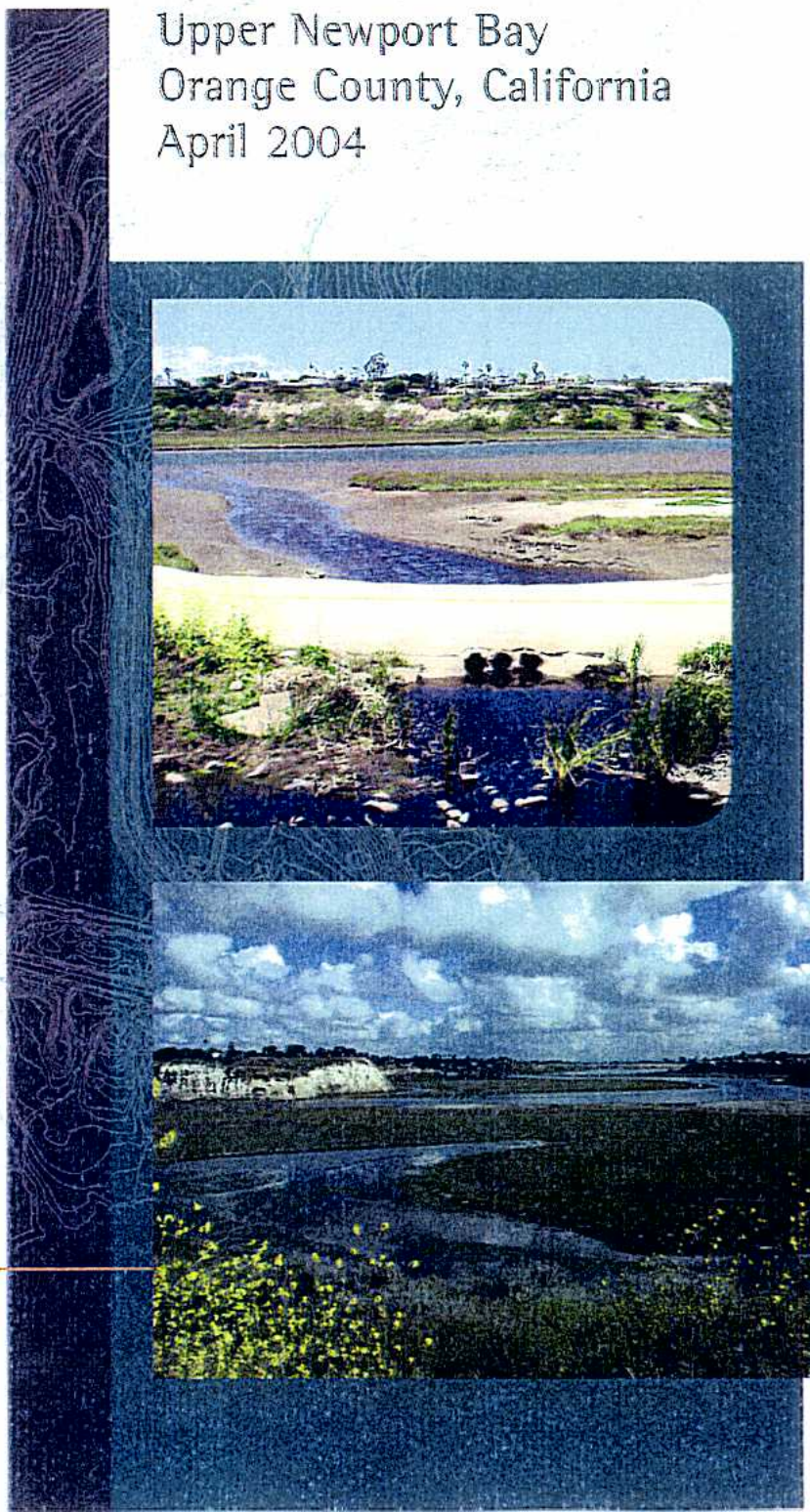
Prepared by Community Conservancy International

BIG CANYON CREEK

Historic Tidal Wetlands Conceptual Restoration Plan



Upper Newport Bay
Orange County, California
April 2004

Coastal Conservancy

Newport Bay Naturalists & Friends

City of Newport Beach California

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Funded by

California Coastal Conservancy,
Southern California Wetlands Recovery Project

City of Newport Beach

Community Conservancy International

Newport Bay Naturalists and Friends

PROJECT TEAM:

Project Direction and Development	Community Conservancy International
Aerial & Ground Survey	3Di West
Biological Assessment	Coastal Resources Management Keane Biological Consulting
Engineering, Hydrology, Soils	WRC Consulting Services Tetra Tech Coastal Frontiers Corporation
GIS Mapping	GreenInfo Network
Habitat Restoration	Earthworks Construction & Design Wetlands Research Associates
Landscape Architecture	Withers Sandgren Landscape Architecture Lynne Dwyer, Landscape Architect

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SPECIAL THANKS

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Cover photos:	Withers Sandgren Landscape Architects, Jim Cokas Graphic Design

Upper Newport Bay

FIGURE 1.1

Big Canyon Creek Project Location

Community Conservancy International

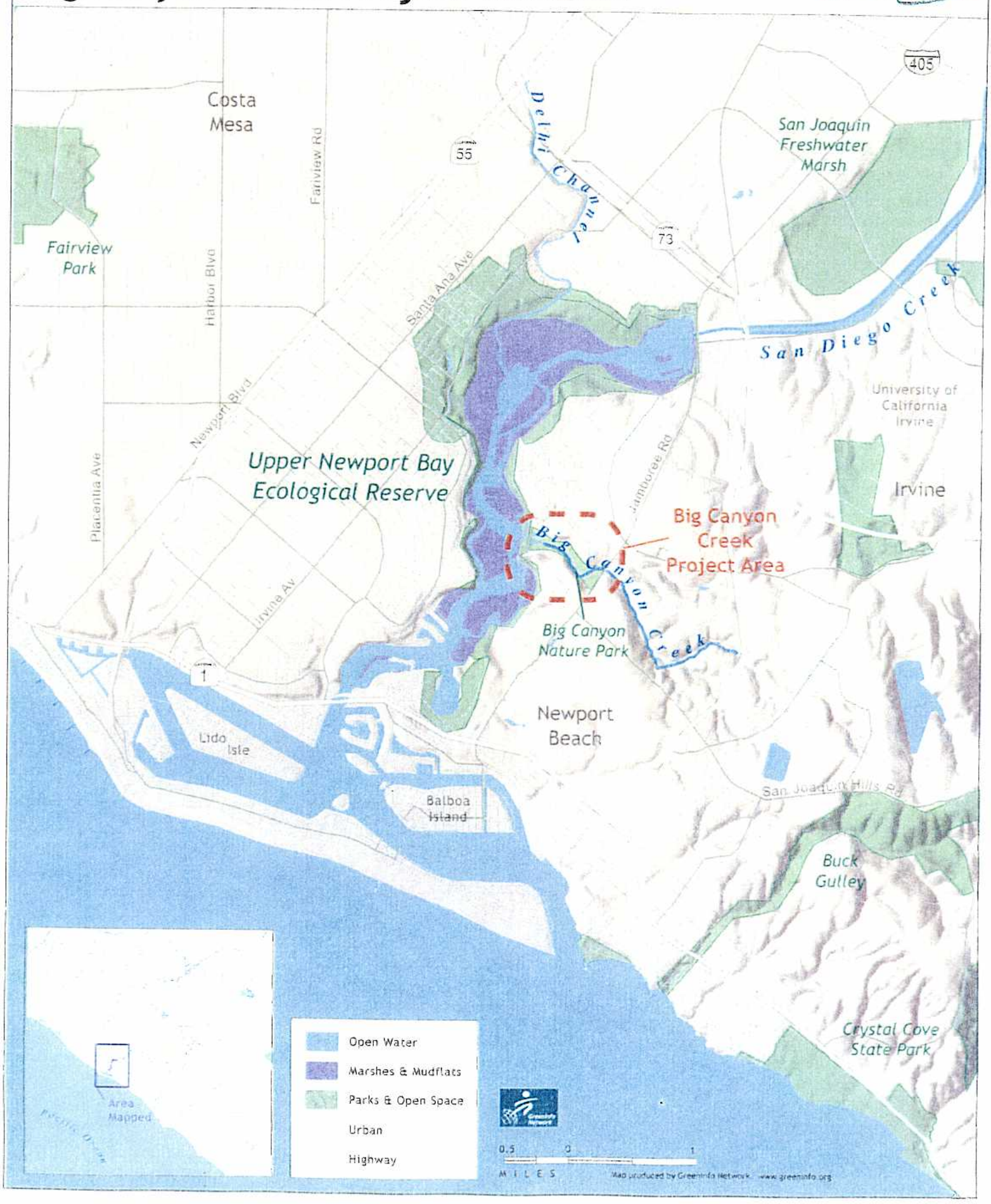


FIGURE 1.2

BIG CANYON TOPOGRAPHY

Section 1
EXECUTIVE SUMMARY

INTRODUCTION

Community Conservancy International (CCI) is pleased to present this Historic Tidal Wetlands Conceptual Plan for Big Canyon Creek in Upper Newport Bay, Orange County, California. Funded by the City of Newport Beach and the California Coastal Conservancy Southern California Wetlands Recovery Project, with additional support from CCI and Newport Bay Naturalists and Friends, this conceptual plan is the result of more than a year of effort by CCI, many scientific and technical experts, federal, state, regional and local public agencies, conservation organizations and community members. CCI directed the planning effort, which included field research, site surveys, engineering and hydrological studies, historical research, GIS mapping, restoration analysis and design, public meetings and coordination with all involved public agencies.

Big Canyon Creek drains directly into Upper Newport Bay and runs through the 70-acre Big Canyon natural open space area in the City of Newport Beach; the lower half of Big Canyon is within the Upper Newport Bay State Ecological Reserve. With easy road access via Back Bay Drive, Big Canyon provides the key public access for the east side of Upper Newport Bay, attracting hundreds of thousands of visitors annually. Big Canyon is the only natural, undeveloped portion of the Big Canyon Creek Watershed, and the only significant remaining natural canyon on the east side of the Bay.

SPECIAL ECOLOGICAL SIGNIFICANCE OF UPPER NEWPORT BAY

The Big Canyon Creek Restoration Project is particularly significant both because of the ecological importance of Upper Newport Bay as an estuary and because of the severity of threats to its ecological integrity and health. Upper Newport Bay is especially important in Southern California because it has the largest number of wetland sub-habitats of all estuaries from Point Conception to the Mexican border, and is the only remaining Southern California wetlands system that still has all the habitat types of a coastal wetlands. Upper Newport Bay is even more important today because Southern California has already lost more than 80% of its coastal wetlands.

SERIOUS PROBLEMS IN BIG CANYON AND UPPER NEWPORT BAY

Natural tidal flow into Big Canyon was destroyed in the 1930s with the construction of Back Bay Drive, which effectively created a ten-foot high dam and destroyed more than five acres of tidal wetlands. There has been significant habitat degradation throughout the canyon due to decades of dumped dredge spoils and piecemeal projects, invasive non-native plants from surrounding developed areas, erosion, and lack of a comprehensive plan. Dumped dredge spoils in Big Canyon have resulted in large areas of saline and infertile soils, which cannot support native plant communities. The freshwater pond, constructed in the 1980s, is now a very shallow basin filled with sediment, with water temperatures too hot to support native populations.

Big Canyon Creek drains a two-square-mile urbanized watershed directly into Upper Newport Bay. The creek carries fertilizers, pesticides, heavy metals and other toxic pollutants. Contaminated water from unfiltered urban runoff carried by Big Canyon Creek is a serious problem, with direct impacts on Upper Newport Bay and the nearly 500 species of animals, fish and plants that depend on the Bay for survival. Big Canyon Creek carries unfiltered urban runoff from a two square mile urbanized watershed; this runoff contains fertilizers, pesticides, bacteria, metals and other pollutants directly into the Bay. The Bay is listed as an impaired water body under the federal Clean Water Act due to the high levels of pollutants flowing into the Bay.

Despite decades of human impacts, Big Canyon still supports a diversity of habitats and species, including 42 plant communities, 16 birds and plants that are endangered, threatened or of special concern, and well over 100 bird species. Big Canyon supports the largest population of the endangered Salt Marsh Bird's Beak in Southern California. Big Canyon includes a broad range of

habitats, ranging from open water channels, tidal wetlands, saltmarsh and mudflats, freshwater marshes, meadows, riparian woodlands, grasslands and coastal sage scrub. However, many are fragmented, discontinuous or threatened by invasive non-native species. Of Big Canyon's 202 plant species, 86 are native and 116 are non-native.

PROJECT PURPOSE

The Big Canyon Creek Restoration Project was developed to address serious water contamination, destruction of natural tidal flow, loss of tidal wetlands, dumped dredge spoils, erosion, flooding, habitat degradation and public access, trail and interpretive needs in Big Canyon.

The Big Canyon Creek Restoration Project focused on evaluating the potential for restoring tidal influence to Big Canyon Creek and re-establishing natural transitions between woodlands, freshwater marsh, salt marsh, mudflats and the Bay's open water channels. The project also includes providing improved, habitat-sensitive public trail access, scenic overlooks and interpretive opportunities throughout Big Canyon, improving drainage, removing dredge spoils and other infertile soils, repairing flood damage, addressing contaminated urban runoff into the creek, removing invasive non-natives, restoring native habitats and addressing the degraded freshwater pond constructed in the 1980s.

The Historic Tidal Wetlands Conceptual Plan for Big Canyon Creek addresses all of these issues as holistically as possible, while taking into consideration site constraints, maintenance needs and public safety issues. Long-term sustainability and feasibility of implementation were also key considerations in developing this conceptual plan.

SCIENTIFIC AND TECHNICAL STUDIES, RESEARCH AND RESTORATION PLANNING

CCI directed a talented team of biologists, engineers, scientists and restoration specialists to conduct the scientific and technical research and analysis of Big Canyon and its problems. Working together across many disciplines, and with input from all involved public agencies, community organizations and surrounding communities, we evaluated existing and historical site conditions, analyzed site needs and constraints and developed possible restoration alternatives.

PUBLIC AGENCY AND COMMUNITY INVOLVEMENT

The location of Big Canyon in a densely populated urban area meant that community input was very important to the planning process. CCI met with conservation organizations and held a public workshop to assess the needs and priorities of the project area, review the proposed restoration alternatives and develop the conceptual restoration plan. CCI worked closely with the City of Newport Beach and the Department of Fish and Game, who manage Big Canyon, as well as with the following agencies:

U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
National Marine Fisheries Service
State Coastal Conservancy
California Coastal Commission
Regional Water Quality Control Board
County of Orange Sanitation District
County of Orange

CCI worked closely with Newport Bay Naturalists and Friends, and met with a broad range of conservation organizations during the planning process. One public workshop was held to review and comment on needs in Big Canyon and the two restoration alternatives for addressing those needs. Information on the planning process and public workshops was distributed to a comprehensive mailing list consisting of homeowner, community, conservation and recreation organizations, user groups, local businesses, schools, public agencies and elected officials.

NEXT STEPS

This conceptual restoration plan completes the Phase I planning for the Big Canyon Creek Restoration Project. Additional planning, design refinement, technical and engineering studies, final design, legal review, public comment and permitting will be necessary to move the project to implementation. The State Water Resources Control Board has approved partial funding for Phase II planning, with an emphasis on

addressing water contamination issues through the design process. Additional funding to complete all planning and design, legal review and permitting is expected from the State Coastal Conservancy and the City of Newport Beach. All planning, design and permitting is expected to be completed 2005, with implementation anticipated in 2005 and 2006.

ABOUT CCI

CCI is a Los Angeles-based, non-profit organization dedicated to combining the protection and restoration of natural lands and waters with compatible community uses. With a focus on developing innovative solutions to challenging conservation problems, CCI is dedicated to working in areas with exceptional unmet needs: where natural habitats have been degraded; where communities have been neglected; and where recreation, economic, education and cultural opportunities are significantly lacking. CCI concentrates on the intersection between natural and human communities, and provides a broad range of expertise. CCI is committed to building strong partnerships by integrating local communities into all projects and by working closely with key stakeholders.

Section 2
PUBLIC AGENCY AND COMMUNITY INVOLVEMENT

CCI's planning process for Big Canyon emphasized the integration of input from public agencies, community members and leaders, and involved organizations. Community input was very important to the planning process. Over a two-year period, CCI met with public agencies, Newport Bay Naturalists and Friends and with other conservation organizations involved in Upper Newport Bay and Big Canyon. We held a well-publicized public workshop to assess the needs and priorities of the project area and to review and comment on the proposed restoration alternatives. This feedback was an important part of developing the Historic Tidal Wetlands Conceptual Restoration Plan for Big Canyon.

Big Canyon is heavily used by surrounding communities, schools from throughout Orange County, naturalists, researchers and the general public. Three quarters of a million people visit Upper Newport Bay annually, and Big Canyon provides one of the two major access points. CCI solicited public input on a number of issues pertaining to Big Canyon and Big Canyon Creek; the responses helped guide the development and refinement of the selected conceptual restoration plan (see Table 2.1). Project updates and public workshop information were mailed to 20 homeowners organizations and to local businesses, libraries, schools, elected officials, and civic, community, recreation and conservation organizations. Notices were placed in local newspapers and in the newsletters of local organizations.

The input of public agencies was also essential to the planning process. CCI met with a number of departments and staff at the City of Newport Beach, including the City Attorney, Department of Public Works, Utilities Department, Department of Engineering, Department of General Services, Park and Tree Superintendent and the Fire Warden. CCI also worked closely with the Department of Fish and Game, who manages the lower portion of Big Canyon.

Public agencies provided valuable guidance throughout the planning process. We held several planning meetings with the Project Team and with representatives from the following public agencies:

U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
National Marine Fisheries Service
State Coastal Conservancy
California Coastal Commission
Regional Water Quality Control Board
County of Orange Sanitation District
County of Orange

PROJECT GOALS

The following project goals were established as a result of input from public agencies, local organizations and the public.

- Re-establish a functioning complex of wetland and upland habitats:
  - restore tidal influence to Big Canyon Creek
  - allow natural transitions between open water, mudflats, salt marsh, freshwater marsh, riparian woodlands and upland habitats
- Address decades of degradation and effects of urbanization in Big Canyon
- Improve water quality in Upper Newport Bay by addressing contaminated urban runoff from Big Canyon Creek before it reaches the Bay
- Restore habitat and species diversity and expand endangered species' habitat
- Improve drainage patterns
- Repair flood damage and provide non-structural flood control
- Reduce erosion in Big Canyon and sedimentation into Upper Newport Bay
- Develop a system of habitat-sensitive public access and trails
- Develop scenic overlooks and expanded interpretive opportunities
- Remove non-native, invasive plants
- Remove dredge spoils and other infertile soils
- Able to be implemented and sustainable long-term

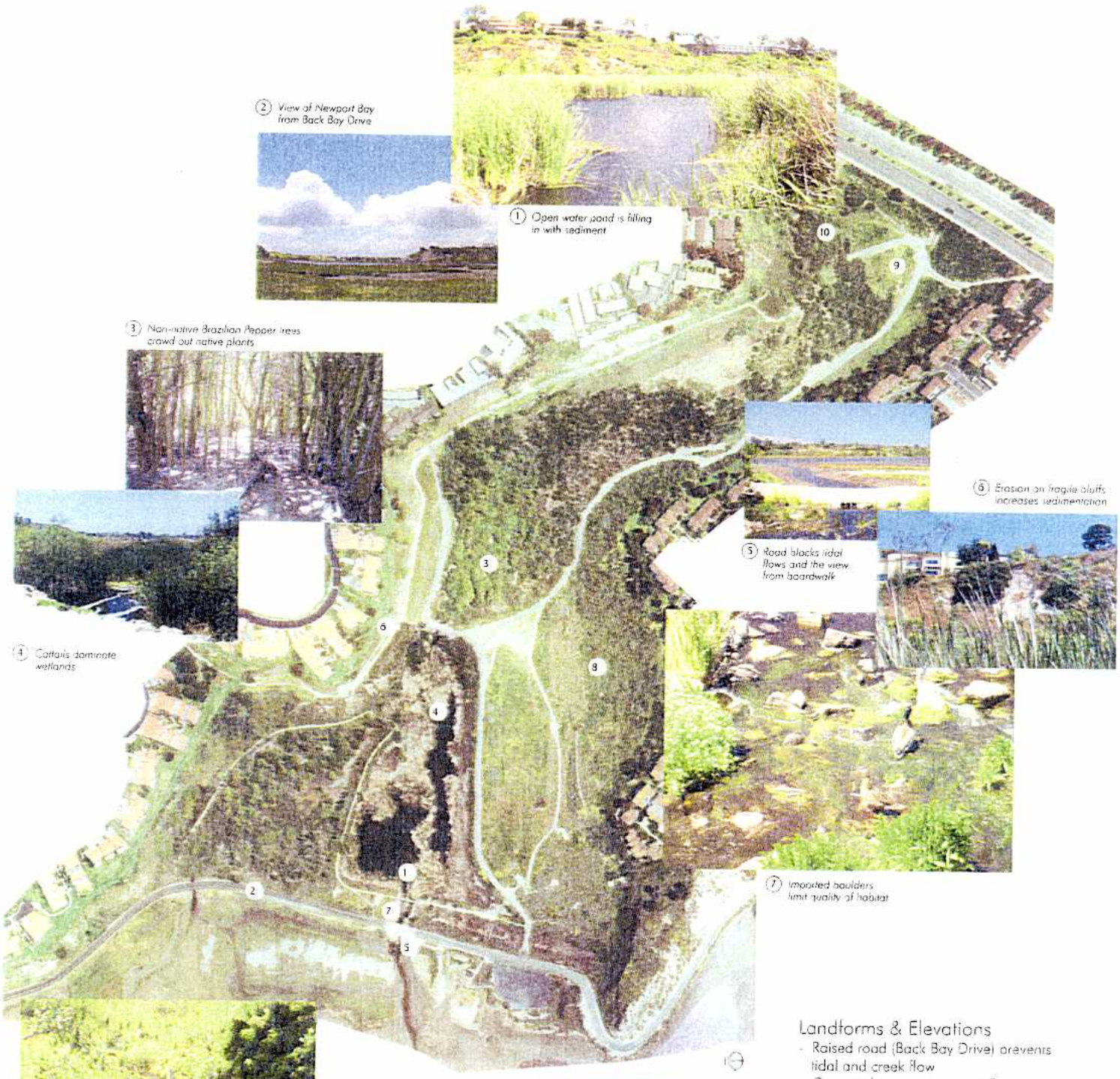
Table 2.1: Public Workshop Results, September 2003

Issues of Concern: Highest Priorities	% of Participants Who Ranked Issue a Concern
Contaminated water from urban runoff poisons critical food sources for shorebirds and fish (fertilizers & pesticides)	75.6%
Sustainability of restoration long-term/maintenance	61.0%
Damaged boardwalks & public trails	41.5%
Location of Back Bay Drive determines project design	34.1%
Loss of critical habitat for wetlands-dependent birds, fish & invertebrates	31.7%
Loss of natural tidal influence & tidal wetlands	26.8%
Impact on species currently using site during construction (road re-alignment on Bird'sBeak)	24.4%
Preservation & enhancement of freshwater pond (major experience for visitors)	19.5%
Public Access & Signage: Highest Priorities	
Damage done by dogs & horses	39.0%
Poor boardwalks (damaged, non-ideal locations, lack of coordinated system	36.6%
Effect of floods on improvements	34.1%
Boardwalks rather than trails in wetlands (less impact)	34.1%
Inappropriate use of step slopes	29.3%
Access & Safety during construction	26.8%
Restroom facilities (need vs. aesthetic)	26.8%
Rest Stops (benches along trails)	26.8%
OTHER ISSUES	
Roads too wide	
Car speed/conflicts with pedestrians	
Extensive public education needed/must build support	
Preservation of California Gnatcatcher habitat	
Should involve Native American communities	
Dog use & horses = problem	
Old & limited interpretive signage	
Group sites for interpretation	
People friendly signs/Dog on leash signs	
Do not encourage access from Jamboree	
Rest stops & signage should outline impacts on habitat & provide opportunity to learn & respect habitat	
No picnic tables	

FIGURE 3.1

BIG CANYON TODAY: ISSUES OF CONCERN

Community Conservancy International



Landforms & Elevations

- Raised road (Back Bay Drive) prevents tidal and creek flow
- Cement dams restrict water flow
- Raised terraces of infertile dredge material
- Ring of fragile bluffs
  Steep grades limit access

Habitats

- 42 plant communities
- Invasive non-native species throughout
  Cattails and algae choke pond
- 18 endangered/threatened wildlife species

Views and Aesthetics

- Views of Upper Newport Bay
- Views of Big Canyon
- 70 acres of open space in the urban environment

FIGURE 3.2

BIG CANYON TODAY: ISSUES OF CONCERN

Community Conservancy International

Roads, Trails and Boardwalks
- Back Bay Drive provides primary access
- Wide gravel and dirt sewer access roads
- Damaged bridges and boardwalks
- Limited official trails
- Unauthorized trails and access

Public Access and Interpretive Use
- Big Canyon is key public access to Upper Newport Bay
- One-way car access on Back Bay Drive
- Parking lot in sensitive wetlands area (35 cars, 2 buses)
- Limited bicycle access on Back Bay Drive
- No disabled access
- Deteriorating and isolated interpretive signage

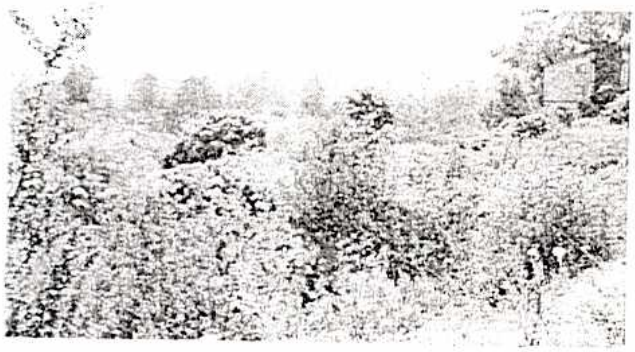
Urban Infrastructure
- Constricted drainage at creek mouth
- Sewer lines and manholes
- Storm drains
- Cement "dams"
- Riprap edges (concrete stream banks)

Prepared by Withers & Snodgrass Ltd.

Section 3
BIG CANYON TODAY: EXISTING SITE CONDITIONS

Big Canyon is a coastal canyon originally carved by an intermittent stream on the eastern shore of the Upper Newport Bay tidal estuary. Big Canyon drains a two square mile watershed that is now completely developed. Big Canyon is the only remaining natural and undeveloped area in the watershed.

The canyon slopes, the coastal plain and the tidal wetlands of Big Canyon are part of the Upper Newport Bay State Ecological Reserve managed by the California Department of Fish and Game. The Big Canyon Creek Restoration Project area is 70 acres and extends from Jamboree Road to the edge of the open water channel of Upper Newport Bay.



Residential development surrounds Big Canyon

Single-family homes and apartment buildings now surround the canyon. Year-round irrigation of the adjacent residential homes, other landscaped areas in the watershed and the Big Canyon Country Club golf course have created a perennial stream in the canyon that now feeds a constructed freshwater pond.

Untreated urban runoff from the two-square mile watershed drains directly into Upper Newport Bay through Big Canyon. Sediments, nitrogen, phosphorous, fecal coliform bacteria, pesticides, heavy metals and other contaminants are carried by Big Canyon Creek, threatening the health of native plants and wildlife in the canyon and in the Bay.

Figures 3.1 and 3.2 provide an overview of the issues of concern in Big Canyon today.

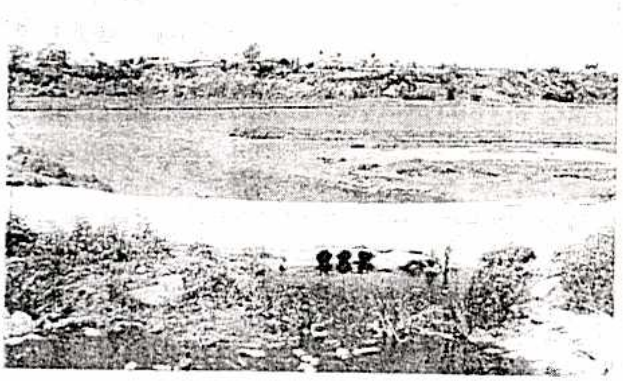
BIG CANYON: TIDAL WETLANDS

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 3.3). 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.



Culverts under Back Bay Drive drain Big Canyon Creek into the Bay.

Sediment eroding from the bluffs and the un-compacted 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.

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 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.

Salt marsh established on tidal mud flats

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

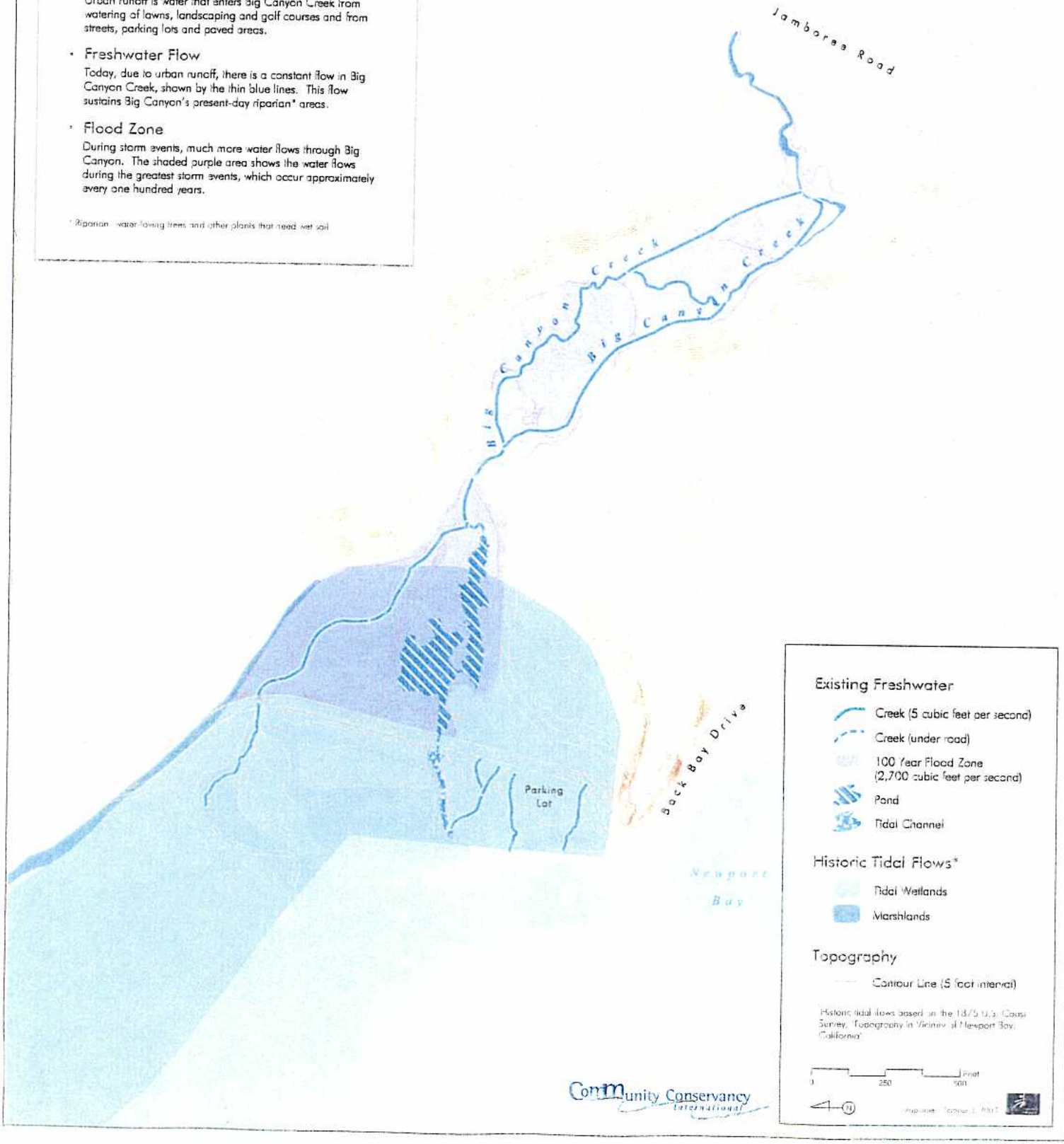
FIGURE 3.3

HISTORIC TIDAL WETLANDS & WATERS OF BIG CANYON

Waters of Big Canyon

- **Historic Tidal Wetlands**
  The shaded blue-green area shows Big Canyon's historic tidal zone. Before Back Bay Drive was built, tidal wetlands existed where the freshwater pond is today.
- **Urban Runoff**
  Big Canyon drains a two square mile urbanized watershed. Urban runoff is water that enters Big Canyon Creek from watering of lawns, landscaping and golf courses and from streets, parking lots and paved areas.
- **Freshwater Flow**
  Today, due to urban runoff, there is a constant flow in Big Canyon Creek, shown by the thin blue lines. This flow sustains Big Canyon's present-day riparian* areas.
- **Flood Zone**
  During storm events, much more water flows through Big Canyon. The shaded purple area shows the water flows during the greatest storm events, which occur approximately every one hundred years.

* Riparian - water-loving trees and other plants that need wet soil



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.

Issues of Concern

- Endangered and threatened species
- Continued loss and degradation of native 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.

Large 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.

The cattails found in the pond are a native plant species that has become invasive due to the high levels of nitrogen in the water. Both the cattails and algae are choking the pond from the edges inward, and will continue to reduce the open water areas as they spread. Sediment from loosely aggregated dredge spoil areas is filling in the pond, and the increased shallows will encourage cattail encroachment.

Stands of Brazilian Pepper Tree associated with areas of infertile soils have choked out all native plants in those areas. The African Clawed Frog dominates the freshwater pond and devours native fish and amphibians.

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
- Storm water run-off from surrounding streets and parking lots
- Fertilizer and pesticide contaminants from surrounding homes and golf course
- Sedimentation from bluffs and uncompacted dredge spoils

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.

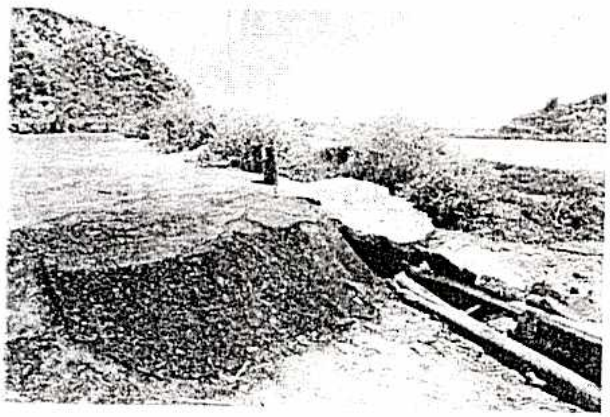
Portions of the Bay have been closed to water-contact recreation since 1974, and shellfish harvesting has been prohibited in the Ecological Reserve since 1978. Pesticides in the Upper Bay are now at levels toxic to aquatic life, and urban runoff continues to poison shellfish and invertebrates, the critical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

Issues of Concern

- Impact of pesticides, fertilizers and other toxins on water quality of Upper Newport Bay
- Water quality contamination from urban runoff and storm water in the Big Canyon Creek watershed
- Flood management

ROADS, PARKING, TRAILS & BOARDWALKS

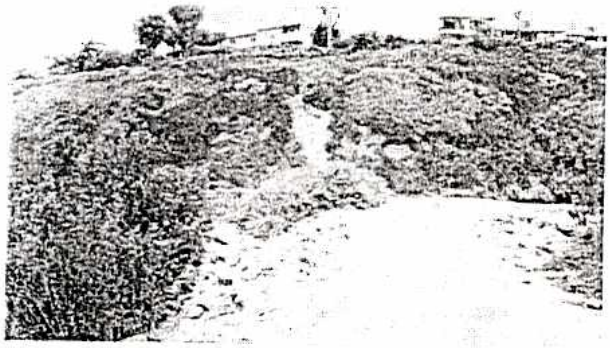
The primary access to Big Canyon is via Back Bay Drive, a one-way, single lane scenic drive with a class 2 bicycle lane and soft shoulders. Back Bay Drive cuts across the mouth of the canyon, through an area that was once tidal wetlands. An asphalt-paved parking lot is located on the western side of Back Bay Drive in the middle of existing tidal wetlands. Damage from recent storm surges is evident along the outer edges of the tarmac.



Damage to parking lot at wetlands' edge.

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.



Concrete embankment and maintenance road crossing over creek

A small system of designated interpretive trails provides access to the downstream portion of the canyon. These trails follow the northern edge of the freshwater wetland to the middle of the canyon, cross over the stream and double back along the toe of the northern bluffs. The bridges and boardwalks adjacent to Back Bay Drive are deteriorated and flood-damaged and no longer provide the 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 habitat areas.

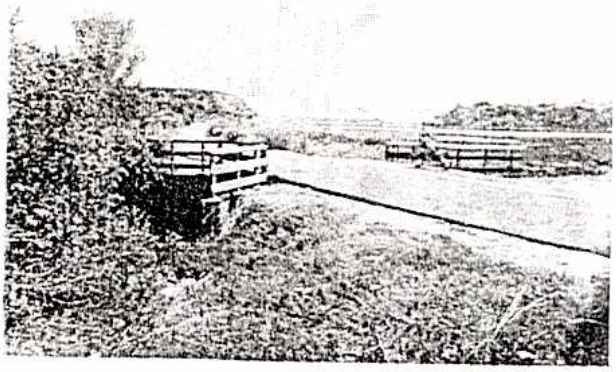
Issues of Concern

- Lack of coordinated public access and trails
- 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 ADA access
- Old and damaged boardwalks and public trails

PUBLIC ACCESS & INTERPRETIVE USE

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 and the County of Orange. Big Canyon is the primary access point on the eastern side of the estuary.



Bicyclist crossing creek's northern drainage course

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. 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.

Issues of Concern

- Lack of integrated public access and trail system
- Old and deteriorated kiosk and interpretive signs
- Poor quality of the interpretive experience
- Habitat damage due to public uses in sensitive areas
- Lack of scenic overlooks
- Lack of trail system in upper canyon

VIEWS & AESTHETICS

Whether by car, foot, bicycle, or by boat, 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.

Issues of Concern

- Protection of Bay and wetland views
- Raised terraces and dams block views into Big Canyon from Back Bay Drive
- Poor location and design of parking area
- Lack of scenic overlooks

URBAN INFRASTRUCTURE

Back Bay Drive is a levee roadbed with three 15" 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 form 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 to eliminate erosion on the bluffs.

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, oil, heavy metals and other contaminants draining into the creek from the watershed.

A county sewer line along the northern edge of the canyon joins a city-owned line that follows the southern edge. Maintenance of these lines is via manholes located throughout the project site.

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

Issues of Concern

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

- Restricted tidal flow
- Access for on-going removal of sediments from the constructed freshwater pond
- Unfiltered, contaminated urban run-off entering Big Canyon
- Flooding

Section 4
BIG CANYON: TERRESTRIAL BIOLOGICAL RESOURCES

1.0 ABSTRACT

This report summarizes the results of surveys of terrestrial (non-marine) biological resources conducted in Big Canyon during the spring and summer of 2003. Results are described in more detail in Appendix B (Terrestrial Biological Technical Appendix).

Surveys for terrestrial biological resources in Big Canyon in 2003 identified 42 plant communities and mapping units such as urban areas. The upper part of Big Canyon is primarily composed of arroyo willow scrub, annual grassland, alkali meadow, freshwater marsh, sagebrush scrub, and ornamental plant communities. In contrast, 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, annual grassland, chenopod scrub, coyote brush scrub, and sagebrush scrub. The slopes above the drainage contain areas of coastal bluff scrub, coyote brush scrub, and ornamental plant communities. The drainage also contains dense stands of Brazilian pepper (*Schinus terebenthifolius*)[1]. The area west of Back Bay Drive supports large areas of saltmarsh, with smaller areas of alkali grassland, alkali meadow, alkali marsh, brackish marsh, mulefat scrub and sagebrush scrub.

One special-status[2] insect species, the western mudflat tiger beetle (*Cicindela trifasciata sigmoidea*), was detected in Big Canyon during 2003 surveys. The wandering skipper butterfly (*Panoquina errans*) also likely occurs here; it was not detected because focused surveys for this species were not conducted. Six special-status plants were detected in Big Canyon including salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritumus*), southern tarplant (*Centromadia parryi* ssp. *australis*), California boxthorn (*Lycium californicum*), Southwestern spiny rush (*Juncus acutus ssp. leopoldii*), estuary seablite (*Suaeda esteroa*) and woolly seablite (*Suaeda taxifolia*). Diversity of amphibians and reptiles was low in Big Canyon during 2003 surveys, and no special-status amphibian or reptile species were detected during focused surveys; none are expected to occur in Big Canyon. Focused surveys for three special-status bird species, the least Bell's vireo (*Vireo belli pusillus*), California gnatcatcher (*Polioptila californica*) and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) were conducted during 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 California gnatcatchers and eight pairs of Belding's savannah sparrows were observed. No special-status mammals were observed during 2003 surveys and none are expected to occur in Big Canyon in its current condition.

Big Canyon supports a diversity of habitats, although many of these have been disturbed by human uses. Still, an abundance of plant and wildlife species occur in Big Canyon, although some are non-native or invasive and could benefit from restoration activities.

2.0 INTRODUCTION

2.1 Site Description

Big Canyon is located in the Newport Beach area of Orange County, California. Specifically, it is located in a relatively undisturbed strip of land between Jamboree Boulevard and Back Bay Drive approximately one mile north of Pacific Coast Highway (Highway 1) along the east shore of Upper Newport Bay. The 70-acre area consists of a nature park mostly east of Back Bay Drive that is situated between residential developments on bluffs overlooking the site to the north and south. Areas to the west of Back Bay Drive include a small parking lot, information kiosk, and Upper Newport Bay. The survey area is generally bounded as follows: on the west, approximately 200 feet west of Back Bay Drive, on the north by residential areas

[1] Scientific names are provided after the first mention of the common name in this report.

[2] The term "special-status" is similar to the formerly used term "sensitive" to describe plant and animal species whose populations are limited or declining and are thus designated endangered, threatened, rare, or species of concern by governmental resource agencies and/or conservation organizations. This concept, and special-status species known to occur or potentially occur in Big Canyon, is discussed in Section 6.

(Eastbluff Park and Santa Ana Heights), on the east by Jamboree Road; and on the south by residential and commercial developments. Thus, the survey area includes salt marsh and mud flat habitats on the west, and the north, south and east bluffs of the canyon. The survey area is situated within Section 23, Township 6S, Range 10W within the U.S.G.S. Newport Beach 7.5' series quadrangle map.

Land use varies within and adjacent to the survey area, and includes residential areas, golf courses, paved and unimproved roads, power lines, and commercial developments. Relatively undisturbed natural areas associated with the Upper Newport Bay Ecological Reserve (± 752 acres) are present within and at locations to the north, south, and west of Big Canyon. The Reserve was created in 1975 and is managed jointly by the California Department of Fish and Game and the County of Orange Department of Harbors, Beaches and Parks in cooperation with the City of Newport Beach and the U.S. Fish and Wildlife Service (USFWS).

Topographically, Big Canyon is characterized by steeply sloping bluffs and flat areas with a combined maximum vertical relief of roughly 75 feet between the highest and lowest elevation points on the property. Elevations range from approximately 0 to 75 feet above mean sea level. Surrounding topographic features in the project vicinity include gently to steeply sloping hills with canyons and ridgelines, and flat areas adjacent to Upper Newport Bay.

A perennial stream area is present within Big Canyon and supports willow, mulefat, sycamore, cottonwood, and associated riparian species as well as non-native species. Just east of Back Bay Drive is an artificial damn and freshwater pond, with a dense population of cattails. Several areas of Big Canyon support some form of human disturbance and associated ruderal and invasive vegetation. Coastal sage scrub is also present, particularly on the steep slopes along the north and south edges of Big Canyon.

2.2 Purpose of the Study

Baseline surveys of terrestrial biological resources were conducted in order to determine the existing biological conditions within Big Canyon and to assist in establishing opportunities and constraints for restoration. Surveys focused on documenting the locations of existing resources that have become degraded due to human activities, locations of non-native plant communities and invasive and other non-native species, and locations of special-status resources that warrant protection and/or that could benefit from creation or enhancement of additional habitat in Big Canyon. These surveys encompassed the entire 70-acre site from canyon edges on the north and south and from the coastal salt marsh on the west to Jamboree Road on the east. Surveys included:

- mapping of plant communities
- botanical assessment of the plant communities
- list of plant species including native, special-status and invasive species
- evaluation of dominant plant species within each plant community
- assessment of insect fauna
- assessment of herpetological (amphibian and reptile) fauna
- assessment of avian fauna
- assessment of mammalian fauna
- focused surveys for special-status species for which suitable habitat was located during the assessment surveys.

Methods used to conduct these surveys are discussed in Section 3.0.

3.0 METHODS

3.1 Methods for Plant Community and Botanical Surveys

Botanist Dave Bramlet conducted the plant community mapping, botanical surveys to develop an inventory of plant species in Big Canyon, conducted focused surveys for special-status plant species, and authored the botanical sections of this report. Surveys were conducted on several dates during May, June and July 2003. Survey methods are described in Section 1 of Appendix B.

3.2 Methods for Entomological (Insect) Surveys

Surveys for insect fauna in Big Canyon were conducted by entomologist Guy Bruyea on May 19, June 14, and July 10, 2003. The entomological surveys included a general daytime insect survey and an insect habitat survey, with special

consideration in locating potentially suitable habitat for rare, threatened, endangered, and other special-status insects, including the wandering skipper butterfly (*Panoquina errans*) and several species of tiger beetles (*Cicindella* sp.) (see Section 6). Focused surveys for the presence or absence of these or other special-status species were not conducted during this assessment. Survey methods are described in the Section 2 of Appendix B.

3.3 Methods for Herpetological Surveys

Herpetological (amphibian and reptile) surveys in Big Canyon were conducted on numerous survey dates from May through July of 2003 by herpetologist Brian Leatherman, using various survey techniques further described in Section 3 of Appendix B.

3.4 Methods for Avian Surveys

3.4.1 General Bird Surveys

Surveys to document bird use of habitats within Big Canyon were conducted on March 14, April 20 and during focused surveys for special-status species. Surveys were conducted by ornithologists Kathy Keane, Spencer Langon, Nathan Mudry and Matthew Amalong. Survey methods are further described in Section 4 of Appendix B.

3.4.2 California Gnatcatcher Surveys

To determine the status of the California gnatcatcher (*Poliptila californica* spp. *californica*) in Big Canyon, focused presence/absence surveys were conducted on February 28, May 31, and July 10, 2003. Survey methodology followed the guidelines of Mock *et al.* (1990), the Southern California Coastal Sage Scrub Scientific Review Panel (Brussard *et al.* 1992) and the United States Fish and Wildlife Service (USFWS) monitoring protocol (USFWS 1997). Methods are further discussed in Section 4 of Appendix B.

3.4.3 Least Bell's Vireo Surveys

To determine the status of the least Bell's vireo (*Vireo belli pusillus*) at the proposed site, focused presence/absence surveys were conducted. All riparian habitat in Big Canyon potentially suitable for Least Bell's vireo was surveyed on April 10; May 31; June 10, 20, 30; and July 10, 20, 30, 2003. Survey methods followed the guidelines of the USFWS monitoring protocol (USFWS 2001), further discussed in Section 4 of Appendix B.

3.4.4 Belding's Savannah Sparrow Surveys

Saltmarsh habitat dominated by pickleweed (*Salicornia virginica*) noted to be suitable for Belding's savannah sparrow was identified west of Back Bay Drive and north of the kiosk and parking lot during an overview survey of the project area on April 16, 2003. Survey methods to census the approximate number of singing males were the same as those used during statewide censuses for this species and were conducted on April 23, April 27 and June 1. Methods are further discussed in Section 4 of Appendix B.

3.5 Methods for Mammalian Surveys

Mammalogist Shana Dodd conducted the mammal survey in Big Canyon using three techniques on June 9 and 10, 2003. Methods are further discussed in Section 5 of Appendix B.

4.0 HISTORICAL INFORMATION

4.1 Botanical History of Big Canyon

Existing literature specific to Big Canyon is limited; however, a review of existing literature on botanical resources occurring in Upper Newport Bay reveals that overall, the Bay supports an estuarine community, including open water, mudflats, and three associations of salt marsh vegetation. The creeks and channels associated with the Bay, including the Santa Ana Delhi Channel, San Diego Creek, and Big Canyon Creek support riparian herb, riparian scrub, and riparian forest, along with alkali, brackish, freshwater marshes. The upland areas consist of annual grassland, ruderal grassland, coastal sage scrub, chenopod scrub, coastal bluff scrub and toyon-sumac chaparral. In addition, the Bay supports large areas of ornamental vegetation, both as part of the adjacent residential and commercial developments, and large stands of "escaped" exotic (ornamental) plant species have established in a number of localities within the Bay. Some wetlands are also found in these localities, including alkaline meadows, and marshes.

Previous studies have noted the presence of 13 special-status plant species within or adjacent to Upper Newport Bay. One of these, the salt marsh bird's beak (*Cordylanthus maritimus ssp. maritimus*)

is currently listed as federally and state endangered. Further details on these species are provided in Section 6.2.

4.2 History of Wildlife Use in Big Canyon

Previous surveys of wildlife use of Upper Newport Bay have been conducted, but results of surveys focusing on Big Canyon are limited and some are unavailable. Several special-status species of birds have been observed in Big Canyon, including the threatened California gnatcatcher (*Poilioptila californica*) and endangered light-footed clapper rail (*Rallus longirostrus levipes*) and Belding's savannah sparrow (*Passerculus sandwichensis* ssp. *beldingi*). Statewide surveys that include Upper Newport Bay are conducted annually for light-footed clapper rail and approximately every three to five years for Belding's savannah sparrow; both species have been recorded at the mouth of Big Canyon over the approximately 20 years that surveys have been conducted. Kathy Keane conducted a color banding study of California gnatcatchers in Big Canyon in 1991; several pairs of gnatcatchers were present at that time. See Appendix B, section 6.5, for more detail.

5.0 ANALYSIS OF EXISTING BIOLOGICAL CONDITIONS

5.1 Plant Communities

The following section summarizes descriptions of the plant communities and other mapping units noted on the habitats and sensitive species map associated with this report (see Appendix A, Figure A2). Results of the rapid assessment percent cover technique for each plant community are listed in Appendix BB. More detailed discussions are included in Section 1 of Appendix B and a list of all observed plant species is provided in Appendix B.

5.1.1 Coastal Sage Scrub Habitats

Big Canyon supports several types 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, mixed sage scrub/grassland ecotone and mixed sage scrub/grassland ecotone/alkali meadow.

Each of these subtypes is described in detail in Appendix B. They are generally dominated by California bush sunflower (*Encelia californica*), California buckwheat (*Eriogonum fasciculatum*), coastal prickly pear (*Opuntia littoralis*), California sagebrush (*Artemisia californica*), bladderpod (*Isomeris arborea*), four-wing saltbush (*Atriplex canescens*), quail bush (*Atriplex lentiformis*), Mexican elderberry (*Sambucus mexicana*), and coyote brush (*Baccharis pilularis*), Emory's baccharis (*Baccharis emoryi*), coastal isocoma (*Isocoma menziesii*), and an unnamed, unidentified saltbush introduced into the canyon during a prior restoration project.

5.1.2 Chaparral Habitats

Two types of chaparral habitats were identified in Big Canyon: toyon-sumac chaparral and toyon-sumac chaparral with ornamental plantings. These plant communities include stands of lemonade berry (*Rhus integrifolia*), along with toyon (*Heteromeles arbutifolia*), Mexican elderberry, California sagebrush, coyote brush, Emory's baccharis, myoporum (*Myoporum laetum*), Brazilian pepper (*Schinus terebinthifolius*), and acacias (*Acacia* sp.). Another type of chaparral identified as is composed of a toyon-sumac chaparral with scattered acacia or oleander (*Nerium oleander*) and myoporum shrubs.

5.1.3 Grassland Habitats

Grassland habitats in Big Canyon include Annual grassland, annual grassland/Ornamental vegetation, ruderal grassland, alkali grassland and alkali grassland/ruderal. These areas are dominated by primarily non-native species including ripgut brome (*Bromus diandrus*), red brome (*Bromus madritensis* ssp. *rubens*), foxtail barley (*Hordeum murinum* ssp. *leporinum*), soft chess (*Bromus hordeaceus ssp. hordeaceus*), slender wild oat (*Avena barbata*), Italian ryegrass (*Lolium multiflorum*), foxtail fescue (*Vulpia myuros*), scattered acacia, myoporum, and/or Brazilian pepper trees (sometimes quite dense), small-flowered iceplant (*Mesembryanthemum nodiflorum*), five-hook bassia (*Bassia hyssopifolia*), bur clover (*Medicago polymorpha*), tocalote, Australian salt bush (*Atriplex semibaccata*), cheese weed (*Malva parviflora*), telegraph

weed (*Heterotheca grandiflora*), schismus (*Schismus barbatus*), Spanish sunflower (*Pulicaria paludosa*) statice (*Limonium sp.*), common horseweed (*Conyza canadensis*), and Bermuda grass (*Cynodon dactylon*), garland chrysanthemum (*Chrysanthemum coronarium*), alkali heliotrope (*Heliotropium currasivicum*), common sow thistle (*Sonchus oleraceus*), bristly ox tongue (*Picris echioides*), alkali heath (*Frankenia salina*), common woody pickleweed (*Salicornica virginica*), and salt grass (*Distichlis spicata*). Each of these areas is further described in Section 1 of Appendix B.

5.1.4 Saline Wet Meadows

A saline wet meadow dominated by native herbaceous species such as saltgrass (*Distichlis spicata)*, jaumea (*Jaumea carnosa*), and alkali heath. Other typical species include pickleweed, rabbit's foot grass (*Polypogon monspeliensis*) and other annual herbs. This community is restricted to areas with seasonal soil saturation and wetness with summer drying that brings salts to the soil surface. The greater abundance of native plants and the less disturbed soil profile distinguishes this area from alkali ruderal habitats.

5.1.5 Marsh Habitats

Several types of marsh are present in Big Canyon, including salt marsh (upper, middle and lower intertidal), freshwater marsh, coastal brackish marsh and cismontane alkaline marsh.

Salt marsh (upper, middle and lower intertidal salt marsh.) Characteristic species in these habitats include jaumea, salt grass, shore grass (*Monanthochloe littoralis*), alkali heath, California marsh rosemary (*Limonium californicum*), common woody pickleweed, estuary sea blite (*Suaeda esteroa*), American saltwort (*Batis maritima*), and in some areas the salt marsh bird's beak (*Cordylanthus maritimus*), and California cord grass (*Spartina foliosa*).

Freshwater marsh in big Canyon is present around a large pond that has formed above the outlet of Big Canyon Creek. This marsh is dominated by dense stands of broad-leaved cattail, with some occasional stands of California bulrush with margins supporting a variety of herbaceous plant species.

Coastal brackish marsh is influenced by brackish and freshwater and is often found in channels that may have some tidal influence. In some locations, these marshes may consist of dense stands of alkali bulrush (*Scirpus maritimus*). In other channels the marsh may be composed of broad-leaved cattail (*Typha latifolia*) and/or California bulrush (*Scirpus californicus*).

Cismontane alkaline marsh is found in moist or potentially inundated areas that lacked tidal fluctuations. These areas are dominated by open stands of broad-leaved or narrow-leaved cattails, along with stands of alkali bulrush.

5.1.6 Riparian Habitats

Several types of riparian habitats were identified at Big Canyon, including riparian herb, willow riparian scrub, mulefat scrub, black willow forest and willow riparian forest. Common species in these communities consist of rabbit's foot grass, yellow sweet clover, Spanish sunflower, bristly ox tongue, dwarf nettle (*Urtica urens*), common sow thistle, nettle-leaved goosefoot (*Chenopodium murale*), alkali heliotrope, mugwort (*Artemisia douglasiana*) water cress (*Rorippa nasturtium-aquaticum*), coarse goosefoot (*Chenopodium macrospermum*), lamb's quarters (*Chenopodium album*), black willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), Brazilian pepper, and western sycamore (*Platanus racemosa*). Each of these communities if further described in Section 1 of the Appendix B.

5.1.7 Woodlands

The Mexican elderberry woodland/Ornamental woodland community consists of a dense stand of Mexican elderberry, associated with a large area of castor bean. Other species in this habitat included California sagebrush, coastal goldenbush, California bush sunflower, bladderpod, horehound, and Russian thistle. These areas are further described in Appendix B.

5.1.8 Sandy Flats

Sandy flats are open sandy areas generally lacking vegetation that were found on the two islets on the western portion of the study site. These open sandy

areas were subject to occasional tidal inundation, but were not considered disturbed sites. There was often some scattered cover of batis, shore grass, salt grass, jaumea, and/or alkali heath within or on the margin, but overall these flats were unvegetated.

5.1.9 Marine and Coastal Habitats
Tidal mudflats consist of tidal flats within the study area that are exposed by low tides. This mapping unit often has a large amount of green macro algae (*Ulva* and *Enteromorpha*) and diatoms growing on the muddy substrate.

5.1.10 Ponds and Creeks
Open Water consists of the large freshwater pond found at the western end of the creek. The only plant species noted in this habitat were some Pacific mosquito fern (*Azolla filiculoides*), and lesser duckweed (*Lemna minor*) floating on the surface of the pond. Other smaller ponds along the creek were not mapped, since they were obscured on the aerial by the overstory of willows and mulefat shrubs.

Creeks consist of the main and distributary channels of Big Canyon Creek. These channels are often vegetated as described above, but exhibit directional water flow. The main channel is well defined in the upper and lower portions of the canyon. In the middle, flatter portion of the Canyon, several distributary channels are found that discharge water primarily following storm events when the open water ponds are full.

5.1.11 Ornamental Plantings
Ornamental Plantings not associated with native plant communities were placed in this mapping unit. These areas support dense monotypic stands of ice plant and dense stands of several species of acacia, eucalyptus (*Eucalyptus spp.*), myoporum, pines (*Pinus spp.*), Mexican fan palm (*Washingtonia robusta*), Pride of Madera, lantana (*Lantana camara*), cape honeysuckle (*Tecomaria capensis*) and silk oak (*Grevillea robusta*). These species are further described in Appendix B.

5.1.12 Mixed Ornamental Plantings and Riparian
Other types of communities with ornamental plantings include Ornamental Plantings/Riparian and Ornamental Plantings/Willow riparian scrub and Ice plant plantings (15.5) consists of large areas of ice plant and included hottentot fig and at least two other iceplant species found within the canyon.

5.1.13 Developed
Urban & Commercial (including paved streets) includes existing residences and associated streets found the north and south sides of the canyon. It also includes portions of Jamboree Road and the adjacent sidewalk. Back Bay Drive was also mapped in this unit. Non-urban/commercial structures (includes boardwalks, kiosks, etc.) include the existing kiosk and portions of the boardwalks found within Big Canyon.

The graded mapping was used to map the existing dirt roads, and some open disturbed areas that had previously been graded or disturbed by maintenance activities. The parking lot off of Back Bay Drive was also placed in this mapping unit.

5.2 Entomological Survey Results
Five basic habitat types for insects were identified at the Big Canyon site. These are: 1) tidal salt marsh; 2) freshwater marsh; 3) riparian; 4) coastal sage scrub; and 5) disturbed and/or ruderal. Virtually all habitat types at Big Canyon are insect habitats. A list of insects observed in Big Canyon during surveys is included in Appendix B, and results are further detailed in Section 2 of Appendix B.

A total of twenty-one relatively common butterfly species were observed during the survey in Big Canyon (see Section 8 of Appendix B). Butterflies can be a good indicator of habitat quality in a particular area.

Relatively few other insect species were observed during the survey. This may be due to several factors, including an atypically cool, wet and late spring in 2003, which may have delayed or disrupted insect emergence patterns.

Potential native and non-native nectar resources for insects were abundant on the site, and included Spanish sunflower, mulefat, alkali heliotrope, California buckwheat, tocalote, and other plants. However, the diversity of nectar-feeding insects such as bees and wasps was low. Sonoran

bumblebee (*Bombus sonorus*) and honeybee (*Apis mellifera*) were the most abundant bee species. Carpenter bees (*Xylocopa varipuncta*) and sand wasps (*Bembix comata*) were also observed.

Several species of dragonfly and damselflies were observed in association with the freshwater marsh pond at the mouth of Big Canyon. These and other insects observed during the surveys are further described and a list of observed insect species is provided in Appendix B.

5.3 Herpetological Survey Results

5.3.1 Herpetological Inventory

A total of seven species of amphibians and reptiles was observed at Big Canyon during the 2003 surveys (see Section 8 of Appendix B). Two of these, the Pacific tree frog (*Hyla regilla*) and African clawed frog (*Xenopus laevis*), are stream breeding amphibians. The third species, the common kingsnake (*Lampropeltis getula*), would likely be detected in the upland area in a more extensive survey effort. One species was observed in upland habitat but not in riparian habitat. This species was the southern alligator lizard (*Elgaria multicarinata*).

No southwestern pond turtles were trapped during the two-night trapping period. Twenty-five crayfish (*Procambarus clarkii*) and sixteen African clawed frogs were trapped, and a large numbers of these species were observed in the system during the nocturnal survey. Results are further detailed in Section 3 of Appendix B.

5.3.2 Relative Herpetological Abundance

A total of five different species representing 98 observations was made during the transect and cover board surveys. When expressed as a rate of detection, cover board success averaged 0.19 specimens per cover board per day (observations were made at an average of one out of every five boards per day).

Table 8 in Appendix B shows the number of observations of each species by habitat type and for the site as a whole. The raw numbers shown in the table are equivalent to the relative abundance because standardized methods were used to collect the data in each habitat type (i.e., the same transects were walked, the same number of cover boards were used, and the same amount of time was taken to complete the sampling each week).

The western fence lizard was the most abundant species at Big Canyon. The western fence lizard and side-blotched lizard were equally abundant in the upland area, but the western fence lizard was significantly more abundant than the side-blotched lizard in the riparian habitat. The southern alligator lizard was more abundant in the upland habitat. A list of amphibian and reptile species observed is provided in Section 8 of Appendix B.

5.4 Avian Survey Results

A total of 107 bird species was observed in Big Canyon during the three surveys, suggesting that Big Canyon supports a diversity of bird species. Surveys conducted during the fall and winter would likely yield additional migrating and wintering species. Observations by major habitat type revealed that eight species were observed in aerial habitat, eight in alkaline meadow, 11 in coastal sage scrub, nine in freshwater marsh, 36 in coastal salt marsh, 16 in willow riparian and three in ruderal/ornamental habitat.

Results of avian surveys are further detailed in Section 4 of Appendix B, and a list of bird species observed at Big Canyon is provided in Section 8 of Appendix B. Results of surveys for special-status bird species (California gnatcatcher, least Bell's vireo, Belding's savannah sparrow) are discussed in Section 6.5 of this report.

5.5 Mammalian Survey Results

Mammal species that were recorded based on sign or visual detection included California ground squirrel (*Spermophilus beecheyi*), Audubon's cottontail (*Sylvilagus* audubonii), wood rat (Neotoma sp.), Botta's pocket gopher (*Thomomys bottae*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), and domestic dog (Canis *familiaris*). Only one species was captured in the live traps, which was the western harvest mouse (*Reithrodontomys megalotis*).

The results of this survey suggest that Big Canyon, although disturbed by trails, non-native vegetation, and human encroachment, is still used by an assortment of native mammals. Other than

domestic dogs, no non-native mammals were detected on the site. However, domestic or free-roaming cats are likely due to the close proximity of residential areas on either side of the canyon. Cats are an important consideration because they are a significant cause of mortality for native wildlife. Another introduced species expected to occur in Big Canyon, as it is common throughout southern California, is the Virginia opossum (*Didelphis virginiana*). Results are further detailed in Section 5 of Appendix B, and a list of mammal species observed is provided in Section 8 of Appendix B.

6.0 ENDANGERED, THREATENED AND OTHER SPECIAL-STATUS SPECIES

Prior to conducting surveys, Keane Biological Consulting (KBC) reviewed the project maps and existing literature on the biological resources of Big Canyon to ascertain habitat suitability and use of Big Canyon by special-status species and other native wildlife species. KBC also reviewed documents pertaining to special-status species that may be present in the project vicinity. A plant or wildlife species is defined as special-status when it has been afforded special recognition by federal, state, or local resources conservation agencies (e.g., U.S. Fish and Wildlife Service [USFWS], California Department of Fish and Game [CDFG]) and/or resource conservation organizations (e.g., California Native Plant Society [CNPS] or the National Audubon Society [NAS]). Sources used to identify special-status species and sensitive plant communities potentially occurring in the project vicinity are listed in Appendix B and are available through http://www.dfg.ca.gov/whdab/html/lists.html.

This review and consultations with the biological experts conducting surveys for this study allowed us to determine which special-status species and sensitive plant communities may occur at Big Canyon. These are described in the following sections. See Appendix B for detail.

6.1 Plant Communities of Concern

The communities of special status are those declining communities of concern to the CDFG (CNDDB 2002b), or County of Orange (Gray and Bramlet 1994b). Special-status plant communities in Big Canyon include:

- coastal salt marsh
- freshwater marsh
- brackish marsh
- alkali marsh
- alkaline meadow
- riparian communities
- coastal sage scrub
- coastal bluff scrub
- alkali grassland
- estuarine/mudflats

6.2 Special-Status Plant Species

This section summarizes special-status plant species observed or expected to occur in Big Canyon. More detail on these species is provided in Table 10 of Appendix B. Special-status plant species observed in Big Canyon, listed by common name followed by scientific name in italics are:

- Salt marsh bird's beak, *Cordylanthus maritimus* ssp. *maritimus*
- Southern tarplant, *Centromadia (Hemizonia) parryi* ssp. *australis*
- Southwestern spiny rush, *Juncus acutus* ssp. *Leopoldii*
- California boxthorn, *Lycium californicum*
- Estuary seablite, *Suaeda esteroa*
- Wooly seablite, *Suaeda taxifolia*

Special-status plant species known to occur in Upper Newport Bay and therefore could potentially occur at Big Canyon, listed by common name followed by scientific name in italics are:

- Aphanisma, *Aphanisma blitoides*
- Coulter's saltbush, *Atriplex coulteri*
- South coast saltbush, *Atriplex pacifica*
- Many-stemmed dudleya, *Dudleya multicaulis*
- Upright burhead, *Echinodorus berteroi*
- Little spike-rush, *Eleocharis parvula*
- Beaked spike-rush, *Eleocharis rostellata*
- Vernal barley, *Hordeum intercedens*
- Coulter's goldfields, *Lasthenia glabrata* ssp. *Coulteri*
- *Microseris douglasii* var. *platycarpha*
- Coast woolly-heads, *Nemacaulis denudata* var. *denudata*
- Rayless ragwort, *Senecio aphanactis*

6.3 Special-status Insect Species

This section summarizes special-status insect species observed or expected to occur in Big Canyon. More detail on these species is provided in Table11 of Appendix B.

One special-status insect species, the western mudflat tiger beetle (*Cicindela trifasciata sigmoidea*), was observed in Big Canyon. Special-status insect species known to occur in Upper Newport Bay and therefore could potentially occur at Big Canyon, listed by common name followed by scientific name in italics are:

- Quino Checkerspot, *Euphydryas editha quino*
- El Segundo blue, *Euphilotes battoides allyni*
- Palos verdes blue, *Glaucopsyche iygdamus palosverdesensis*
- Wandering skipper, *Panoquina errans*
- Monarch Butterfly, *Danaus plexippus*
- Mormon metalmark butterfly, *Apodemia mormo* (El Segundo ecotype)
- Busck's gall moth, *Carolella busckana*
- Henne's eucosman moth, *Eucosma hennei*
- Ford's sand dune moth, *Psammobotys fordi*
- Globuse dune beetle, *Coelus globosus*
- Dorothy's dune weevil, *Trigonoscuta dorothea*
- Lange's el Segundo weevil, *Onychobaris langei*
- Sandy beach tiger beetle, *Cicindela hirticollis gravida*
- Sand due tiger beetle, *Cicindela latesignata*
- Gabb's tiger beetle, *Cicindela gabbii*
- Frost's tiger beetle, *Cicindela senilis frosti*
- El Segundo flower-loving fly, *Rhaphiomidas terminatus*
- Belkin's dune horsefly, *Brennania belkini*
- Jerusalem cricket, *Stenopelmatus* new species
- Sand roach, *Arenivaga* new species

6.4 Special-status Herpetological Species

No special-status herpetological species were located during the 2003 surveys. However, Big Canyon supports potential habitat, albeit marginal, for two special-status herpetological species, the Southwestern pond turtle *(Clemmys marmorata pallida)* and the San Diego horned lizard *(Phrynosoma coronatum blainvillei).* For more detail, see Section 6.4 of Appendix B.

6.5 Special-status Avian Species

Special-status avian species observed in Big Canyon, listed by common name followed by scientific name in italics are:

- California brown pelican, *Pelicanus occidentalis*
- Light-footed clapper rail, *Rallus, longirostris levipes*
- California least tern, *Sterna antilarum browni*
- Cooper's hawk, *Accipiter cooperii*
- Sharp-shinned hawk, *Accipiter striatus*
- White-tailed kite, *Elanus leucurus*
- Northern Harrier, *Circus cyaneus*
- Osprey, *Pandion haliaetus*
- Vaux's swift, *Chaetura vauxi*
- Coastal California gnatcatcher, *Polioptila californica*
- Belding's savannah sparrow, *Passerculus sandwichensis* ssp. *Beldingi*

Special status birds that may occur in Big Canyon or its vicinity include:

- Western snowy plover, *Charadrius alexandrinus nivosus* (may forage on mudflats)
- Merlin, *Falco columbarius*
- Peregrine falcon, *Falco peregrinus* (forage)
- Burrowing owl, *Speotyto cunicularia*
- Loggerhead shrike, *Lanius ludovicianus*
- California horned lark, *Eremophila alpestris actia* (during migration)
- Least Bell's vireo, *Vireo belli pusillus* (may occur as migrant)
- Coastal cactus wren, *Campylorynchus brunneicapillus couesi*
- California yellow warbler, *Dendroica petechia brewsteri* (may occur as migrant)
- Yellow-breasted chat, *Icteria virens* (may occur as migrant)

Further details are available in Table 12 of Appendix B.

6.6 Special-status Mammal Species

No potential habitat for special-status mammal species was located during the surveys. Thus, no mammal species are discussed in more detail in this section, no focused surveys were conducted for special-status mammals in Big Canyon, and none were located during general surveys. The Pallid Bat *(antrozous pallidus)* is likely to forage occasionally

over Big Canyon. More detail is available in Table 12 of Appendix B.

7.0 NON-NATIVE AND INVASIVE SPECIES OF CONCERN

7.1 Non-Native and Invasive Plant Species

The following section notes some of the more invasive, exotic plant species found in the Big Canyon study area. For further detail, see Section 7 of Appendix B.

Non-native and invasive plant species noted in the Big Canyon study area, listed by common name followed by scientific name in italics, are:

- Brazilian pepper, *Schinus terebinthifolius*
- Unknown Saltbush, *Atriplex sp.*
- Iceplants
- Spanish sunflower, *Pulicaria paludosa*
- Statice, *Limonium ramosissimum*
- Glaucous-leaved saltbush, *Atriplex glauca*
- Myoporum, *Myoporum laetum*
- Castor bean, *Ricinus communis*
- Pampas grass, *Cortaderia selloana*
- Evergreen (Shamel) ash, *Fraxinus uhdei*
- Italian thistle, *Carduus pycnocephalus*
- Tocalote, *Centaurea melitensis*
- Black mustard, *Brassica nigra*
- Garland chrysanthemum, *Chrysanthemum coronarium*
- Pride of Madera, *Echium candicans*
- Acacia, *Acacia longifolia, A. retinodes,* plus additional species
- Five-hook bassia, *Bassia hyssopifolia*
- Purple false brome, *Brachypodium distachyon*
- Tree tobacco, *Nicotiana glauca*
- Sweet fennel, *Foeniculum vulgare*
- Poison hemlock, *Conium maculatum*
- Bull thistle, *Cirsium vulgare*

7.2 Non-Native and Invasive Insect Species

Argentine ants *(Linepithema humile)* are small ants often present in great numbers. They are known to forage 24 hours a day. The Argentine ant is now permanently established in California and parts of the southern United States, including Georgia and Florida. These ants are most commonly encountered in urban areas and along the coast. Argentine ants are usually found on trees or shrubs, in flowerbeds, in and around mulch, and in trash heaps. Argentine ants are a serious threat to native ecosystems. They may eat nestling birds. They out-compete native ants and other native insects for food and habitat, thus reducing prey and displacing predators on native insects such as lizards, snakes, and spiders.

Other predators on native insects include non-native sow bugs (*Porcellio laevis*), expected to occur in Big Canyon, and earwigs (*Forficula auricularia*), observed in Big Canyon during surveys. Giant whitefly (*Aleurodicus dugesii*) may also be present on some of the ornamental trees and shrubs above Big Canyon, especially hibiscus. This insect has become a serious pest of plants in recent years from coastal San Diego to Los Angeles County.

7.3 Non-Native and Invasive Herpetological Species

African clawed frog and non-native crayfish are non-native species commonly found in freshwater marshes and streams in southern California, and both were observed in Big Canyon (see Section 3.2.1). These species are known to reduce the populations of native amphibians and fish species, sometimes to the point of extirpation, by consuming their eggs.

7.4 Non-Native and Invasive Avian Species

Several non-native bird species common to southern California are also found in Big Canyon, including the European starling (*Sturnus vulgaris*) and house sparrow (*Passer domesticus*). Both are species native to Britain that were introduced into the United States during the early- to mid-1900's. Both species take over nesting habitat of native species, thereby reducing the populations of native species, and both were observed in Big Canyon. Native species that are a problem for other native birds include the American crow (*Corvus brachyrhynchos*) and brown-headed cowbird (*Molothrus ater*). American crows are very well adapted for living in residential areas, and they prey heavily on native bird species. During surveys for Belding's savannah sparrow in Big Canyon, several crows were observed foraging within the pickleweed marsh, likely searching for garbage washed up during high tide as well as for eggs of native nesting birds of the coastal salt marsh. Brown-headed cowbirds are nest parasites that locate and remove eggs from nests of native birds,

replacing them with their own. The native birds typically do not recognize the foreign eggs and raise the young as if they were their own, thus producing no offspring of their own. No brown-headed cowbirds were observed in Big Canyon during 2003 surveys but they are known to occur in the area.

7.5 Non-Native and Invasive Mammal Species

Non-native and invasive mammal species in the vicinity of Big Canyon include feral cats, a widespread problem in many areas of southern California, as they consume native bird, reptile and mammal species. Another non-native species is the red fox (*Vulpes vulpes*). The red fox is very well adapted to human modified habitats and frequently resides in open space areas such as the borders of coastal salt marshes. Red foxes prey on native species, and substantial reductions in reproductive success as well as in populations of special-status bird species. No red foxes were observed at Big Canyon during the 2003 surveys, and it is likely that coyotes in the area, which prey on red foxes, keep the population in check.

8.0 SPECIES LISTS

Lists of plants, insects, reptiles and amphibians, birds, and mammals observed in Big Canyon during 2003 surveys are provided in Section 8 of Appendix B.

Section 5
BIG CANYON: BENTHIC INVERTEBRATES & FISH

1.0 ABSTRACT

Coastal Resources Management (CRM) conducted a benthic invertebrate and fish survey in the vicinity of Big Canyon on the eastern side of Upper Newport Bay, Orange County, California in 2003. The purpose of the survey was to examine the community structure and distribution of marine invertebrates and shallow-occurring fishes between the channel of Upper Newport Bay to and including Big Canyon Pond. This study was conducted to assist in the development of design alternatives for the restoration of Big Canyon, including the potential to restore tidal action and to predict the types of benthic invertebrates and fish species that might colonize areas within Big Canyon that are reintroduced to tidal action. Channel, mudflat, and shallow freshwater pond benthic samples were collected. The survey yielded a total of 3,062 individuals of marine and freshwater invertebrates, encompassing 48 specific taxa. The distribution of the benthic invertebrates collected during the survey indicated that most species and abundances were associated with the shallow mudflat habitats between +1 to -0.3 ft Mean Lower Low Water (MLLW), and secondarily with deeper open water habitats in the main channel of Upper Newport Bay. Big Canyon Pond exhibited extremely low numbers and diversity of organisms; most were insects (midges).

A total of 1,334 individuals comprising six species of fish were collected at three stations in Upper Newport Bay between the main channel and the drainage culvert leading to Big Canyon Creek. The most abundant species was topsmelt (*Atherinops affinis*), which accounted for 96.4% of the total abundance. Other common species collected included yellowfin gobies (*Acanthogobius flavimanus*), killifish (*Fundulus parvipinnus*), and gobies (Gobiidae, unidentified). The size range of the individuals collected indicated that the area in the vicinity of Big Canyon within Upper Newport Bay supports a viable population of juvenile and subadult fish.

The results of this study suggest that extending tidal influence into Big Canyon will re-introduce a range of shallow water and mudflat-occurring estuarine benthic invertebrates and fishes and will result in higher population densities of benthic invertebrates compared to conditions that currently exist in the degraded Big Canyon Pond.

Given the importance of shallow water and mudflat benthic infaunal organisms in the detrital food web ecosystems of coastal wetlands, and the importance of benthic invertebrates in the diet of foraging shorebirds and marsh birds, the re-introduction of tidal flow, and the subsequent recolonization of Big Canyon wetlands by tidal invertebrates and fishes would result in an increase in coastal wetland habitat value.

2.0 INTRODUCTION

Benthic invertebrate and fish surveys were conducted by CRM in May and July 2003 to determine the community composition and abundance of invertebrates and fishes in the vicinity of the mouth of Big Canyon. This information is being collected to assist in the development of design alternatives for the restoration of Big Canyon, which include the reintroduction of tidal flow to areas within the Canyon that historically (pre-1875) were subjected to tidal influence (see Appendix A, Figure A1). The information collected provides a baseline that can be used to assist in predicting the types and abundances of estuarine and bay invertebrates and fishes that may potentially re-colonize Big Canyon tidal channels once tidal flow is re-introduced to the area.

3.0 METHODS

3.1 Benthic Invertebrates

CRM conducted the benthic invertebrate survey on 30 May 2003. The survey was conducted by Rick Ware, Steve Whitaker, and Jim Stickler, of Coastal Resources Management. A total of 14 stations were sampled in the vicinity of Big Canyon, located on the eastern side of Upper Newport Bay approximately 1.5 miles northeast of the Coast Highway Bridge (see Figure 5.1). The sampling sites are located within the Upper Newport Bay Ecological Reserve, and also within City of Newport

Beach Environmentally Sensitive Habitat Area (ESHA) #3 (Upper Newport Bay Ecological Reserve) and ESHA #7 (Mouth of Big Canyon). General vicinity photographs of station locations are shown in Photographs 1 through 7 in Appendix C. Photograph 8 in Appendix C illustrates the benthic sampler and the volume of sediments sampled in each benthic core.

Stations BC-1 through BC-6 were located in Upper Newport Bay at depths between -0.2 to -4 feet (ft) (MLLW). Stations BC-7 through B-12 were located in a tidal/drainage channel and mudflats surrounding the channel on the west side of Back Bay Drive. This channel connects the Big Canyon Pond with Upper Newport Bay via an outflow culvert that drains Big Canyon Pond and channels storm water runoff into the bay. The culvert primarily functions as a flood control device to channel heavy winter flows into Upper Newport Bay. Two stations (BC-13 and BC-14) were located within Big Canyon Pond. The characteristics of each station and geographic coordinates are listed in Appendix C, Table C1.

At each station, two 1-liter cylindrical core samples were collected by diver biologists using SCUBA apparatus or by biologists wading out on the mudflats. Biologists collected the samples by inserting the corer into the sediment to the top of the coring device, reaching below the corer and capping the sample, and putting the sample into a diver collection bag. Upon completing the collection of the two replicates, the divers returned the samples to the vessel and proceeded to the next station. Field information collected at the time of the survey included latitude/longitude positions (recorded with a Magellan 6000 hand-held Global Positioning System (GPS) unit equipped with a Differential GPS receiver), water depths (later standardized to MLLW), water temperature, and salinity. Water temperature was measured with a hand-held thermometer; salinity was measured with a refractometer.

The surface area of each sample was 0.0078 square meters (m^2). Samples were brought to shore, screened with seawater through a 1.0 mm Nitex screen, and the organisms retained on the screen were preserved in a 10% formalin solution. Photograph 8 illustrates the benthic coring device, the sieving screen, and a typical sediment core.
In the laboratory, samples were then rewashed and preserved in ethanol for taxonomic analysis. Samples were processed by Osprey Marine Services, Long Beach California. Invertebrates were sorted and identified to the lowest possible taxa by qualified invertebrate taxonomists and using procedures and taxonomic standards of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT).

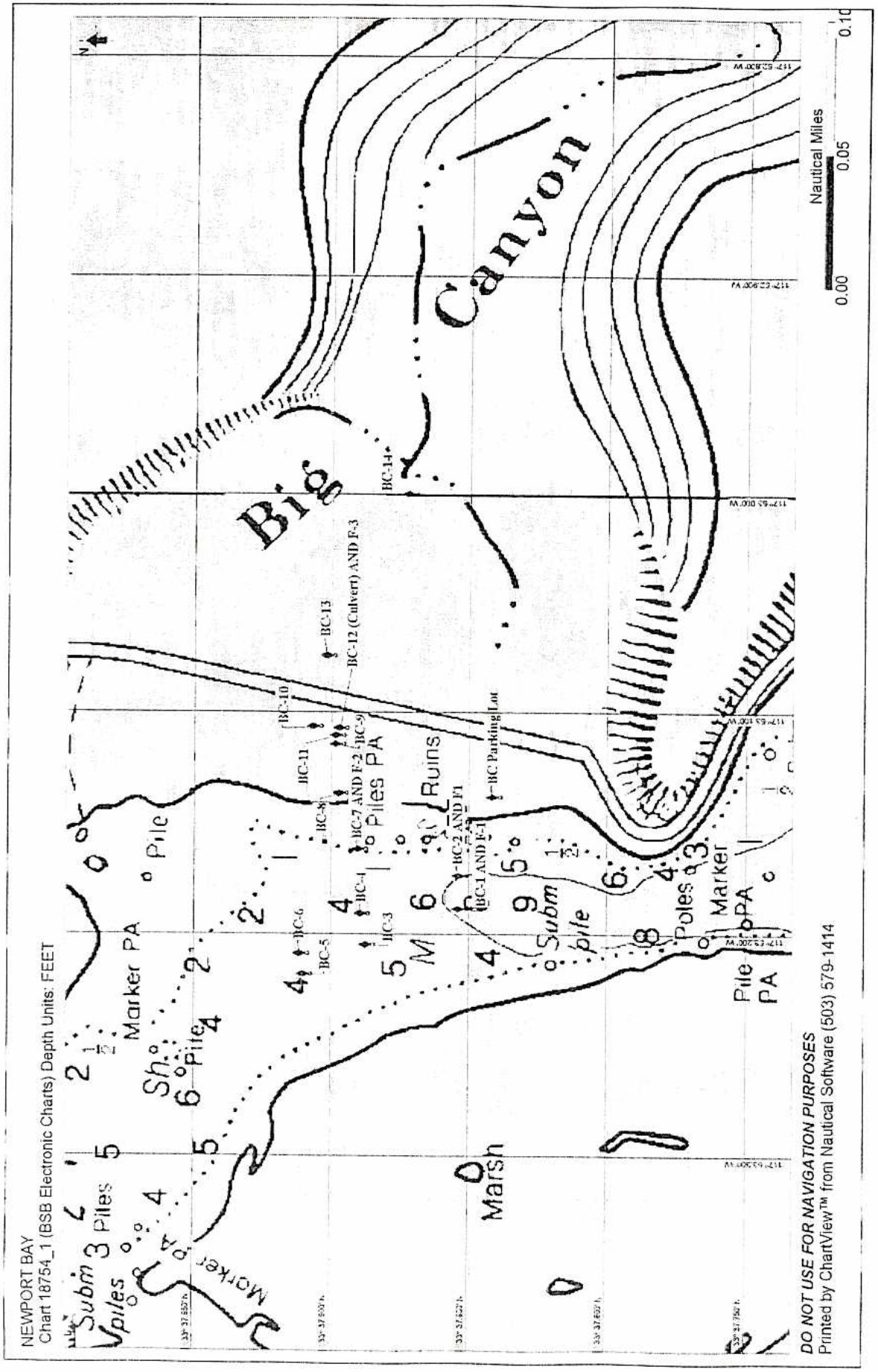
Completed lab data were entered into an Excel spreadsheet and the invertebrate data was compiled and sorted by replicate, station, and survey. A summary for each replicate and station was generated and included total number of individuals per sample, mean, % total, number of individuals per square meter, Shannon Weiner Species Diversity (H') and Species Eveness (J'). H' is a measure of the distribution of individuals among species within a particular sample. Higher numbers represent a higher species diversity of a sample. Species evenness measures the spread of individuals among each species.

3.2 Fish Surveys

Fish sampling was conducted on 15 July 2003. Mr. Rick Ware, Steve Whitaker, and Ray de Wit conducted the fish survey employing a 50-foot long, six-foot deep beach seine fish net. The sampling array focused on shallow water channel habitat and mudflats around the mouth of Big Canyon in Upper Newport Bay. Three stations were sampled (see Figure 5.1). Fish sampling station F-1 corresponds to BC-1 and BC-2; F-2 corresponds to BC-7; and F-3 corresponds to BC-12. The net was deployed with the aid of a 14-foot inflatable vessel and a crew who swung the net in an arc beginning at the shoreline. Upon completing the set, the crew then closed the net and pulled the cod end of the net onshore. The net fished approximately 218 cubic feet of water (182 cubic meters) during each set. All fish were identified and a sub-sample of each species was measured (standard length). The position of each station was recorded with a Differential Global Positioning System. All individuals were returned alive to Newport Bay.

FIGURE 5.1

BENTHIC STATION LOCATIONS



Water temperatures were also measured at each of the three stations. Completed data were entered into an Excel spreadsheet and compiled and sorted by replicate, station, and survey. A data summary for each station was presented based on two replicates per station and included total number of individuals, mean values per sample, percent total, and number of species per station.

4.0 HISTORICAL INFORMATION

Historically, much of Big Canyon was subject to tidal action and it supported salt marsh habitat (see Appendix A, Figure A1). The western one-third of Big Canyon received some form of tidal influence through approximately the early 1950s, when Upper Bay dredge material was placed across the mouth of Big Canyon. The tidal influence was significant enough to form coastal salt marsh within Big Canyon, along the periphery of Upper Newport Bay.

The 1875 United States Geographic Survey (USGS) topographic survey of Newport Bay shows marshes that extended to where the east end of Big Canyon Pond is currently located. A 1959 illustration (Stephenson and Emery) shows "reclaimed marshes" in existence at the mouth of Big Canyon in 1951. The 1950 National Oceanic & Atmospheric Administration (NOAA) chart (Figure 25, in Stephenson and Emery 1959) illustrates the mouth of Big Canyon with a dike across the front of Big Canyon. During the 1950s and 1960s, dredge material that originated from Upper Newport Bay dredging operations was placed in Big Canyon. Big Canyon Pond was created in the mid-1980s as mitigation for an Orange County Sanitation District trunk line sewer project. In essence, Big Canyon has not experienced tidal flows since about 1950.

Lower and Upper Newport Bay channel bottoms consist of sand, mud, or combinations of sand/shell hash sediments depending on current velocities, channel depths, the configuration of the bay, and proximity to sources of sediment inputs to the bay. These soft sediments support benthic invertebrates, some of which crawl over the surface of Newport Bay sediments, while others lead a sessile existence and protrude above the sediments from within a tube. While the majority of benthic invertebrates of bays and estuaries obtain their nutrition by consuming organic detritus, some graze on diatoms and algae or actively prey on other invertebrates. In turn, bottom feeding fishes and resident soft bottom-dwelling fishes (gobies, juvenile flatfish, and sand bass) and shorebirds rely upon these benthic organisms as food sources.

Over 300 species of benthic invertebrates have been identified from Newport Bay mudflats and subtidal channel sediments (Barnard and Reish 1959, Dawson 1963 Daugherty 1978, MBC and SCCWRP 1980, Seapy 1981, Ware 1985). At least 255 of these live in the sediments between the Pacific Coast Highway Bridge and San Diego Creek (California Department of Fish and Game 1989). The dominant types of benthic invertebrates are annelid worms (polychaetes and oligochaetes), arthropods (gammarid and caprellid amphipods, isopods, ostracods, and cumaceans), and mollusks (gastropods and pelecypods). Most forms are not endemic to the region, and do not necessarily reflect polluted bottom conditions. Rather, they are widely distributed and highly adaptable, and they survive well under stress conditions that occur naturally in many California coastal bays and estuaries.

The number of benthic infaunal species decreases between the harbor entrance and the regions where water circulation is restricted in Newport Harbor and Upper Newport Bay MBC and SCCWRP 1980, Daugherty 1978). These community changes occur because of increasing environmental stresses due to extremes in salinity, temperature, and dissolved oxygen, as well as decreasing grain sizes within the sediments they inhabit.

Common invertebrates that live in Upper Newport Bay sediments include:

- Polychaete Worms
  - *Capitella capitata*
  - *Pseudopolydora paucibranchiata*
  - *Streblospio benedicti*
  - *Haploscoloplos elongates*
  - *Tharyx* sp. *Neanthes arenaceodentata*
  - *Polydora socialis*
  - *P. ligni*
  - *P. nuchalis*
  - *Prionospio heterobranchia newportensis*
- Oligochaete Worms
- Amphipods

Grandidierella japonica
Monocorophium acherusicum
C. *insidiosum*
Ampithoe spp.

- Caprellid Amphipods
  Mayerella banksias
- Snails
  Cerithidea californica
  Assiminea californica
- Clams
  Theora lubrica
  Chione fructiflaga
  Macoma spp
  Tagelus subteres
  T. californianus

Newport Bay supports a substantial population of both ocean (pelagic) and bottom-oriented (demersal) fishes that occupy several different habitat types, including marsh channels, pools, mudflats, shallow subtidal channels and slopes deeper channels, and marinas (ACOE 2000; 1993). At least 78 species of fish have been identified from Newport Bay, although their distributions and abundance vary greatly by habitat type and time of the year.

The type of sampling gear used to conduct the fish surveys will also influence the types and abundances of species caught. Horn (1999) indicated that up to 40 fish species per year may utilize Newport Bay. However, only a few members of the fish community are numerically dominant. Over the years, these species include lower-trophic level feeders, such as deepbody anchovy, topsmelt, killifish, and mid-to-higher trophic level feeding gobies. There has also been a reduction in the number of freshwater species (mosquito fish, striped bass, bluegill, black bullhead, and threadfin shad occurring in the bay over the years (Allen 1988, ACOE 2000). This may be correlated to maintenance dredging activities allowing greater tidal flow into the upper regions of the Bay and perhaps a reduction in the release of some species (i.e., striped bass).

The bay supports a population of about 10 resident fish species, and is a nursery ground for juveniles of 33 species. Generally, highest abundances occur in spring and summer when transients move into the bay. Abundances are lowest when these species move out of the bay for more coastal and offshore locations during late fall and winter.

The bay's fish population is also an important food source for fish-eating birds such as brown pelicans, terns, herons, and osprey.

Very little fish sampling has occurred in Big Canyon Pond or immediately downstream of Big Canyon Pond. Camm Swift (Los Angeles County Museum of Natural History) and John Scholl (California Department of Fish and Game) collected fathead minnows (*Pimephales promales*) and largemouth bass (*Micropterus salmoides*) as well as African clawed frogs from the pond during a single sampling (Swift, pers. communication with R. Ware, 28 September 2003). Swift also noted the presence of rain water killifish (*Lucania parva*) downstream of the Big Canyon culvert entering Newport Bay (F-3, current study) after heavy El Nino storms. However, rainwater killifish are not usually present under typical climatological conditions.

5.0 ANALYSIS OF THE CURRENT PHYSICAL CONDITIONS AND BIOTA

5.1 SEDIMENT Types, Water Temperature and Salinity

Physical examination of the sediment types within the study area indicated that sediments ranged from fine muds to coarse gravel and rock (see Appendix C, Table C1). Channel and mudflat sediments fronting the main channel of Upper Newport Bay were generally soft muds, layers of sand over mud, or sand over clay (Stations BC-1 to BC-6). Within the narrower and constricted tidal channel leading to the Big Canyon culvert (BC-7 to BC-9 and BC-12), sediments were reflective of periodic, high flow rates with a lighter layer of silt covering a conglomerate of gravel, shell, cobble, and rock, some of which was placed in the area to protect the outflow culvert. The mudflats on both sides of the tidal channel (BC-10 and BC-11) leading to the culvert draining Big Canyon were covered with a green algal mat (*Enteromorpha* sp.). This algal mat covered sediments of soft muds and sands. In Big Canyon Pond, immediately east of the culvert, the sediments were also generally coarse and consisted of mixture of gravel, cobble, and mud. However, on the east side of Big Canyon Pond

(BC-14), the sediments were highly organic muds. Sediments at both BC-13 and BC-14 were mixed with decaying vegetation from the freshwater marsh.

Surface water temperatures ranged between 21 and 24.8 degrees Celsius (69.8 to 76.6 degrees Fahrenheit). Lowest surface water temperatures were in the main channel, whereas the highest temperatures were recorded at BC-6 over the mudflats north of the Big Canyon Drainage Channel, and at BC-14 within Big Canyon Pond.

Surface water salinity (one foot below the surface) declined along a gradient between the main channel of Upper Newport Bay to Big Canyon Pond (see Appendix C, Figure C2). Normal bay salinities of 31 and 32 parts per thousand (ppt) were recorded in the Upper Bay main channel and over the mudflats (Stations BC-1 to BC-6). Lower salinities were recorded in the drainage channel leading to the Big Canyon culvert (BC-7 to BC-12) and hyposaline, near freshwater conditions existed within Big Canyon Pond (4 ppt, BC-13 and BC-14).

5.2. Benthic Invertebrates

5.2.1. Station Results

A total of 3,062 benthic invertebrates and 48 species representing eight invertebrate phyla were collected in 28 benthic samples. Table C3 in Appendix C summarizes the mean data for each station and depth of sampling. Species richness (numbers of species) averaged between 3 and 16 species per station (BC-14 and BC-6, respectively). While there were only slight differences in the numbers of species occurring in Upper Newport Bay between BC-1 and BC-12 (depths varying between -4 ft and +3 ft MLLW), considerably fewer species were present in the Big Canyon Pond. Density by station varied from 1,346 to 45,449 individuals per square meter (BC-13 and BC-6, respectively). Invertebrate densities were lowest within Big Canyon Pond and highest at lower mudflat elevations and shallow channel depths (-1.0 and +0.3 ft MLLW, respectively). Highest densities were attributable to polychaete worms and microcrustaceans. Species diversity (H') values declined along a gradient between the deeper channel stations to Big Canyon Pond (see Appendix C, Table C3), with highest diversity (2.06) at BC-1, and lowest species diversity (0.79) at BC-14. Evenness (J') was lowest at shallow mudflat stations and indicative of conditions where a few species dominated the abundances. Highest J' values were within the Big Canyon Pond, where both abundances and numbers of species were low, and abundances were generally evenly distributed among the few species present.

5.2.2 Species Composition and Abundance

Table C4 in Appendix C summarizes the taxonomic composition of the benthic infaunal community sampled during the survey. Polychaete annelid worms contributed the most species – 17 or 34.5 % - while crustaceans and bivalves each contributed 7 species and 14.6% each of the total number of species. Each of the remaining major taxonomic groups contributed 4 or fewer species.

Polychaetes and crustaceans were also the most abundant invertebrate forms, accounting for 38.8% and 30.8% percent of the total abundance, respectively. Oligochaete worms were the third most abundant group of invertebrates, accounting for 16.8% of the total abundance. Organism density of each of the major taxonomic groups ranged between 4.6 individuals per square meter (cnidarians [anemones and hydroids]) to 5,444 per square meter (polychaete worms). Crustaceans (amphipods and isopods) also occurred in dense concentrations, averaging 4,317.8 individuals per square meter. Based upon the number of species and densities of individual species of crustaceans and polychaetes, crustaceans exhibited a greater mean density per species (617 individuals per square meter) than polychaete species (320 individuals per square meter).

5.2.3. Species Abundances

Table C5 in Appendix C lists the numerically dominant species occurring in the samples and their distributions among the 14 stations. Ten of the 48 species accounted for 93.4 % of the total abundances. These taxa included five annelid taxa:

Fabricinuda limnicola, Pseudopolydora paucibranchiata, oligochaetes, *Capitella capitata,* and the spionid polychaete *Streblospio benedicti*), two amphipod crustaceans (*Grandidierella japonica* and

Mono-corophium acherusicum), two mollusks (the mussel *Musculista senhousei* and the California horn snail *Cerithidea californica*), and one phoronid worm (*Phoronis* spp.).

Of these ten species, three accounted for 55.6% of the abundance indicating a high numerical dominance of the benthic community by a relatively select few species. These species included the tube-building amphipod *Grandidierella japonica* (648 individuals, 21.2% of the total), the polychaete worm *Fabricinuda limnicola* (538 individuals, 17.6% of the total), and oligochaete annelid worms (515 individuals, 16.8% of the total).

Freshwater and brackish-water insects were present in some of the samples and included one order (Diptera) and three subfamilies of chironomids (midges). Nineteen of 22 individuals were in the subfamily Chironomini and all of these were present in the Big Canyon samples. Two other midge subfamilies (Orthocladiinae and Tanypodinae) were represented each by a single individual. These were located at BC-11 and BC-13, respectively.

Taxa with primary affinities to the Upper Newport Bay channel habitats and lower elevational mudflats included anemones and hydroids, the majority of gastropods and pelecypods, the polychaetes *Exogone cf verguera, Euchone limnicola, Pseudopolydora paucibranchiata, Scoletoma* sp. C, *Scoloplos acmeceps, Fabricinuda limnicola, Marphysa* spp NBB1 (a new species), and the phoronid *Phoronis* spp.

Taxa that exhibited wide distributions in both the Upper Newport Bay channel, low elevational mudflats, and the Big Canyon drainage channel leading back to the Big Canyon culvert included the polychaetes *Streblospio benedicti* and *Polydora cornuta,* oligochaetes, and amphipods (*Grandidierella japonica* and *Monocorophium acherusicum*). Oligochaetes and *G. japonica* were also found in the hyposaline areas within Big Canyon samples.

Taxa with a generally restricted distribution in the drainage channel, Big Canyon, or a combination of both areas included the California horn snail (*Cerithidea californica* (found in algal samples in the drainage channel), the polychaetes *Capitella capitata* and *Polydora nuchalis,* and the three subfamilies of insects referenced above. Despite its restricted occurrences in the samples from the drainage channel, the horn snail is one of the most abundant epifaunal species of invertebrates occurring on the mudflats of Upper Newport Bay (R. Ware, personal observation). Estimates of horn snail density on the mudflats along the periphery of Lower Shellmaker in April 2003 ranged from 256 to 586 individuals per square meter (Coastal Resources Management 2003).

Comparatively, 59 species of mudflat and shallow subtidal invertebrates and 2,889 individuals were collected in 18 one-liter box core samples (0.01 square meter surface area) on the De Anza/Bayside marsh peninsula near the Coast Highway Bridge in July 1984 (Ware 1985). Density varied between 6,233 and 42,796 per square meter. Annelids accounted for 86% of the abundances and 41% of the species and crustaceans (primarily amphipods) accounted for 17 species (28.9%) and 247 individuals (8.5%). Many of the dominant species on the De Anza Peninsula were the same as those present near Big Canyon in 2003. The dominants included the polychaetes *Fabricia limnicola, Polydora socialis, Pseudopolydora paucibranchiata, Capitella capitata, and Scoloplos acmeceps, and the amphipods Corophium uenoi, Grandidierella japonica, and Monocorophium acherusicum.*

5.3 FISHES

Data, by station, replicate, and species is provided in Appendix C, Table C6.

5.3.1 Water Temperature

During the survey in July, water temperature was substantially higher than during the May 30th 2003 benthic infaunal survey. Temperatures varied between 76 degrees F (24.4 degrees C) and 81 degrees F (27.2 degrees C) at F-1 and F-3, respectively.

5.3.2 Species Composition and Abundance

A total of six 50 foot long by 6 feet deep beach seine sets were made at three stations in the vicinity of the mouth of Big Canyon. The survey yielded a total of six species of fish and 1,334

individuals. By station, the number of species collected per replicate (minus invertebrates) varied between 0 (F-3) to 5 (F-2). The total number of species per station varied between 3 (F-3) to 5 (F-2).

The species captured, in rank order of abundances from highest to lowest, included topsmelt (*Atherinops affinis*), yellowfin goby (*Acanthogobius flavimanus*), killifish (*Fundulus parvipinnus*), deep body anchovy (*Anchoa compressa*), juvenile gobies (unidentified), and a juvenile croaker (Scienidae, unidentified). In addition, yellow shore crabs and sponges were also incidentally taken in the beach seine nets, along with significant amounts of *Enteromorpha* (green algae) particularly at Stations F-2 and F-3.

The catch was dominated by topsmelt, which accounted for 96.3 % of the catch and an average of 214 individuals per set. It occurred in all six beach seine sets, although 91% of the fish were found in Upper Newport Bay over channel depths and mudflats at F-1. The size range of individuals collected ranged from 16 to 66 mm, young of the year and juvenile age classes.

The second most abundant species (yellowfin goby, 27 individuals and 2% of the catch) was taken from the Big Canyon drainage channel (F-2 and F-3). It was abundant in samples at F-2, where large amounts of green algae (*Enteromorpha* sp.) were collected in the net. Twenty-six of 27 individuals were collected at this station, with an overall mean catch of nine individuals/set. The sizes of individuals caught ranged between 36 to 86 mm, representing juvenile and adult individuals.

California killifish accounted for 0.5% of the catch (7 individuals). Six of the seven individuals were collected at F-1. The size range of individuals caught at F-1 and F-2 ranged between 34 and 81 mm.

Deepbody anchovy accounted for 0.4% of the total abundance, and was collected at F-1 and F-2, in the channel and over the mudflats. The size range of deepbody anchovies varied between 58 to 119 mm; this represents juvenile and adult size classes.

Comparisons of the catch data with a previous beach seine study conducted as part of a larger Army Corps of Engineers study (MEC, Inc. 1997) in the same general vicinity as the CRM July 2003 study indicate that all of the dominant fish species observed during the 1997 surveys were also recorded during the Big Canyon survey in 2003. The CRM survey collected six of the nine species recorded by MEC near Big Canyon, and the mean abundance (446 individuals per station) was substantially greater than recorded during the September 1997 MEC survey (mean of 32 individuals), due to higher numbers of topsmelt collected by CRM in summer 2003. The CRM survey also documented the presence and relatively high dominance of the non-native yellowfin goby in the study area. This species has increased in abundance over time (MEC 1997), and become one of the most abundant gobies in Upper Newport Bay. Other species that are known to occur in the shallow water and channel habitat in the vicinity of Big Canyon, but not sampled by beach seine methods in this study include California halibut, diamond turbot, and pipefish.

6.0 ENDANGERED, THREATENED, OR SENSITIVE SPECIES

6.1 Benthic Invertebrates

No State or Federal listed species of invertebrates occur in Upper Newport Bay. However, one Federal Species of Concern (FSC) is present in Upper Newport Bay-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 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 (US. Army Corps of Engineers, 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.

6.2 Fishes

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 of commercial importance, regularly uses the Upper Bay as a nursery area (Allen 1988, Horn and Allen 1981, USACOE 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) 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.

7.0 RESTORATION RECOMMENDATIONS

The results of the benthic survey indicate that the mudflats and shallow tidal channels near Big Canyon support an estuarine invertebrate fauna not unlike those occurring throughout the rest of Upper Newport Bay (MBC and SCCWRP 1981; Daugherty 1978; Seapy 1981). These organisms exist in a seasonally euryhaline and eurythermal environment nearby the culvert leading to Big Canyon. Big Canyon Pond, however, 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 and all are known from other regions of Upper Newport Bay, the most abundant being topsmelt and yellowfin gobies. No rare or sensitive species of fish were collected near the mouth of Big Canyon.

Restoration of the historic tidal wetlands in Big Canyon (or a portion of it), and restoration of tidal influence to Big Canyon would increase the biological diversity of the western one-third of Big Canyon by re-introducing tidal-dependent species and communities to an area that has been degraded by fill, invasive plant species, and poor water quality.

Creating a tidal channel, mudflats, and additional salt marsh within Big Canyon would widen the distribution of the Upper Bay estuarine invertebrate community. Species most likely to colonize new tidal habitat in Big Canyon are the polychaetes *Polydora nuchalis*, *Streblospio benedicti* and *Polydora cornuta*, oligochaetes, and amphipods (*Grandidierella japonica* and *Monocorophium acherusicum*). Larger marsh invertebrates, such as California horn snails, yellow shore crabs, and fiddler crabs would also be potential recolonizers. The potential increase in benthic secondary productivity as a consequence of increasing the tidal prism in Big Canyon would also enhance the use of Big Canyon by both fishes and shorebirds because of the increased food supply and foraging habitat for these resource groups.

The following recommendations are made in respect to restoring tidal habitats in Big Canyon.

- Determine restoration priorities and focused objectives for tidal restoration in association with other planned restoration activities in Big Canyon;
- Identify potential channel connection points and tidal volumes required for restoration tidal-influenced areas;
- Maximize tidal flat and tidal channel restoration and provide for gentle sloped salt marsh elevations along the periphery of the tidally influenced areas. This is in keeping with the Department of Fish and Game's Upper Newport Bay Management Plan (1988) to maximize restoration of tidal influence to Upper Newport Bay and;
- Conduct post-construction tidal invertebrate and fish surveys at intervals of 0 months, 3 months, 1 year, 2 years, and 3 years following restoration to document tidal habitat restoration success, recolonization by

invertebrates and fishes, and shorebird use. Prepare monitoring survey reports and determine if additional site remediation is necessary to maintain tidal habitat quality and insure use of the habitats by invertebrates, fishes, and shore birds.

8.0 ACKNOWLEDGEMENTS

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Section 6
BIG CANYON: HYDROLOGY, WATER RESOURCES & ENGINEERING

This section provides a summary of the technical review conducted and evaluation of the water supply, floodplain, soils and infrastructure issues related to the development of the restoration projects within Big Canyon.

The two square-mile upper watershed of Big Canyon Creek contributes significant water flow to the Big Canyon Creek Restoration Project Area. There is now a constant flow of 5 cubic feet per second (cfs). Under major flood conditions, such as a 100-year flood, the entire canyon floor will be inundated, with the exception of the raised terrace of dredge spoils south of the freshwater pond. Since the canyon slopes are relatively steep, erosion and sedimentation will occur during these events.

Big Canyon Creek is in a natural, un-channelized condition. The natural function of Big Canyon includes accommodating storm events and flooding; during large floods, the entire canyon floor is expected to be inundated. This natural flooding process provides the necessary soil moisture for plant growth. However, the inundation depth and frequency must be managed in order to establish and protect restored habitats, protect existing habitats and protect existing and proposed infrastructure in of he Big Canyon Creek Restoration Project Area.

SOILS & GEOTECHNICAL FEATURES

Boring tests of the Big Canyon Creek Restoration Project Area consistently revealed that key areas of the project site were covered by dredge spoils, some with very distinct chemical properties such as high salt and sulfide contents. According to the soil texture analysis, the fill materials are typically silty sand while the native site material contains sandy clay.

Approximately five boring logs were explored to identify surface and subsurface soils properties as described in the soils report (see Appendix D, Table D1). These boring tests were performed to obtain slope stability recommendations and planting suitability analyses (see Appendix D, Tables D2 and D3). The boring depth was limited to 10 feet and two samples were excavated to only 2 feet due to high soil moisture. Soil test results confirm the historic tidal maps. Additionally, the soil tests show where dredge spoils have been placed over native soils.

The deposition of dredge materials in Big Canyon combined with the construction of Back Bay Drive have apparently modified the topographic features of the canyon and influenced the establishment of both native and non-native plant communities. The specific soil chemistry and soil characteristics of the dredge spoil locations have created large infertile areas and areas dominated by exotic species (see Appendix A, Figure A2 and Section 7).

Special attention in these areas will be required for grading, drainage, roadway and foundation preparation for structural components. Compaction and over-excavation will be required for any new infrastructure construction.

HYDROLOGY & FLOODPLAIN

Big Canyon Creek's watershed of approximately 1,300 acres (two square miles) is highly urbanized and completely developed. Big Canyon Creek drains this entire watershed directly into Upper Newport Bay (see Figure 6.1). The headwaters are located near the San Joaquin Reservoir east of MacArthur Blvd. Although Big Canyon Creek is a sizable tributary to the Bay, no complete hydrology study has ever been undertaken.

Based on information provided by the City of Newport Beach Master Plan of Drainage (1999) and the 2002 study entitled "Erosion and Water Quality Issues in Big Canyon in the City of Newport Beach" produced by California Department of Fish and Game, the 100-year-flood discharges for Big Canyon Creek are estimated to be 2,910 cfs at Jamboree Road and 3,660 cfs at the outlets at Back Bay Drive. Calculation of these discharges did not consider the proper lag time from the storm drain outlet to the downstream concentration points; therefore, they are considered overly conservative for purposes of this report.

Using the Orange County Hydrograph method, and based on land use, topographic features and soils, the discharges were re-calculated for a 100-year flood. They are estimated to be 2,510 cfs at Jamboree Road and 2,770 cfs at Back Bay Drive (see Table 6.4 below).

Table 6.4: Flood Peak Discharge

WRC Consulting, October-03

Concentration Point	Drainage Area (acres)	Peak Discharge (cfs)		
		10-yr. Flood	100-yr. Flood	2-yr Flood
Jamboree Rd.	1,100	1680	2510	1260
Back Bay Dr.	1,350	1860	2770	1390

The 100-year floodplain boundaries were identified as shown in Appendix A, Figure A1, based on an approximate hydraulic analysis. However, the scope of this project did not allow for a detailed, two-dimensional modeling of freshwater flow distribution between the different channels of Big Canyon Creek. The HEC-RAS Model, developed by the U.S. Army Corps of Engineers, was applied to obtain the tidal backwater profile using eight cross-sections.

WATER SUPPLY

The Big Canyon Creek watershed contains golf courses, parks, and large landscaped residential yards. Irrigation runoff from these landscaped areas make up the base flow in Big Canyon Creek and, given the consistent volume of irrigation water, this runoff can be expected to be a reliable and constant source of water. This is confirmed by water consumption data from the City of Newport Beach. The City's sprinkler reports from sprinkler meters in the Big Canyon watershed and seasonal water consumption records (see Appendix D, Figure D4) show that far more water is being applied via sprinklers than is being taken up by vegetation; the difference results in irrigation runoff. Since the Big Canyon watershed has been completely developed for more than ten years, including the landscaped areas, it is anticipated that the resulting irrigation runoff will continue and be available as dry season water supply for restored habitat.

In addition, dry season measurements from the United States Geological survey measurement station for San Diego Creek at Campus Drive show that average summer daily flows in San Diego Creek range from 1 to 3 cfs. Big Canyon Creek does not have a gauging station to record daily flow measurements, but as a sub-watershed of San Diego Creek, can be expected to show similar flow rates. Additionally, the Big Canyon Creek watershed, although smaller, is far more urbanized than the San Diego Creek watershed. As a result, a dry season base flow in Big Canyon Creek due to urban runoff from extensive landscaping and irrigation in the watershed can be expected. This has been confirmed through on-site observation. This dry season flow appears to be sufficient to maintain soil moisture in Big Canyon and to provide adequate water to sustain proposed habitat restoration areas.

TIDAL FLOW

Tidal inundation and fluctuation of tidal range are critical to the restoration of salt marsh. Currently, the tidal inundation area is limited to the bayside of Back Bay Drive. The roadway was constructed at an elevation of ten feet above mean sea level, out of the high tide range, although it may be subject to wave action during storms. The roadway embankment has been damaged by storms in the past, requiring costly repairs and maintenance by the City of Newport Beach.

The 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, as shown in Appendix A, Figure A1. 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. The potential of restoring the historic tidal area was considered and evaluated in the formulation of alternatives during concept plan development.

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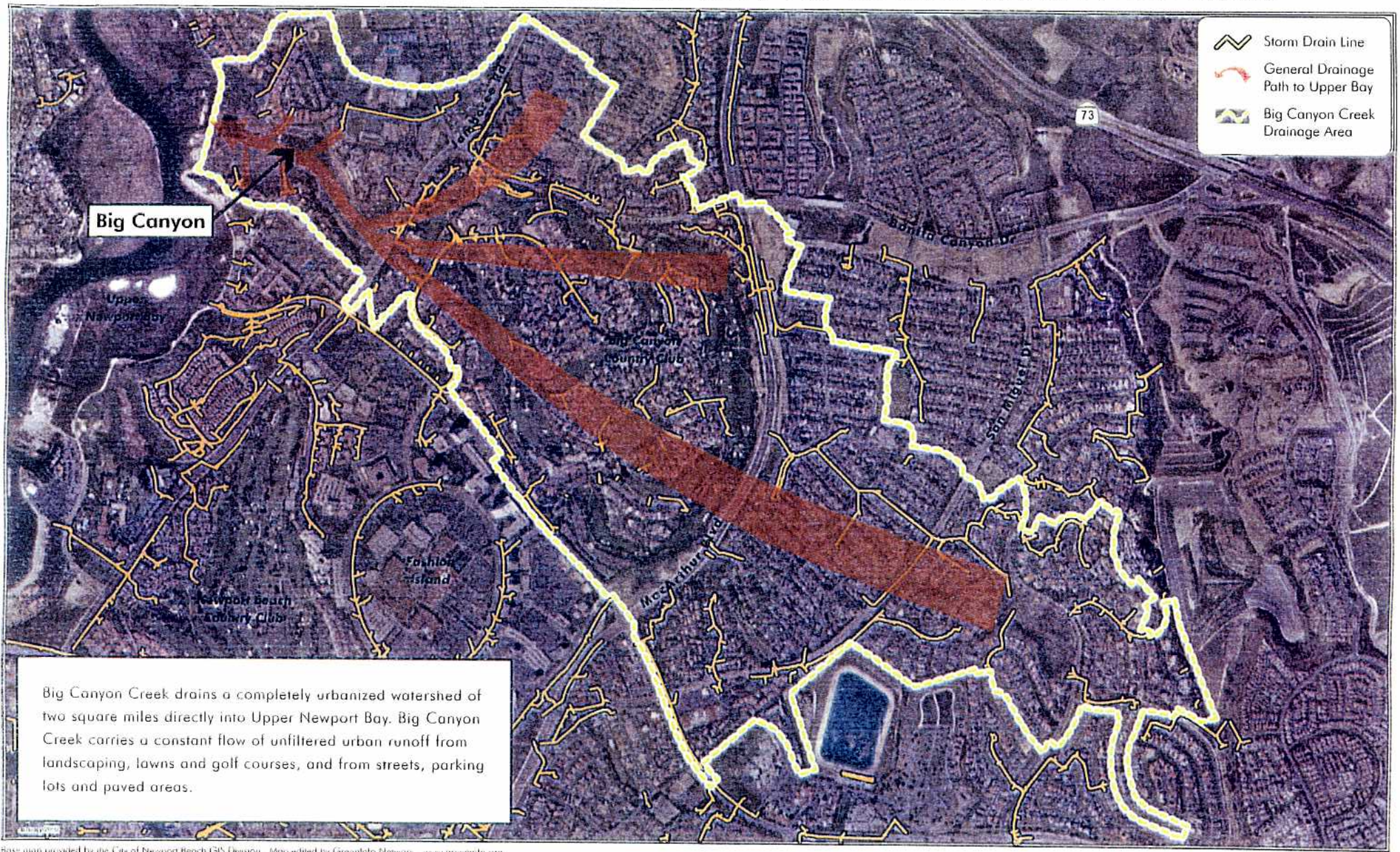
BIG CANYON CREEK WATERSHED & URBAN RUNOFF FLOWS INTO BIG CANYON CREEK



Base map provided by the City of Newport Beach GIS Division. Map edited by GreenInfo Network. www.greeninfo.org

FIGURE 6.1

Tidal fluctuation and elevation ranges are also critical to tidal habitat restoration. A study by the U.S. Army Corps of Engineers and Coastal Frontiers, Inc., in 1992 was reviewed pertaining to the project site. Figure D5 in Appendix D shows the tidal curve at the Newport Bay entrance and Figure D6 in Appendix D shows its comparison to Upper Newport Bay for a selected period. 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.

EROSION & SEDIMENTATION

Erosion in Big Canyon has been a problem associated with past storms. The erosion sources have been identified as follows: loose fill from uncompacted dredge spoils; uncompacted gravel access roads; cliffs; and tidal wave action during storm events. The erosion pattern is considered localized and without the risk of gross instability.

The Big Canyon Creek flow regime is sub-critical and the average flow velocities are relatively slow and range from 4 to 8 feet per second (fps) for a 100-year flood. While the general scour may not be significant with this velocity range, local scouring can and has caused roadway and structural failure and substantial damage to sensitive habitat areas. Additionally, local erosion from uncompacted maintenance roads and dredge spoils and from the canyon cliffs damage native plant habitats.

Because Big Canyon Creek is a natural channel, some erosion and sedimentation is expected. While it is healthy for the Big Canyon ecosystem to experience nominal erosion and sedimentation, proper management of the creek drainage is important in order to minimize erosion and sedimentation problems during storm events and to address the erosion impacts of the decades of human manipulation of Big Canyon.

Eroded sediments have accumulated in the freshwater pond, further contributing to the scour in the downstream portion of Big Canyon Creek. The current channel at the outlet of the pond has been armored with concrete to prevent head-cutting. Back Bay Drive is currently serving as the overtopping weir for flood flows and is subject to major erosion potential both from canyon flows and from tidal surges during storm events.

Because Big Canyon Creek is a natural channel, Big Canyon still functions essentially in a natural manner. The canyon is subject to a certain amount of natural erosion and sedimentation, and accommodates the natural fluctuations of Big Canyon Creek during storm and flood events. The proposed restoration plan needs to consider these natural functions of Big Canyon and Big Canyon Creek, and must address debris management, sediment control and flood protection of infrastructure in order to protect restored habitats and new infrastructure.

WATER QUALITY

Although Big Canyon Creek has little historical water quality measurements, sufficient data exists to conclude that the creek has the same water contamination problems as other coastal streams located within heavily urbanized drainage basins, including sedimentation, eutrophication, bacterial and toxic contamination, pesticides and heavy metals. The Santa Ana Regional Water Quality Control Board Region (8) Watershed Management Initiative Chapter for the Newport Bay Watershed Area highlights all of these water quality problems.

The water in Big Canyon Creek is unfiltered urban runoff draining a two-square mile developed and completely urbanized watershed; the creek carries fertilizers and pesticides from lawns, landscaping and golf courses and pollutants from cars, streets and paved areas. During storms, water sampling has shown very high levels of fecal bacteria at the Big Canyon Creek outlet in Upper Newport Bay.

Upper Newport Bay is listed as an impaired water body under section 303 (d) of the federal Clean Water Act. According to this classification, the following contaminants occur in both Upper and Lower Newport Bay: pesticides and metals; nutrients; pathogens; and sedimentation/siltation. Total Minimum Daily Loads (TMDLs) for Newport

Bay have been established for sediments, nutrients and fecal coliform. A more detailed description of the water quality issues for Upper Newport Bay can be found in "Erosion and Water Quality Issues in Big Canyon in the City of Newport Beach" (2002).

The Big Canyon Creek Restoration Project intends to help meet these TMDLs by addressing the polluted runoff in Big Canyon Creek before contaminated water can reach Upper Newport Bay. Properly designed wetlands systems in other areas have been found to provide the most efficient measures for stream-flow pollution control. The proposed concept plan includes an integrated system of water quality improvement components, erosion and sedimentation control and use of natural habitats.

Water quality testing and analysis will need to be carried out to establish baseline information, prioritize pollutant treatment efforts, and confirm post restoration results.