding cycle may serve as a baseline of analysis for upcoming cycles. Federal and state grant funding opportunities – including those available in the most recent Consolidated Grants Program – are identified in Table 8.1-1.

#### 8.1.2 Potential Local and Private Funding Sources

In addition to state and Federal grant funding sources, there are numerous local and private resources providing funding for a variety of environmentally-focused projects in Orange County. These resources include small foundations, major landowners and corporations. In fact, one private source – the Irvine Ranch Land Reserve Trust – has been a key contributor to the Big Canyon Restoration Project to date.

The majority of local and private funding sources provide small grants unrelated to capital/construction funding. Examples include (1) the CM and Edna Cotton Family Foundation and (2) the Lillian Sherwood Griswold Foundation, both of which provide small grants for environmental education. Past funding sources in this category include the San Francisco-based Bella Vista Foundation, which provided $25,000 to Community Conservancy International for pre-restoration technical and scientific studies for the Big Canyon Creek Restoration Project in 2004.

However, it is important to note that certain local and private sources may provide construction funding. A survey of such sources includes the following: (1) Donald L. Bren Foundation, (2) Environment Now Foundation, (3) Gochnauer Family Foundation, (4) Robert and Margaret Green Foundation, and (5) Ingram Micro Corporate Giving Program. While these funding sources generally lack the systematic selection criteria and funding level availability of their state and Federal counterparts, they may be considered as part of a comprehensive project funding strategy.

## TABLE 8.1-1
## STATE AND FEDERAL GRANT FUNDING SOURCES

| Funding Source | Eligible Applicants | Eligible Project Types | Notes |
|---|---|---|---|
| Proposition 40<br>Nonpoint Source Pollution Control Program | Local public agencies and non-profit organizations. | Projects that protect the beneficial uses of water throughout the state through the control of nonpoint source pollution. | The Nonpoint Source Pollution Control Program was funded as part of the 2005-06 Consolidated Grants Program. Projects awarded funding ranged from $375,000 to $5,000,000. |
| Proposition 50<br>Coastal Nonpoint Source Pollution Control Program | Municipalities, local public agencies, educational institutions, and non-profit organizations. | Projects that restore and protect the water quality and environment of coastal waters, estuaries, bays and near-shore waters, and groundwater. | Funds available as part of the 2005-06 Consolidated Grants Program. Funds must be encumbered by June 2008 and must be spent by June 2010. At least $10 million will fund high priority coastal and ocean protection projects that specifically address the priorities of both the State Water Resources Control Board and the Ocean Protection Council. |
| Federal CWA Section 319 Program | Nonprofit organizations, local government agencies including special districts, Indian tribes, and educational institutions.<br>State or federal agencies may qualify if they are collaborating with local entities and are involved in watershed management or proposing a statewide project. | 1. Implementation of measures and practices that reduce or prevent nonpoint source pollution to ground and surface waters.<br>2. Projects consistent with Total Maximum Daily Loads, local watershed-based plans, and the California Nonpoint Source Program Plan.<br>3. Projects can include restoration and public education/outreach. | Annual funding of approximately $4.5 - 5.5 million per year under CWA Section 319. Funds were available as part of the 2005-06 Consolidated Grants Program. |

## TABLE 8.1-1
## STATE AND FEDERAL GRANT FUNDING SOURCES

| Funding Source | Eligible Applicants | Eligible Project Types | Notes |
|---|---|---|---|
| Proposition 40<br>Urban Storm Water Grant Program | Local public agencies. | Projects designed to implement stormwater runoff pollution reduction and prevention programs, including diversion of dry weather flows to publicly owned treatment works for treatment, acquisition, and development of constructed wetlands and the implementation of approved BMPs, as required by stormwater permits. | Proposition 40 Urban Storm Water Grant Program is a new funding program and the specific requirements are in the process of being established. Funds were available as part of the 2005-06 Consolidated Grants Program. |
| Proposition 40<br>Integrated Watershed Management Program | Public agencies and non-profit organizations. | Projects for development of local watershed management plans and for implementation of watershed protection and water management projects | The Integrated Watershed Management Program was funded as part of the 2005-06 Consolidated Grants Program. Total funding of up to $47.5 million was expected to be awarded. |
| Proposition 50<br>Clean Beaches Initiative (CBI) Grant Program | Local public agencies, non-profit organizations, state and Federal agencies. | CBI Grant Program provides funding for projects that restore and protect the water quality and the environment of coastal waters, estuaries, bays, and near shore waters. Funding priority is given to projects that reduce postings and closures on California public beaches caused by bacterial contamination. | The current concept proposal solicitation period for submission of project proposals via the State Water Board's Financial Assistance Application Submittal Tool opened on October 26, 2006 and closes on Wednesday, January 31, 2007. The 2005/06 Budget Act appropriated $23 million of Proposition 50 funds for CBI projects. |

## TABLE 8.1-1
## STATE AND FEDERAL GRANT FUNDING SOURCES

| Funding Source | Eligible Applicants | Eligible Project Types | Notes |
|---|---|---|---|
| National Fish and Wildlife Foundation (NFWF) / National Association of Counties (NACo) / National Oceanic & Atmospheric Administration's (NOAA) Community-based Restoration Program<br><br>Coastal Counties Restoration Initiative | NACo member counties or public or nonprofit private agencies, institutions, and organizations, educational institutions, and any form of local government working in partnership with a NACo member county are eligible for funding. | Funds innovative, high quality county-led or supported projects that support wetland, riparian and coastal habitat restoration projects. | Grants will be awarded through a competitive process to eligible grant recipients. Grants that are community-based in nature and willing to work in partnership with NOAA will be given special consideration, as NOAA's Community-based Restoration Program is providing major financial support for this partnership. Grants will range from $25,000-$100,000, based upon need. |
| NFWF General Matching Grants | Federal, state, and local governments, educational institutions, and nonprofit organizations. | The NFWF awards matching grants to projects that address priority actions promoting fish and wildlife conservation and the habitats on which they depend, work proactively to involve other conservation and community interests, leverage Foundation-provided funding, and evaluate project outcomes. | Project proposals are received on a year-round, revolving basis with two decision cycles per year. Grants typically range from $25,000-$250,000 (based upon need). |

## TABLE 8.1-1
## STATE AND FEDERAL GRANT FUNDING SOURCES

| Funding Source | Eligible Applicants | Eligible Project Types | Notes |
|---|---|---|---|
| Proposition 50<br>California River Parkways Grant Program | Public agencies and nonprofit organizations. | Eligible projects must provide public access or be a component of a larger parkway plan that provides public access. In addition, projects must meet two of the following conditions:<br>1. Provide compatible recreational opportunities including trails for strolling, hiking, bicycling, and equestrian uses along rivers and streams.<br>2. Protect, improve, or restore riverine or riparian habitat, including benefits to wildlife habitat and water quality.<br>3. Maintain or restore the open-space character of lands along rivers and streams so that they are compatible with periodic flooding as part of a flood management plan or project.<br>4. Convert existing developed riverfront land into uses consistent with river parkways.<br>5. Provide facilities to support or interpret river or stream restoration or other conservation activities. | Competitive award program. Applications for latest funding cycle were submitted under an October, 2006 deadline. Parking and/or road improvement elements of a project can only be a minor component of overall project to qualify for funding. |

## TABLE 8.1-1
## STATE AND FEDERAL GRANT FUNDING SOURCES

| Funding Source | Eligible Applicants | Eligible Project Types | Notes |
|---|---|---|---|
| California Department of Parks and Recreation (DPR)<br>Habitat Conservation Fund Program | Cities, counties and districts are eligible to apply. | Projects involving the enhancement or restoration of:<br>1. Wetlands.<br>2. Aquatic habitat for spawning and rearing of anadromous salmonids and trout resources.<br>3. Riparian habitat. | Funding will be provided annually from July 1, 1990 to July 1, 2020; $2 million is available under the program (annually). The program provides funds to local governments under the California Wildlife Protection Act of 1990. |
| California DPR / National Parks Service (NPS)<br>Land and Water Conservation Fund | Cities, counties and districts authorized to acquire, develop, operate and maintain park and recreation areas. | Acquisition or development of outdoor recreation areas and facilities. Priority development projects include trails, campgrounds, picnic areas, natural areas and cultural areas for recreational use. | Grants for local agencies are divided 60% for southern California and 40% for northern California. There is a 50% match requirement. The next application deadline is May 1, 2007. |
| California DPR / Federal Highway Administration (FHWA)<br>Recreational Trails Program (RTP) | Cities, counties, districts, state agencies and nonprofit organizations. | Development and rehabilitation of trails, trailside and trailhead facilities, as well as construction of new trails. | The RTP provides funds annually for recreational trails and trails-related projects. The RTP is administered at the state level by the California DPR. Non-motorized projects are administered by the Department's Office of Grants and Local Services.<br>The maximum amount of RTP funds allowed for each project is 88% of the total project cost. Applications are generally due in early October. |
| California Wildlife Conservation Board (WCB)<br>California Riparian Habitat Conservation Program (CRHCP) | Nonprofit organizations, local government agencies, state departments and Federal agencies. | Riparian conservation projects (acquisition and restoration). | WCB accepts applications for funding on a continuous basis and relies on the DFG to review, recommend funding and assist with assigning priorities on proposed projects. |

**TABLE 8.1-1**
**STATE AND FEDERAL GRANT FUNDING SOURCES**

| Funding Source | Eligible Applicants | Eligible Project Types | Notes |
|---|---|---|---|
| California WCB<br>Habitat Enhancement and Restoration Program | Nonprofit organizations, local government agencies, state departments and federal agencies. | Eligible enhancement and restoration projects must provide for the long-term maintenance of the restored and/or enhanced habitat | WCB accepts applications for funding on a continuous basis and relies on the DFG to review, recommend funding and assist with assigning priorities on proposed projects. |
| NACo / NFWF / Wildlife Habitat Council, in cooperation with the U.S. Environmental Protection Agency (EPA)<br>Five-Star Restoration Matching Grants Program | Local governments; public and private organization, agencies. | Community-based wetland, riparian and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities. Projects must include a strong on-the-ground wetland, riparian, or coastal habitat restoration component and should also include training, education, outreach, monitoring, and community stewardship components. | Awards are between $5,000 and $20,000; the average grant is about $13,000. Current funding cycle applications are due March 7, 2007. |

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