Upper Newport Bay
Back Bay Science Center
Interpretive Plan

Shellmaker Island, City of Newport Beach

Prepared by:

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The City of Newport Beach
and
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December 15, 2003

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Acknowledgments:

Nature Tourism Planning would like to thank the members of the Back Bay Science Center Steering Committee for their valuable contributions to this interpretive plan. If the BBSC is managed with this degree of cooperation and enthusiasm, then a bright future for the center is assured. Members of the steering committee included

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Thanks are also due to the following individuals for offering their expertise and ideas, and for reviewing an early draft of this document.

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TABLE OF CONTENTS

I. Project Overview

A. Why a Back Bay Science Center?

Upper Newport Bay Ecological Reserve (UNBER) was created in 1975 to conserve and enhance 752 acres of saltwater marsh ecosystem found in the upper reaches of Newport Bay, commonly referred to as the Back Bay. UNBER protects one of the richest and most threatened ecosystems found in California. The quiet waters and mudflats of UNBER are home to over 935 species of plants and animals. While the back bay itself has been protected as an ecological reserve, the long-term health of the bay is in jeopardy. The watershed of the bay, over 154 square miles of land that surround the bay, supports over 750,000 people. Much of the trash, oil, pesticides, and soil that wash into the surrounding storm drains and streams pass through the bay before it moves on to our coastal beaches. This nonpoint source pollution and sedimentation is clearly changing the configuration of the back bay. In addition, public demand for access to these fragile aquatic habitats threatens the plants and animals that seek refuge there.

The idea of a Back Bay Science Center (BBSC) grew out of the need to respond to these threats. While a number of governmental agencies are involved in marine and watershed conservation efforts in the region, until now collaboration and cooperation has been as needed, not by design. By moving water-quality scientists and biologists within the same campus as environmental educators and students, we will link the two key components for the long-term health of the back bay—scientific research and community involvement.

The Back Bay Science Center Project will transform Shellmaker Island on Upper Newport Bay from a former industrial site to an environmental education center. Central to the project will be the creation of a Back Bay Science Center campus housing a state-of-the-art water-quality laboratory, teaching facilities for junior- and senior-high school and college students, aquaria and exhibits on the marine life of the bay and coast, as well as upgraded facilities for the University of California, Irvine rowing crew. Beyond the footprint of the campus, Shellmaker Island's wetlands will be restored, and trails will provide access to this rich habitat.

The educational components of the project will emphasize the environmental impact of humans living in a watershed that drains into a southern California marine estuary. The primary focus will be the effects of water quality on marine life and our stewardship role in maintaining a healthy bay. These components will fill gaps left by the environmental education programs at other facilities within the watershed. Nine separate facilities and programs were identified and a chart of their program focus, target audience, and relationship to the Back Bay Science Center can be found in Attachment A. Through a series of focus group sessions and discussions with these facility managers and local educators, we have developed a comprehensive plan that encourages collaboration between organizations and minimizes any duplication of efforts.

Since water is a central topic throughout the BBSC, water conservation will be woven throughout all programs at Shellmaker. Orange County is home to 2.5 million people and receives 13–15" of rainfall per year. Water conservation efforts are crucial to ensure that both humans and wildlife will continue to maintain a healthy ecological balance in the region. Water conservation is easily understood as a need for water in relationship to human survival, and an additional incentive is the financial savings to

consumers. Yet we rarely consider the benefits to wildlife and our natural surroundings. Rather than simply offer conservation tips, the BBSC will explore and educate the public on how water usage affects wildlife. The BBSC will directly address the effects of water conservation in the watershed and, as research programs continue, we will better understand what contributes to and what detracts from the long-term health of the bay.

B. Back Bay Science Center Goals

The following goals were developed by the project partners during the initial planning stages of the project. These goals provide the direction and focus for all programmatic and architectural decisions that will be made during the development of this project.

1. Compile baseline data on the physical and biological resources of the bay and surrounding watershed
2. Monitor the environmental health of the bay and surrounding watershed
3. Promote water conservation as it relates to the watershed, water quality, and the marine estuary
4. Provide policy makers with scientific information on the health of the watershed
5. Develop a high school and college marine studies curriculum to prepare today's students to be tomorrow's scientists, decision makers, and voters
6. Link students with professional scientists to encourage mentoring and career counseling
7. Offer elementary school and public programs on the aquatic and terrestrial life of the area
8. Encourage all people living in the watershed to participate in protecting the back bay
9. Reduce habitat degradation from recreational and educational uses of the back bay and coastal areas by focusing these activities on Shellmaker Island

C. Project Description

The Back Bay Science Center campus will be comprised of four new buildings totaling approximately 13,000 square feet. The campus will contain the existing UC Irvine Rowing Center, the Orange County Water Quality Laboratory, the Department of Fish and Game's Back Bay Science Center, and administrative offices for the educational and biological staff of partnering organizations.

The Back Bay Science Center's educational programs will cater to junior- and senior-high school as well as college students. Elementary students will be a secondary market for the BBSC site but a primary target market for the new tidepool and shark outreach programs. The BBSC facility will be open to the public at regularly scheduled times during the week and on weekends. Outdoor learning stations and an exhibit courtyard, complete with aquaria and interactive exhibits, will provide visitors with the opportunity to learn about the Newport Bay watershed and observe the diversity of marine life hidden beneath the surface of the back bay. The center also will develop a comprehensive web site and outreach program to offer residents information on how to minimize their impact on the watershed.

Two student laboratories will contain aquaria, water-quality testing equipment, and computer terminals to allow students to conduct watershed experiments and monitor the environmental health of the watershed. In addition, outdoor learning stations and research vessels will serve to link students to the natural resources of the bay in a way that is both fun and educational.

Project architect Ron Yeo has designed the campus to protect coastal resources by placing buildings away from the shoreline, by reducing the height of the buildings to conform to the surrounding dunes and hills, and by placing public trails and open space on the perimeter of the island. The buildings will utilize construction techniques that incorporate recycled materials, and conserve water and energy.

D. Partnering Agencies and Organizations

The campus will accommodate six partnering agencies and organizations:

California Department of Fish and Game will oversee the on-island educational programs, public exhibit space, and island restoration efforts.

City of Newport Beach will oversee the tidepool and coastal interpretive outreach efforts at Little Corona and Big Corona State Beaches.

County of Orange Health Care Agency will oversee the water-quality laboratory.

University of California, Irvine will oversee the rowing crew facility.

California Coastal Commission will oversee the native plant nursery and restoration education program.

Newport Bay Naturalists and Friends will provide the volunteer and docent support for the educational programs and public exhibit space.

E. Facility Name and Branding

This facility has had a number of working titles since the project's beginning, starting with "Marine Studies Center" and, currently, the "Back Bay Science Center." The name has slowly evolved to reflect the refined focus and market niche that distinguishes this educational facility from other outstanding educational institutions, including but not limited to the Muth Interpretive Center, the Ocean Institute, Cabrillo Marine Aquarium, and the Aquarium of the Pacific.

What started as a fairly narrow focus on marine studies quickly expanded to include the entire watershed of the Newport Bay. From the upland hills and streams to the coastal beaches and tidepools near the mouth of the bay, the facility will focus on studying and monitoring the diversity of life which relies upon Newport Bay for its home and health.

A number of names have been considered over the last year, and each has its merits. We will rely upon the partnering agencies to work out the final and best name for the facility. Although the "Back Bay" is recognized regionally, it may not have significant recognition beyond Orange County. We strongly recommend that "Newport Bay" or "Upper Newport Bay" be included in the title to provide place name recognition as well as the link to the aquatic environment. For the purposes of this document, we will use the name "Back Bay Science Center."

The partnering agencies also should seriously consider the graphic image associated with the name of the facility. The current logo of an octopus does not reflect the expanded focus on the entire watershed. The graphic should depict a component of the estuary and/or watershed in order to carry the themed message to the public.

F. The Interpretive Plan—Setting the Tone, Creating the Experience

Interpretation, as defined by Freeman Tilden, is "an educational activity which aims to reveal meanings and relationships through the use of original objects, by firsthand experience, and by illustrative media, rather than simply to communicate factual information." Similarly, an interpretive plan identifies the meanings and relationships of a specific place and recommends the use of illustrative media, firsthand experiences, and original objects to relay those messages to specific audiences. By extension, an interpretive plan is the roadmap that defines where we are going, whom we are inviting to go along, and the route we will be taking to get there.

This interpretive plan provides a vital link between the educational programs and the facility design. The plan assists the project architect and other specialists in creating a unified project that best serves the end users and reflects the educational goals of the institution. The interpretive planning process, and this interpretive plan, reflects the collaborative ideas and needs of the partnering agencies and organizations, their education staff, and the elementary, secondary, and university instructors that will ultimately utilize this facility.

While an interpretive plan guides the development of a site, it does not replace the need for an active management plan. Marketing, programs, and operations must underscore the same themes presented in the interpretive plan. Ideally, management of all aspects of the site would be coordinated by designated planning teams and would include all agencies housed on the campus.

II. Summary of Existing Conditions

Upper Newport Bay Ecological Reserve was established in 1975 to protect 752 acres of saltwater marsh ecosystem found in the upper reaches of Newport Bay. Managed by the California Department of Fish and Game, the reserve allows limited recreational and educational access as specified in the California Fish and Game Code.

Back Bay Drive borders the east side of the estuary for three and a half miles and is heavily used by recreational cyclists, walkers, and birders along the bay. Although this road is popular for self-guided recreation, this section of the plan will only focus on the formal activities at the reserve, not the numerous independent recreational or educational activities that also take place.

A. Facilities

Shellmaker Island

The eastern edge of Shellmaker Island is comprised of "high quality salt marsh, mudflats, and tidal channels."[1] This undisturbed habitat supports a large variety of wildlife including endangered plants

[1] Initial Study and Negative Declaration—DFG 2003.

and nesting habitat for endangered birds. However, the lower bay habitats, including Shellmaker Island, were disturbed by fifty years of dredging operations and dredge dumping. The western portion of Shellmaker Island was formed from dredge spoils and was used for a number of commercial purposes, including the production of calcium supplements for chicken farms and as a staging area for lower bay dredge operations prior to the creation of the reserve in 1975. Much of the lower island is exposed sandy surface. Today Shellmaker Island is the main point of public contact for the lower bay and the headquarters for the reserve.

Currently Shellmaker Island houses two trailers, four buildings, two storage containers, and an amphitheater. A limited trail system offers views across the upper salt marsh and the bay. The trailers serve as temporary office space for California Department of Fish and Game, Newport Bay Naturalist and Friends, California Coastal Commission, and County of Orange Water Quality Testing Lab. The buildings on Shellmaker house the UCI rowing crew boats, restrooms, and storage. Access to Shellmaker is limited to scheduled educational programs, organized groups (including UCI rowing teams), and special events.

Big Canyon

A parking area with wayside exhibits and native plant restoration serves as the staging area for birding on the Upper Bay and for exploring the Big Canyon trail. This site is located along Back Bay Drive and is used by educational and recreational groups alike.

Muth Interpretive Center

The Muth Interpretive Center opened in Fall 2001 and is owned and operated by the County of Orange Harbors, Beaches and Parks Department. Located on the north side of Upper Newport Bay, the 10,000-square-foot building features interpretive exhibits, audio-visual programs, and educational programs for the public. Operational space includes staff offices, a library, as well as a combined conference and classroom space. Although the Muth Interpretive Center offers no access to the bay, its unique setting allows for an undisturbed view of the Upper Newport Bay and creates a sense of discovery for visitors as they descend the path to the building. It is part of the 140-acre Upper Newport Bay Nature Preserve that borders the Ecological Reserve. The facility is open to the public year-round.

B. Programs

Shellmaker Island

The Department of Fish and Game Marine Studies trailer serves as the main contact point for the public. School tours, scout programs, general public programs, and special events are offered at Shellmaker Island.

Estimated annual person days[2] use figures for Shellmaker:

School tours[3]	1,845
Scout programs	5,040
Public programs	1,600
Environmental program days	7,000
UCI crew	32,700
Total	48,185

School Tours

The Newport Bay Naturalists and Friends, in cooperation with DFG staff, offers formalized programs for elementary students and scouts. Tours for the third through sixth grade are currently offered at Shellmaker. All curricula are aligned with grade-appropriate California Science Content Standards and cover endangered species, past lifestyles of the indigenous Native Americans, bird adaptation and migration, as well as invertebrates, plankton, and fish of the estuary. Starting in fall 2003, the first of a series of seventh-through-twelfth-grade tours will be offered as a pilot program. Focused on water-quality testing, mud analysis, biological sampling, and estuary ecology, the new tours will involve Public Health Laboratory staff and equipment from the County of Orange. Students will be engaged in hands-on activities and the results of their monitoring will be posted to a database.

The California Coastal Commission is developing material for the Restoration Education Program at Upper Newport Bay. Also designed to serve high school-level students, this program provides classroom activities that emphasize estuary ecology, nonpoint source pollution, nonnative invasive plants, and loss of biodiversity. Students travel to Upper Newport Bay to participate in restoration activities in the salt marsh and uplands.

Chapman University is using Shellmaker as a study site for science education. The curriculum is based on the internationally accepted Globe program, which seeks to quantify broad changes in our global environment. Globe is endorsed by NASA, NSF, the EPA, and the U.S. Department of State for scientific study of weather patterns, water quality, soils, and habitats. The Globe program involves students in data collection, data recording, database analysis, graphing, and map design with Globe scientists around the world. The scientists for each Globe protocol make sure that the data is scientifically valid and used for research. One hundred two countries partner in Globe to study the Earth's changing patterns.

Scout Merit Badge Programs

Merit badge programs for scouts are a draw to the bay. Programs are offered mainly in the afternoons, as well as some evenings and weekends. Scout merit badge programs are well coordinated between the Muth Interpretive Center, the Environmental Nature Center, and Shellmaker. The cooperative efforts to serve scouts has worked out well and will encourage future activities at BBSC.

[2] Person days reflect the number of times people use services at Shellmaker. This includes repeat visits by the same individuals.

[3] Including Newport Bay Naturalists and Friends, California Coastal Commission, and Chapman University.

Public Programs

Public programs include monthly Marine Life Inventory programs, Adult/Family Walking Tours, Adult/Family Water (boat) Tours, Wednesday Steward Days, and Restoration Teamwork Days. Public programs are consistently successful at Shellmaker. They allow the public guided opportunities to understand and appreciate the bay. Both college and high school students use these programs as educational resources to meet their community service or service learning requirements.

UC Irvine Rowing Practices and Classes

Although the UCI rowing facility is separate from the BBSC campus, the new trail system and lawn area will bring students closer to the rowing facilities. Crew practices and classes are traditionally held in the early morning (5–8 A.M.) with an average attendance of 90 members, and afternoon (4–6 P.M) with an average attendance of 24, so conflicts with parking and the lawn area will be minimized.

Big Canyon

Big Canyon is used by the Orange County Department of Education's Inside the Outdoors for science classes. The program brings approximately 9,900 students per year to the site. Inside the Outdoors uses its own study guide that covers indigenous culture, estuary ecology, birds, and plants of Upper Newport Bay.

Muth Interpretive Center

The Muth Interpretive Center offers formalized school tours for first through third grades, formalized scout tours, and public programs.

Estimated annual use figures for the Muth Interpretive Center:

School tours[4]	800
Scout tours	1,000
Public programs	4,000
Public walk-ins	22,000
Total	27,800

School Tours

Themes for school tours include plant and animal habitat components, soils and mud, as well as bird adaptation. School tours are aligned with California Science Content Standards.

Merit Badge Programs for Scouts

Scout badge programs are an afternoon draw to the Muth Interpretive Center. Scout programs are coordinated with Shellmaker and the Environmental Nature Center in Newport.

Public Programs

Public programs include weekday toddler programs, weekend Family Programs in the summer, and monthly R.O.O.T.S. (Restoration Opportunities, Outreach, Teamwork, and Stewardship) programs.

[4] Newport Bay Naturalists and Friends.

C. Environmental Program Days

Three annual environmental program days are currently conducted on Shellmaker: Ocean Discovery Day (mid-June), Earthday Celebration (late April), and Estuary Clean-Up Day (mid-September). All events are co-hosted by the Muth Interpretive Center and the Back Bay Science Center. Environmental days promote community awareness and involvement in the ecological health of the back bay.

D. Educators' Comments

The following concerns and compliments were expressed by educators during an initial focus group meeting. Selected educators from local high schools, community colleges, universities, and informal educational groups who have used Upper Newport Bay as a field trip location offered their collective concerns and compliments, which are prioritized below.

Concerns

1. The indoor space limits activities. Rooms should be organized with displays, be easy to clean up, and partitioned for lab research.
2. Low tide is a problem for data collection; better access points should be considered.
3. Habitats need to be restored and protected.
4. Paths and fences should be improved.

Compliments

1. The site offers a wonderful environment for students to learn and observe through hands-on activities. It brings classroom science to life. The site provides an auxiliary site for schools to enhance science curriculum.
2. The site is nearby and easy to get to.

Overall, educators were excited to have a lab facility like the Back Bay Science Center available for use.

III. Target Audiences

This section of the plan identifies target audiences and estimated attendance figures at full capacity. The number of visitors is expected to double from current use figures as the site grows in popularity and formalized programs are marketed throughout the watershed.

Anticipated full-capacity annual figures:

School tours[5]	13,310
Scout programs	1,035
Public programs	1,600
Public walk-ins	10,000
UCI rowing	62,400
Special events	10,000
Total	98,345

A. Formalized Groups

The new BBSC will host many audiences in the years to come. Primary target audiences in order of priority are seventh to twelfth grade classes, university-level classes, and adult education. Elementary grade levels will be considered a secondary market for on-site marine programs. The California Coastal Commission as well as Newport Bay Naturalists and Friends will be offering grade-level appropriate curricula designed to meet the California Science Standards. With each grade level a more challenging aspect of the bay will be introduced. This will allow for repeat visits and in-depth study. Tours will double their current numbers. By scheduling groups into specific time slots, parking and facility use conflicts can be avoided.

Organized groups from nontargeted grade levels currently participate in programs on Shellmaker Island and will continue to do so after the new facility is built. Targeted age groups will be given scheduling priority over other groups.

Youth group programs, primarily programs for scout merit badges, are currently offered in the afternoons. At this time the number of participants is high, and the scouts want to continue using this site. Even with the new Sea Base under construction, the scouts see the value of continuing to use the back bay resources. Participation levels should not change.

Chapman University organizes its own tours and anticipates that its program will grow in popularity. In order to avoid site use conflicts, communication with Chapman University will be critical as more of the BBSC formal school programs are launched. As previously mentioned, the BBSC formalized program would benefit from an affiliation with the Globe program currently used by Chapman University for long-term studies on the bay.

B. General Public

General public visitation will increase when the new BBSC is open to the public, initially during special open-house programs and eventually during regularly scheduled hours. As staffing levels and schedules are established, set times and days should be created for general public drop-in visits. These times should be established to accommodate family schedules—for example, weekends and after-school hours—and minimize conflicts with other campus user groups. Marketing efforts for the new facility should be focused on residents of the watershed.

[5] Including Newport Bay Naturalists and Friends, California Coastal Commission, and Chapman University.

C. Environmental Program Days

No new environmental program days are planned; however, the attendance at current events will grow as more people learn about the new facility and grounds. The resulting vehicle traffic, noise, and visitors should be managed in a way that respects the local community and wildlife.

D. Outreach

Two outreach vehicles will feature educational displays and live animals. One vehicle will emphasize tidepool conservation and will be stationed primarily at Big and Little Corona State Beaches. When not being utilized at the state beaches, the vehicle can travel to schools, festivals, and science events throughout the watershed (see Section VIII). A second vehicle, the "Sharkmobile," will promote the conservation of sharks, rays, and other cartilaginous species. The Sharkmobile will target fourth grade and older students, and will have greater flexibility in outreach opportunities to schools since it is not dedicated to a specific location. When not scheduled for schools, the vehicle can be used in similar markets as the tidepool vehicle. Both vehicles will offer learning opportunities about individual species and their habitat, as well as our human role in ensuring healthy ecosystems within the watershed.

Furthermore, an interactive web site will be established to provide watershed residents, regional schools, and the general public with access to the latest news, research, and program listings. Each week an educational article will describe a seasonal feature of the estuary. Users also will be able to view the latest samplings of marine life and water quality. Video clips of the BBSC and the bay will show marine life, restoration efforts, and special environmental programs. Live cams stationed in a few locations will allow users to enjoy their favorite views of the bay from home.

IV. Visitor Flow Plan—Creating the Visitor Experience

Visitor flow planning generally rests with the project architect. Because the sequencing of a visitor's experience on Shellmaker Island is critical to the overall delivery of the educational messages, flow planning is addressed here within the context of exhibit and program goals. The issues of public safety, resource protection, and accessibility will be left to the project architect and wetlands consultant.

The visitor flow plan addresses three different visitor scenarios: organized classrooms arriving by bus or carpools, general public and small group self-guided visits, and large-scale environmental program days.

A. Organized Classroom Visits

The Back Bay Science Center will be used primarily by organized groups of junior- and senior-high school students that preregister for use of the facilities. They will be chaperoned by adults and will need volunteer or paid staff instructors. While it is difficult to determine the average group size, we are planning the facility to accommodate one group at one time with a maximum size of 60 students (the approximate capacity of one school bus). Programs will be set up for two-hour visits.

Over time, a variety of watershed and water-quality curricula will be developed that tie into the overall research, monitoring, and management objectives for Upper Newport Bay Ecological Reserve and the

surrounding watershed. While specialized curricula may focus on learning stations or activities within the labs themselves, this visitor flow plan assumes that there will be equal use and interest in each part of the facility. Stations will be prepared in advance so that students can make the most of their field trips.

Stop 1. Students arriving at Shellmaker Island will start their visit at the staging area near the bus drop-off area. The staging area provides public restrooms, a drinking fountain, and an open area where a maximum of 60 students can be welcomed to the island, offered an orientation to the campus, and divided up into work groups.

Stop 2. The entire group will visit the exhibit courtyard, where the concepts of watersheds, aquatic habitats and wildlife, scientific research and monitoring, and stewardship are presented.

Stop 3. Large groups will be divided up into four groups. Two groups will go to the two science labs, one group to the outdoor learning stations, and one group to the pontoon boat/dock. Students will be rotated between the labs and the outdoor experiences.

Science labs. Each science lab will have a different emphasis (for details see section V. Interpretive Elements by Location, C. Indoor Exhibitry for Lab Space). Both labs will contain wet tables and aquaria for the study of marine organisms, banks of computers for logging and analyzing data, and desks for independent or group activities. The exhibit courtyard also will be incorporated into the classroom experience as students observe aquaria or review exhibit information as part of their studies. A maximum of 15 students at a time will observe a demonstration of a water-quality lab test for bacterial microbes in the County of Orange Water Quality Lab. This will allow students time to interact with water-quality scientists, determine what bacteria is in tap water, and hypothesize on the source.

Outdoor learning stations. The learning stations will be set up with the necessary portable equipment prior to the arrival of the students. Depending on their maturity and experience, students can be divided up into smaller independent work groups or kept together as a team. They will rotate through the stations, performing research, monitoring, or stewardship activities.

Pontoon boat/dock/sampling station. One group will be assigned to the adjoining dock and sampling station. A number of students will participate in mud core sampling, bottom trawls, seining, and/or plankton netting on the boat while other students will sort, size, and record the samples.

Stop 4. A full group wrap-up session will be conducted at the amphitheater or picnic area, and the group will be free to use this area for lunch or free time before returning to school.

B. Self-Guided Visits

Families, individuals, and unscheduled school groups will be invited to use the public portions of the campus at regularly scheduled times during the week and on weekends. While we do not anticipate a large number of drop-in visitors at any one time, program staff will need to monitor use and determine if there are conflicts with scheduled programs or other island operations. Every effort should be made to accommodate and welcome guests, particularly residents of the watershed.

The science labs and docks will not be available to drop-in visitors, but weekend open-house hours should be considered to provide limited public access to these areas.

C. Environmental Program Days

Well-planned visitor flow during special all-day environmental programs is critical to the success of the activity. Earth Day and other seasonal events have been conducted on Shellmaker Island for over a decade. It is anticipated that these types of programs will continue on the island. When Shellmaker Island was one flat parking area, the locations for information booths, food vendors, and stages could be determined at the time of setup. Now, designated parking, additional buildings, and restored habitats will limit the options for designing special events.

Large events such as Earth Day will require that the parking area be closed and off-site parking be coordinated with Newport Dunes; the University of California, Irvine; and other local agencies.

There are two primary open space areas suitable for portable stages, information booths, or food concessions. A flat open area of decomposed granite adjoining the staff offices and amphitheater will be maintained for special events. Power outlets and water spigots will be located nearby and the gravel base will allow awnings to be staked down as needed. The parking lot will serve as the other open space area. The parking area is well suited for portable stages, large group seating areas, food concession trailers, and portable restrooms.

V. Interpretive Elements by Location

Interpretive elements address specific themes throughout the campus and outdoor stations. These elements add focus and purpose to the site development. They also enrich the visitor's experience by providing a learning adventure. Concepts and principles of the natural systems are highlighted at each location in order to heighten visitor awareness and impart an educational message. Interpretive elements address themes and subthemes in visitor-friendly detail and allow visitors to engage in the natural area with more sensitivity, curiosity, and respect. These interpretive elements will make a trip to the Back Bay Science Center not only fun but relevant and educational. If designed skillfully, these elements will encourage long-term commitment to preserving the Back Bay.

This section addresses the interpretive elements throughout Shellmaker Island. Interpretive elements start in front of the campus with an initial staging area. From there, they travel through the exhibit courtyard, which features ten exhibit panels and four aquaria. Flowing through the courtyard to the back of the campus, the elements lead to a trail that connects nine outdoor

learning stations selected for their unique features. Water sources throughout the campus will feature small exhibit panels that show visitors where the water goes. The panels also will mention the impacts of water conservation in relation to the estuary and watershed.

The courtyard exhibits are designed to take the visitor through the watershed, starting in the uplands and progressing through the bay to the coastal intertidal zones. The progression of exhibits reveals the story of life in different natural communities as visitors travel through the bay to the rocky shores.

The exhibits in the two teaching labs will focus on different aspects of the bay. The interpretive elements in Lab A will focus on observing and recording estuary conditions. The interpretive elements in Lab B emphasize how humans influence wildlife.

Lab A will contain an exhibit of seasonal changes in biota and water quality, three living aquaria, and an exhibit on the food web in the estuary. Students will document their field survey results as well as observe marine life through the remote camera, video, or aquarium. Portable aquaria pulled from the wet tables can be used by small groups to identify details of the specimens. Microscopes and dissecting scopes also can be set up to magnify field samples.

Lab B will feature an exhibit on how human actions can impact wildlife in the bay. Lab B also will house a culture lab as well as an exhibit highlighting current ecological events with pictures and comments of students involved in BBSC projects. Lab B will link the marine component to the plant restoration efforts of the BBSC. Soils of BBSC can be studied to understand plant patterns around the bay. Invasive and native plants can be mapped on the computers to demonstrate revegetation patterns. Using dissecting scopes and microscopes, students can get a closer look at the more conspicuous parts of a plant—such as leaves, root structures, and salt glands—as well as its smallest cells to understand how plants survive in a saline environment.

In addition, the County of Orange Water Quality Lab will have an exterior interpretive panel illustrating how scientists measure microbial activity in water and addressing the impacts of water quality on wildlife.

The ten outdoor learning stations are connected by a designated trail. Each station is designed to stand alone. School group lesson plans, event themes, and staffing will dictate which stations will be used for programs. Interpretive exhibits at each of the stations will allow the public to explore the richness of life on Shellmaker.

A. Staging Area

Upon arrival at the Back Bay Science Center, visitors walking from the parking area and students unloading from buses are greeted by a monument sign with the center's name and agency affiliates, a staging area with benches, and an interpretive panel that welcomes and describes the purpose of the buildings and surrounding area. Restrooms, a drinking fountain, and benches are located in this area.

Entry Panel: *Welcome to Upper Newport Bay and the Back Bay Science Center*.

Theme: Upper Newport Bay is a unique southern California estuary that supports hundreds of species of native plants and animals, some occurring nowhere else in the world. The health of the estuary is dependent on the people living upstream in the watershed. To this end, the

BBSC is dedicated to providing educational programs about the bay and monitoring the long-term health of this remarkable natural treasure.

Storyline: Just as fresh water from this region collectively ends up in the bay, so too should our collaborative energy come together to protect the bay. This center represents a strong community partnership to create dynamic educational experiences focused on this rare southern California estuary. The community efforts in gathering data and information will assist in scientific research and management of the bay.

Media: A freestanding interpretive panel

Design/Construction: A staging area differentiated by colored, graveled, or inlaid substrate that depicts the flow of water from land to bay. This substrate/flooring should be different from the flooring in the exhibit courtyard. Benches to seat 30.

B. Exhibit Courtyard

As visitors walk through the entry passage between the buildings and into the exhibit courtyard, interpretive panels on the walls set the theme and tone of their visit. Aquaria will correlate with habitat descriptions as visitors "flow" from the back bay to tidal pools, following the conceptual flow of water depicted with colored pavement. Every effort should be made to use hands-on activities to reinforce messages on the interpretive panels.

Panel #1: "Where are we in the watershed?" This panel illustrates the extent of the San Diego Creek watershed and its drainage through Orange County to Upper Newport Bay.

Theme: A watershed provides the drainage of water from the land to the sea.

Storyline: Every person who lives or works in this drainage contributes to Upper Newport Bay on a daily basis. Watersheds are important because their natural design allows water to stay on land long enough to filter out toxins before flowing down to the ocean. Today many of our water courses are paved and channelized, not giving water enough time to be filtered. The water carrying the toxins funnels directly into the bay, impacting the water quality of the bay and its wildlife. As caretakers of the environment, humans must understand that water quality can be changed by conscious action. Key concepts introduced in this panel are *bioregionalism* and the importance of understanding our ecological impacts.

Media: A large-scale, wall-mounted interpretive panel that graphically depicts the Newport Bay and San Diego Creek watershed. Residents will be able to identify where they live and to trace the wastewater flow from lawns, streets, and sewers back to the bay. Die-cut, water-drop-shaped panels will pose watershed questions that encourage visitors to use the map. Dark water drops depict dirty water emptying into the bay. Hands-on components could include a row of common water valves (hose nozzle, sprinkler head, kitchen faucet, toilet handle, etc.) and associated buttons that, when pressed, show the route that waste and/or water moves through the watershed.

Panel #2: "Water conservation in the watershed". This panel illustrates the benefits of water conservation in the watershed.

Theme: Water conservation is beneficial to humans and wildlife as long as we couple our conservation efforts with wise product choices.

Storyline: We often hear about what we are supposed to do to conserve water, but rarely do we see the impacts on wildlife. Water conservation is directly beneficial to humans. By using less water we save money on our utility bills. We also reduce the energy required to filter water in treatment plants. Water conservation allows water availability for more uses. Water conservation benefits wildlife by allowing more water to flow through natural ecosystems. By limiting our water use, we help to sustain riparian corridors, limit pollution runoff from agriculture and irrigated urban lands, prevent the drying of wetlands, and reduce the likelihood that our disposal systems will become overloaded. When these systems fail, waste products may be discharged into the natural environment. For similar reasons, measures should be taken to reduce pollution sources, e.g., the amounts and types of chemicals used in cleaning formulas, fertilizers, pesticides, and industrial processes.

Media: A wall-mounted panel with hands-on components. A row of common water valves—such as a hose nozzle, sprinkler head, kitchen faucet, and toilet handle—would serve as doorknobs. When a door is opened, a message is revealed about water conservation and the benefits to wildlife. For example, the door with the hose nozzle would reveal a message about limiting the washing of driveways or sidewalks in order to reduce the flow of pollutants down storm drains and into the ocean. The door with the sprinkler head would reveal that a typical home uses more water outside, for landscaping, than inside, for drinking and washing. Over irrigating lawns contributes to sedimentation loading in the estuary. Sedimentation along with fertilizers and pesticides flow directly into storm drains that lead to the bay. The door with the toilet flush handle would reveal that 75% of our indoor water use occurs in the bathroom. Over flushing can tax the disposal system and lead to a system failure, which can in turn poison fish and birds.

Panel #3: "What is an estuary?" This panel illustrates and defines the importance of Upper Newport Bay as an estuary.

Theme: The estuary performs the tasks of filtering, settling, cleansing, and neutralizing water as it continues its journey down the watershed.

Storyline: Where fresh water meets salt water, plants and animals thrive in the shallow, warm, aquatic environment. These plants and animals in turn help to clean the bay water by recycling nutrients, except when toxic materials kill off the animals or too many nutrients overload the system. Key concepts to introduce are *adaptations* and *tolerance.* Plants and animals acclimate to reduced oxygen and saline levels as well as pollution flowing in from the watershed. Water conservation helps wildlife by limiting the amount of toxins washed into the bay from storm drains. It also allows more untreated water in reservoirs, creeks, and streams to be available for wildlife. So the simple act of covering your swimming pool to prevent evaporation could contribute to more water in our natural waterways.

Media: A wall-mounted interpretive panel will show the progressive flow of water from the watershed. Water droplets will lighten in color as sedimentation, filtration, and the merging with salt water take place. Wildlife and plants from the upper bay are depicted graphically. Hands-on components could include a filtering or settling activity that demonstrates larger particulates settling out, and petrol chemicals remaining on the surface.

Aquarium 1: Species found where the fresh water meets the saltwater, e.g., longjaw mudsuckers and staghorn sculpin, have adaptations to deal with lower salinity and lower oxygen levels. These are the species that are affected when polluted water enters the bay.

Panel #4: "Importance of mudflats". (Position to either side of the mudflat aquarium.)

Theme: Mud holds the bacteria and microscopic plants that are the basis for life in the marsh and bay.

Storyline: Mud is the mixing of land and water. The nutrients created by decomposing plant material infuses the mud with food for worms, clams, and other invertebrates that feed off bacteria and microscopic plants. Concepts communicated in this panel should include the productivity of mudflats as it correlates to oxygen levels. The upper four to six inches of the mudflats is oxygenated and teaming with life. Deeper layers contain significantly less oxygen and have limited life. The concepts of *aerobic* and *anaerobic* can be introduced here. Healthy mudflats increase bird populations in the area, which is how many visitors detect that an unseen habitat is thriving.

Media: A wall-mounted panel. Water droplets lighten (but not by much) to demonstrate the flow of higher-quality water. A hands-on component compares the smell of productive mud to unproductive mud.

Aquarium 2: Mudflat habitat with invertebrates. If this is displayed in a horizontal aquarium, other species that swim above or walk on mudflats could be incorporated into this exhibit. This exhibit includes Medusa worms, bent-nose clams, jackknife clams, white sand clams, isopods, amphipods, fat innkeeper worms, and polychaete worms.

Panel #5: "Eel grass beds". This panel graphically depicts eel grass beds and the habitat they provide for marine species. Top smelt and sand bass are two key species that rely on eel grass.

Theme: Eel grass beds serve as feeding, resting, and egg-rearing areas for marine life.

Storyline: Eel grass is an important habitat in an estuary for marine life. It provides food, resting places, and nurseries. Many fish that are food to larger predators need the beds to hide and reproduce. Eel grass, however, is highly sensitive to water turbidity and is struggling to survive in the back bay. Eel grass is so sensitive that different species of eel grass occupy specific parts of the bay. Water conservation helps to keep sediments from washing into the bay and adding to the turbidity of the water. Continue traveling through the water corridor to learn how native plants help these vital eel grass nurseries. Water drops are lighter in color. A key concept to communicate is that limited light penetration can cause extinction of a core habitat for marine species.

Media: A wall-mounted panel. A hands-on component may include a simulated model of light penetration through turbidity and its connection to eel grass health.

Aquarium 3: Diorama of eel grass bed. (Eel grass may be difficult to maintain in an aquarium.)

Panel #6: "Open water". Again following the water to the open-water sandy channel, this panel discusses habitat and wildlife.

Theme: The open channel allows for faster water flow. Sandy bottoms form due to tidal flow. This area provides a suitable habitat for a variety of fish and invertebrates.

Storyline: Traveling through the estuary toward the sea, water channels drain the shallow mudflats as the tides change, creating sandy bottoms. These areas provide habitat for various fish and invertebrates that can survive in swift currents. Changing tides and deeper water create feeding grounds for large fish. The tides bring in plankton as a food source for smaller fish. Because the open water provides fewer hiding places for small fish, they become prey for larger fish. Birds too are attracted to the open water to prey upon fish. Water droplets are lighter or blended to show a higher mix of salt.

Media: A wall-mounted panel.

Aquarium 4: A sandy bottom with a variety of local fish found while seining, such as flatfish, rays, skates, and gobies.

Panel #7: "Tidepools". This panel will take the visitor from the bay to the rocky shore tidepools.

Theme: Marine life on the rocky shores is adapted to crashing waves and exposure to sun and air. Storyline: Life in the tidepools has adapted to harsh environments. Exoskeletons, hard shells, and the ability to conserve moisture during sun exposure are all unique survival adaptations in the tidepools. Water drops evaporate at the rocky shores, reentering the water cycle. Key concepts to communicate are *exposure* and *zonation*.

Media: A wall-mounted panel demonstrating life in the tidepool. The panel should show the area at a high tide and then at a low tide.

Aquarium 4: A tidepool exhibit with anemones, crabs, snails, blennies, and sculpin. Crashing wave action will simulate ocean waves

Panel #8: "Water Quality Lab".

Theme: Water testing provides measurable evidence of the health of the ocean, bay, streams, and lakes.

Storyline: Water testing benefits people and the environment. The water-quality lab tests for microbes to ensure that water is safe for consumption and recreation. Educational programs will provide information on the microbial safety of the water at Shellmaker and within the county. Stages of water testing will be graphically depicted. The test results of water from the tap and from the bay will be compared so the public can see the differences and understand potential sources of microbes. "How does water quality impact estuary wildlife?" "How does water quality impact our lives?" Pose these questions on a large waterdrop cutout. With additional water testing beyond what this water quality lab currently offers, chemical residues may be measured to determine the ecosystem's "environmental health." Water conservation has a role in managing the spread of diseases. Some disease-causing bacteria tend to grow rapidly in standing or slow-moving water. Conserve water by limiting the irrigation of landscaped areas. Empty containers of standing water and allow water to flow into the ground rather than down storm drains.

Media: A wall-mounted interpretive panel on the Water Quality Lab's external wall.

Panel #9: "Terrestrial native plants".

Theme: Native plants provide shelter and food sources for wildlife specific to Upper Newport Bay. Nonnative invasive plants push out natives and can alter wildlife populations.

Storyline: Upper Newport Bay has changed over time and so have wildlife populations. Urban development surrounds the back bay, and wildlife has few wild places left to live. Human inhabitants not only took up open space, but they also brought in nonnative plants for landscapes and gardens. Some of these plants have invaded the salt marsh and estuarine habitats, pushing out the native plants and the animals that rely on them for food and shelter. Native plants, which slow erosion on the steep banks, have been superseded by nonnatives that have shallow roots and do not retain soil as well. Soil erosion has caused more sediment loading in the bay and limited light penetration. Both of these factors have altered wildlife habitats. Water conservation can take place at home too by using native plants for landscaping, thereby reducing landscape irrigation by 50%. Native plants also provide food and shelter for native birds and butterflies. Xeriscaping offers additional water conservation by implementing planning and design, soil analysis, low-flow effective irrigation, appropriate plant selection, mulching, and selective turf areas. The result is less maintenance and less water use. Key concepts to communicate in this panel are habitat conversion through *competition* and *biodiversity.*

Media: A wall-mounted panel with illustrations of native plants. The exhibit will have wells to display fresh cuttings. A brief explanation of the unique features of the plants is addressed on a small plaque located by the cuttings. The features could involve a plant's adaptation to particular conditions, a chemical inherit in the plant that may be used for pharmacological purposes, or the role of the plant in today's ecosystem.

Panel #10: "Native plant restoration connects the community with the resource".

Theme: Native plant restoration can help re-create a healthy ecosystem.

Storyline: Native plant restoration benefits the local wildlife community and the people who live in this area. By participating in native plantings, invasive plant removal, propagation, and restoration efforts, community members can learn about this unique habitat and become better stewards of the environment. The local community can witness and be encouraged by the return of native plants and wildlife. Restoration can never replace conservation, yet it provides a sense of ownership and responsibility. When people care about an area, they will want to conserve and protect it. Key concept to introduce is *stewardship*

Media: A panel with a pictorial timeline marking the changes of Upper Newport Bay and the watershed, and ending with photos of current restoration efforts. Focusing on the historic changes of a single species will demonstrate the impact of humans on the land.

Panel # 11: "Water works".

Theme: Human-made salt water aquarium systems need pumping, filtering, cooling and oxygenating to support marine life; in many instances duplicating the processes which occur naturally in the Back Bay.

Storyline: Hundreds of gallons of salt water must be pumped, filtered, chilled and oxygenated daily through this system in order to provide a clean and healthy environment for the marine life, students and scientists using the Back Bay Science Center campus. The water is originally pumped from the ocean into this large storage tank where it is then filtered, cooled, oxygenated and circulated to each tank and the

labs, over and over again. Within the natural system of the Back Bay, the pumps would be comparable to water moving down the watershed, and in and out with the tidal flow. The filters in this system are comparable to the plants and soils that remove particulates and toxins from the watershed. Water temperature, pH, salinity, and oxygen levels vary greatly within the Back Bay and the animals move within the bay to find the ideal conditions to meet their needs. But in this system, a careful balance is kept and monitored to ensure that the captive marine life has healthy conditions.

Media: A flat panel most likely mounted on or near the security fence near the pumping area to identify the various components of the system with a graphic depiction of the related water flow and conditioning through a marsh.

C. Indoor Exhibitry for Lab Space

To continue with the themes of watershed and estuary, the exhibits in the teaching labs take the message a step further into stewardship. Stewardship is a behavioral change that may not occur until the student understands what plants and animals need to survive. The classrooms provide this opportunity by offering a close-up look at animal life already contained in aquaria or set up under microscopes or dissecting scopes. Through teacher- and naturalist-led activities, students can understand how humans impact bay wildlife. Once the concept of stewardship is introduced in the classroom, it will be easier to reinforce at the outdoor educational stations.

Teaching Labs

The exhibits in the two teaching labs will focus on different aspects of the bay. The interpretive elements in Lab A will focus on observing and recording estuary conditions. Two interpretive panels and three aquaria will be housed in Lab A. One panel will demonstrate the need for record keeping, and the other will assist in understanding the important links of life in the bay through "the web of life." The interpretive elements in Lab B emphasize how humans influence wildlife and address the native plant restoration efforts. Lab B will house two interpretive panels and a culture lab. One panel will show students in action at BBSC. This same panel will address current events that affect estuary/marine resources. The second panel will demonstrate the niche and function of specific marine and plant life, as well as the role humans have in preserving a healthy environment. The outcomes of water conservation will be identified in this panel.

Lab A

Panel #12: "Bay keepers". (Above the computers.)

Theme: By recording and studying biological samples of the back bay, we can better manage this unique ecosystem.

Storyline: By recording in one database the findings of all the classes who visit the bay, environmental trends and patterns will be easier to detect. Managers and biologists will be able to use this information for planning strategies, educational programs, and public awareness to protect this Ecological Reserve.

Media: An interpretive panel showing a graph of seasonal change in biota due to high and low levels of runoff, tidal flow, oxygen levels, temperature, turbidity, and pH. This could be

demonstrated with a month-and-year-comparisons graph. A large format would allow this to be a teaching tool and display. A digital readout would display current water-quality levels of pH, temperature, oxygen, and turbidity from remote locations.

Panel #13: "Web of life". (On the wall above the wet tables.)

Storyline: The web of life links all species, primarily through food. Long-term human neglect of the environment can significantly alter species. In this graphic, visitors can locate some of the species from the BBSC database and discover what other species they are linked to. Visitors also can compare water conditions to population levels on the database. This panel could include contaminants in the food chain. This will relate to eco-risk assessments and increase of coliform as it relates to wildlife. A key concept to discuss is *bio-accumulation*. Phosphate, nitrate, and nitrite levels can be related to wildlife

Media: An interpretive panel graphically depicting the web of life. Habitats and wildlife at the BBSC will be illustrated. Arrows can be used to show links between species. Three teaching aquaria will feature mudflat, sandy bottom, and tidepool species for observations. An interchangeable interpretive panel at each aquarium will feature each species displayed in the tank. The species signs will include a photograph, name, where it is found in the bay by season, and the water conditions it needs to survive (water temperature, oxygen level, and pH level).

Lab B

Panel #14: "Students in action". (On the wall above the computers.)

Theme: Students understand ecological concepts by actively restoring the bay.

Storyline: A changeable display will show students at work on BBSC programs and will highlight current events that have an effect on the environment. Topics and themes can be changed to address current events impacting estuary and marine resources, and lead to discussions, decisions, and recommendations by students.

Media: A wall-mounted panel with areas designated for pictures and articles.

Panel #15: "Life in the bay and the role we play". (On the wall above wet tables.)

Theme: Humans have a significant role in safeguarding the health of the bay.

Storyline: Wildlife needs a clean environment to thrive. By understanding the basic needs of wildlife, we can ensure that our actions are not detrimental to the health of the estuary. The effects of water conservation and product choices will be discussed so students can see the direct link between wildlife and human actions.

Media: An interpretive panel illustrating how the results of human activity can change the quality of life in the bay, e.g., the proliferation of litter, petroleum products, and biological waste.

Panel #16: "Culture Lab".

Theme: The smallest plants and animals are connected to the well-being of larger life forms.

Storyline: Algae provides food for plankton, which in turn provides food for larger marine life. The Culture Lab imitates how nature provides the correct environment to grow plankton. Light, oxygen, and clean water are necessary ingredients.

Media: An interpretive panel explaining the functions of the Culture Lab.

Design/Construction: A window to view the workings of the lab.

Panel #17: Additional small waterdrop-shaped panels (enough for all water outlets in the public area).

Location: Bathroom stalls, urinals, lab faucets (fresh and salt), sinks, and water faucets.

Theme: Water flows down the drain to another area where it meets wildlife.

Storyline: These droplet panels will show where water goes, its chemical or bacterial treatment, and its benefit or detriment to wildlife. Each drop should have a different message. For example, water from a regular faucet is eventually reclaimed and is used to replenish the Orange County ground basin. Water from the toilet eventually makes its way to the regional sanitation plant where, once treated, it is pumped into holding ponds. These ponds are populated by cattails, tule, and aquatic plants that in turn provide a habitat for freshwater wetland species .

Media: Die-cut drops are large enough to hold easily readable messages about where water flows and its effect on wildlife. These have changeable text sections so that messages could be updated and changed every season.

D. Outdoor Learning Stations

The new nature trail and outdoor learning stations will provide visitors with opportunities to view and participate in the ongoing natural processes on Shellmaker Island. Formal seventh through twelfth grade classes, informal education groups, and the general public will use the learning stations. Each station is designed to stand alone and deliver a message that reflects specific ecological principles studied and observed on Shellmaker Island. All stations are designed with a carrying capacity of 15 individuals, unless otherwise noted.

Each of the user groups will participate in the stations to varying degrees. The stations solidify classroom concepts by offering practical scientific experimentation and serve as part of a three-step field trip at the new Back Bay Science Center. For school groups, the typical BBSC experience may include time in the classroom, on the water, and at a selection of outdoor learning stations. For the informal education groups, the stations will provide hands-on activity sites as coordinated by their leaders. For the general public, the sites offer a chance to view the unique qualities of Shellmaker Island as well as educational opportunities to understand the natural dynamics of the estuary.

The following learning station descriptions correlate to the sites on the map (see Attachment B) and provide an overview of each station, themes and subthemes, storylines, interpretive media, and design/construction details.

Station 1. Estuarine Life Recording Station and Seining Area

This station is divided into two sections. The first serves as a study area for groups to observe, count, and record aquatic life gathered from seining, coring, bottom trawls, or any form of macrosampling of the bay. Students will be instructed how to handle, measure, record, and release live specimens. The station is designed to protect the marine life by using aquaria, wet tables, and sufficient shade. The information gathered at this station by the students will be date-posted on the interpretive panel for the public and entered into the Estuarine/BBSC database inside the center. The second section is the shoreline immediately below the recording station where beach seining occurs. Students will assist in collecting specimens, utilizing the correct equipment and techniques to minimize impact to animals and habitat as they transport marine life to the recording area.

Theme 1-1: Estuaries are some of the richest habitats on earth, serving as feeding grounds, nurseries, resting areas, and shelter for resident and migrant wildlife.

Subtheme 1-1A: Water quality causes changes in the variety and concentration of marine life.

Subtheme 1-1B: Mudflats, eel grass beds, and the open water habitat all host different plant and animal communities.

Storyline: Sampling makes sense. By tracking dates, times, species, and quantity, cumulative data will show trends and changes that may correlate with human activity, weather patterns, or other environmental changes.

Media: A freestanding interpretive panel illustrating life in the bay and factors that affect changes in sampling. A changeable information section will show sampling information correlated to environmental changes at Upper Newport Bay.

Design/Construction: 800 sq. ft. platform area. Two wet tables (with sectional capabilities) approximately 10'–14' long X 18'–24' wide, two 4' aquaria, four holding bins, a table and shelves for the culture lab grow-out station, a water connection from the bay for holding tanks, a large shade structure if the tree is removed, and a windbreak to protect the area. Adjacent to the platform area, six boot and equipment wash stations with drainage and fresh water access.

Station 2. Dock

This station serves at least four purposes. First, the dock is a gathering point to embark and disembark safely from aquatic vessels. Boating safety and sampling protocols will be reviewed. Groups will prepare for observation or sampling in various estuary locations. Second, the dock will be used as a sampling station. An extension platform will be attached to the dock. Water and mud samples will be taken from this platform. This information will be correlated to plant and animal life collected at Station 1. Third, there is also potential for a floating lab to be added at the end of the dock. The dock will provide a permanent location for remote water readings on

temperature, pH, oxygen, and turbidity. The information will be transferred to digital read out in the classrooms and web site. The fourth purpose of the dock is to provide an underwater view of fouling organisms as they grow on the dock edge or along lines.

Gathering point

Theme 2-1: When in a boat or on the dock, safety comes first—for yourself, for others, for all wildlife collected, and for the equipment you use.

Sampling station

Theme 2-2: Water quality will affect the variety and quantity of species in the bay.

Design/Construct: Permanent mooring location on the dock.

Theme 2-3: Mud provides the basis for healthy aquatic life. The microscopic plants and bacteria in the mud provide food and nutrients for larger species.

Subtheme 2-3A: Mud sampling reveals the health of the bay by identifying and monitoring macro-invertebrates and their relationship to tidal flows, water quality, and weather.

Storyline: Mud is the basis for life in an estuary. The mud holds microscopic plants and bacteria that provide the ingredients for a thriving marsh. Without these, a marsh cannot sustain healthy plants, invertebrates, birds, fish, and mammals. Polluted water from the watershed can impact the basic building blocks of the marsh.

Media: None

Design/Construction: 1–2 additional floating dock segments to add to existing dock. This will allow for safe embarking and disembarking as additional vessels are acquired. Lighting will be installed along the dock extending to the terminus. A mud-sampling dock addition will allow students to sample at various depths.

Theme 2-4: The dock's edge provides a substrate for fouling organisms to accumulate and grow. This location will allow participants to observe a small habitat that will attract marine algae and fauna.

Media: None

Design/Construction: A removable viewing tube like an periscope that will look under the water and focus on the dock's edge. The scope should be able to rotate and change depth.

Station 3. Salt Marsh Restoration Point

This station overlooks an area that will be restored to salt marsh habitat as part of the overall project. Salt marsh restoration efforts can be visually monitored from this location. A variety of salt marsh plant species, including the endangered Salt marsh bird's beak *(Cordylanthus maritimus* subspecies *maritimus),* will naturally regenerate and stabilize soils.

Theme 3-1: Uniquely adapted plants support the estuary by providing the basis of the food web.

Subtheme 3-1A: Methods of native plant restoration are tested for success. Each species may respond differently to the restoration techniques.

Subtheme 3-1B: Successful plant restoration is dependent on many variables, including water availability, water quality, and coexisting plants in the habitat.

Storyline: Human actions can change a habitat enough that native plants and the wildlife dependent on them cannot survive. By monitoring the restoration of certain native plants and habitats, biologists can determine what conditions contribute most to their survival.

Media: A freestanding interpretive panel will address the importance of restoration and restoration methods. An ocular survey spatial percentage guide will be mounted as part of the interpretive panel or separately so that visitors can use the guide as a way of noticing changes in the restoration area.
Design/Construction: 15' wide X 20' long leveled area at the end of the spur trail. If the soil cannot be compacted and stabilized, a 15' X 20' deck will have to be built at this station. Railings should be included for safety and to discourage walking in restoration area. There will be benches along the perimeter for seating 5 visitors.

Station 4. Demonstration Filtration Marsh and Geological Observation Point

This station serves several purposes. First, the demonstration marsh uses ecologically friendly methods to process runoff from the parking area. Students will become familiar with the dynamic role of marsh ecology as a filtering mechanism. Second, the site is an experiment in the revegetation of wetlands. Half the marsh will be planted and the other half will be allowed to return naturally. Students will monitor sedimentation, nutrients, water chemistry, and wildlife as the site reestablishes. Third, this station offers a glimpse into the geology of Upper Newport Bay. An exposed cliff face on the opposite side of the channel can be compared to weathered bluffs surrounding the bay. Visitors will see for themselves how sedimentary layering and erosion help to form the bay.

Theme 4-1: Wildlife benefits when humans use nature's principles to treat runoff and create a marsh habitat.

Storyline: Wetlands naturally attempt to clear chemicals and toxins from the watershed. Chemicals and toxins are neutralized through percolation, sedimentation, and filtration. Cleaner, oxygenated water creates a healthy habitat for people and wildlife.

Media: A freestanding interpretive panel illustrating the natural dynamics of the leaching system and the key role of plants as filters to settle sediments, neutralize chemicals, and restore oxygen levels.

Design/Construction: Seating for 15. The bench arrangement should offer a good view of the marsh and bluffs. Provide one access point to safely gather water samples.

Theme 4-2: Geology is the foundation for the bay.

Storyline: The exposed cliffs of the bay offer a unique glimpse of ancient layers of sand, silt, and clay that once formed the seafloor. These soft, easily eroded bluffs support our neighborhoods. If native plant cover is removed or replaced with water-thirsty nonnative plants, then the vulnerable bluffs can quickly wash away and fill the bay with mud and sand.

Media: A freestanding interpretive panel illustrating the geology of the bluffs and the bay.

Station 5. Lawn

The lawn is a gathering area for briefings and lunches. This space offers an alternative for groups to spread out and execute larger activities that require dynamic movement, space for simulated predator/prey or environmental concept activities, or noisy activities that do not suit the other learning stations.

Capacity: 60 individuals

Media: None

Design/Construction: Picnic tables for 60 individuals.

Station 6. Upper Salt Marsh Restoration and Demonstration Area

Focused on the upper salt marsh plant species, this station investigates plant adaptations in a native plant area and nursery. Students will analyze plant varieties and discover the impact of invasive plants. A demonstration garden featuring native species offers students an opportunity to compare different plant communities. This station also will serve as a nursery for propagating plants used in restoration efforts around the bay.

Theme 6-1: Native plants have unique adaptations to survive in a saline environment.

Theme 6-2: Invasive plants push out natives and cause a chain reaction that impacts other native plant and animal species.

Storyline: Upper salt marsh plants have unique adaptations to cope with a saline environment and some plants benefit by coexisting with other native plant species. However, these unique plants are vulnerable to nonnative, invasive plant species. Increased biodiversity of native plants allows greater stability in the marsh ecosystem.

Media: An interpretive panel illustrating local plants and plant communities.

Design/Construction: Fresh water access for plant irrigation and tool cleaning. A second interpretive panel in this location will focus visitors on the restoration efforts viewable from this area.

Theme 6-3: Native plant restoration supports more wildlife by creating more diversity.

Storyline: Visually compare the hillside of native plants to an area of invasives. The invasive plants cover the area but offer little diversity for wildlife. By removing all nonnatives and replacing them with indigenous plants, restoration efforts create more opportunities for wildlife to thrive. Biologists understand that restoration is not a replacement for conserving natural habitat. Restoration methods must be tested and are not always successful. Biologists must cultivate clippings, prepare the soil, plant, and monitor the success rate.

Media: A freestanding interpretive panel.

Design/Construction: None

Station 7. Amphitheater

The amphitheater will be used as a staging area for group activities and presentations. Using local plantings of coastal sage scrub, restoration around the amphitheater demonstrates dune stabilization.

Media: None

Design/Construction: Shade structure requested over seating to provide one outside group area with shelter from the sun.

Capacity: 100

Station 8. Bird Observation

This station offers students a chance to quietly and unobtrusively observe bird behavior. Shorebirds can be viewed from a distance without disturbing their natural behavior. Students will infer that diverse and healthy bird populations reflect the health of the bay. This site offers an opportunity to practice wildlife-friendly viewing skills.

Theme 8-1: Migratory and resident bird species feed on the abundant source of invertebrates along the shores of the bay. Species and populations will vary seasonally.

Theme 8-2: Nonintrusive wildlife watching techniques allow visitors to watch birds behave in their natural patterns.

Storyline: Fluctuations in resident and seasonal bird populations can indicate the health of the bay. Birds depend on the abundance of food, clean water, and open space to thrive. When any of these three components is lacking, birds will leave or become sick. Observation of bird behavior is one way to understand the health of the bay. By tracking the types and numbers of birds that visit the back bay throughout the year, birdwatchers can assist scientists in establishing the trends of specific populations.

Media: Interpretive panels mounted on perimeter railings illustrate the most common bird species by season with brief descriptions of food sources, migration routes, and breeding/wintering locations. A sidebar on bird-viewing tips will encourage responsible viewing behavior.

Design/Construction: Widen the trail to accommodate 15 students along the railing that supports horizontal interpretive panels. Level areas should be provided on each end of the station to accommodate spotting scopes and tripods.

Station 9. Special Events/Activity Area

This area allows for the safe setup of canopies, exhibits, booths, and demonstrations while providing ample room for foot traffic. The open space allows vehicles to easily load and unload, and provides close access to the building for power and for the storage of event materials.

Capacity: 200

Design/Construction: Level the area. Electric power and water sources are available at two or three locations.

Station 10. Off-Island Support Equipment

Two remote water-quality monitoring stations and video cameras will be set up in the back bay. Information from both locations will be relayed back to the BBSC labs for digital output and posting on the web site. These stations will be used as support for the educational programs that will be offered at the BBSC and will provide science staff with critical data for monitoring bay health. These support facilities are located off Shellmaker Island.

Design/Construction: Install new or use existing pilings to mount water-quality sensors, remote-controlled video cameras, solar panels, batteries, and relay equipment to send data back to studies center.

VI. Construction Considerations

The Back Bay Science Center is part of a campus comprised of buildings that house recreational facilities, boat storage, professional science laboratories, and staff offices. Secondary facilities include two boat docks, an interpretive amphitheater, a native plant greenhouse, and outdoor learning stations linked by a perimeter trail. The predominant landscape features are the Upper Newport Bay and extensive salt marsh habitats to the north and east, as well as the developed bluffs, marina, and bayside homes to the south and west. The island itself was used for commercial purposes prior to 1975 and ongoing restoration efforts need to be continued.

The current and proposed educational programs planned for Shellmaker Island will utilize scientific testing equipment and facilities. Commercial-sized pumps and pipes will move seawater through the facility and visitors will unwittingly will track water and sand throughout the building. Thus the installation of safe, nonslick, and easy-to-clean floors and surfaces is a priority. Hose-down areas to clean boots and equipment, and plenty of storage space will be needed for staff and students. We envision a simple, modern building design that emphasizes the industrial and scientific nature of the facility. Exposed vents, pipes, open (but organized) storage shelves and hooks, and metal-framed aquaria will lend themselves to the overall professional and no-nonsense look of the campus.

Where possible, the campus should be landscaped and graded to blend into the dunes that surround other parts of the island. The exteriors of the buildings should blend into the island's landscape but, at the same time, should reflect a modern marine lab. As with the overall theme of the Back Bay Science Center, the buildings and grounds should reflect the necessary balance between science and nature.

The main entrance to the campus will consist of an open staging area and bus unloading area. Directly behind the staging area will be a high-roofed courtyard with aquaria and exhibits interpreting the watershed and research being conducted at the center. This courtyard will serve both as a learning station and the primary public exhibit area for the facility. This area merits additional design attention and funding.

VII. Estimated Costs

Cost estimates for the interpretive components of the project include the costs for research, text writing, design, fabrication and installation of display aquaria, interpretive exhibits, permanently fixed interpretive equipment such as web cameras, wet tables or display monitors, and directional signs. These costs do not include structural elements related to the building design, furniture, portable equipment, or supplies.

Cost estimates are based on two approaches; square footage costs and individual interpretive panel costs. Square footage costs range from $250 - $650 depending on the complexity of the individual interpretive module. For example, the public aquaria module will be comprised of four separate aquariums, water supply systems, a mounting framework and individual interpretive panels which require a budget of $650/ square foot. The teaching labs and exhibit courtyard are budgeted at $250-300/ square foot because the complexity of the exhibit design and permanent equipment is much less than the aquarium module. The other budgeting approach is to estimate the cost of an individual interpretive panel. Based on today's design and fabrication costs, a standard panel approximately 36 inches by 48 inches runs about $5,000. These square footage and individual panel rates were confirmed with exhibit and aquarium design firms throughout the country.

With these figures in mind, the total cost estimate for the interpretive components of the project amount to $1,272,000. Please keep in mind that this figure can raise or fall depending on the complexity of the final design. However, we are confident that this budget estimate is well within the standard costs for high quality, professionally designed and fabricated exhibits that will last well into the future. Detailed budget estimates can be seen in Attachment C.

VIII. Operational Considerations

This section of the interpretive plan identifies operational needs and constraints for the educational components of the facility. It is not intended, however, to be a comprehensive operational analysis and plan, which will be needed to identify staffing levels, annual operating costs, and cost sharing between the partnering agencies.

A. Staffing

Educational staffing on Shellmaker Island currently consists of 3 full-time positions (Fish and Game and California Coastal Commission), 1 seasonal employee, as well as 15 volunteers and docents. It is anticipated that demand for programs will double after the new facility is built. Scheduled public hours of the BBSC will increase the need for staff. In addition, administrative support for scheduling and janitorial services will be required with the new facility.

When the building is completed, the City of Newport Beach's tidepool education coordinator and seasonal staff will be housed at the Back Bay Science Center. While there may be some opportunities to share workload responsibilities at the center, these staff members' primary responsibility is to conduct educational programs at Little Corona State Beach.

Docents and volunteers are the lifeblood of the educational programs at Upper Newport Bay. Because all the docents and volunteers at the BBSC are currently shared with the Muth Interpretive Center,

ascribing more hours to them as demands increase would seem unrealistic. What's more, the Muth Interpretive Center is also expanding its educational programs. The BBSC may be able to satisfy some of its need for staffing by drawing new volunteers from within the watershed.

At this time, with severe state and federal budget cutbacks threatening existing programs, new educational positions will not likely be funded in the next three to five years. Therefore, staffing plans will need to be based on existing staffing and volunteer resources. Listed below are four options to deal with the anticipated demand for educational programs:

1. Maintain current program levels at Shellmaker Island. Monitor requests for additional programs to justify increased staffing and use a lottery system to ensure that every teacher has the opportunity to fairly compete for a field trip slot..

2. Establish a program that would require teachers and parent volunteers who want to use the facility to attend a previsit orientation. This program would reduce the need for paid staff during their class visit.

3. Seek corporate, foundation, and agency grant funds to hire additional contract or seasonal employees to conduct educational programming.

4. Work with the County Office of Education to place science teachers on a rotational assignment at the Back Bay Science Center to oversee the educational programs.

B. Scheduling and Prioritized Use

The Back Bay Science Center's primary target audience is high school students. Two-hour site visits by organized classes will be scheduled in the mornings. Mid- to late-afternoon sessions will be reserved for extracurricular science club or youth group programs. It is not known what the increased demand will be for these types of programs. To meet current staffing constraints we recommend starting with a limited amount of time slots (Tuesday/Thursday/Friday from 9 to 11 A.M. for school tours, etc.). This will allow for regularly scheduled public hours for families and individuals who want to visit the labs.

To ensure that the target audience has the first chance to book lab time, we recommend that flyers or e-mail be sent to targeted schools and teachers, offering them a two-week exclusive time period to book their tours before the rest of the calendar is opened for other grade levels. While it is tempting to accept any and all school groups that want to visit, we recommend not booking lab time for students under fifth grade and precluding access to the Orange County Water Quality Lab for any students below grade seven.

To accommodate fourth grade and lower grade levels at Shellmaker Island, we recommend that self-guided access to the courtyard and learning stations be provided during hours when older students will not be on the grounds. Offer lunch visits with access to the picnic area or amphitheater. This also could be a time when overflow tours from Little Corona State Beach are redirected to Shellmaker to view the aquariums and observe tidepool species.

C. Support Facilities

Little Corona Tidepool Program Support

Initial design concepts called for the development of a naturalistic tidepool exhibit on Shellmaker Island to redirect a portion of the exiting school tours from Little Corona State Beach and thus lessen the impact on tidal life. After considerable thought and research, we believe that there is a better alternative to placing a large tidepool exhibit at Shellmaker Island.

We propose a mobile outreach option at Shellmaker, rather than a static tidepool exhibit, to better serve the classes, the resource, and the City of Newport Beach. Modeled after a similar program at the successful Cannon Beach Haystack Rock Awareness program in Oregon, a mobile education van, complete with tidepool animals and interpretive exhibits, will be set up at the entry point to Little Corona State Beach or at nearby Big Corona State Beach. The van will be equipped with holding tanks, a recirculation pump, and oxygenation devices to protect the health of the animals. The Haystack Rock program has found that bringing the animals to the visitors has significantly reduced the human impact to the tidepools. This option would allow for more effective tidepool education without damaging the resource and would provide direct contact with school groups that do not schedule through the City of Newport Beach. Foot traffic on the tidepools would not only be reduced but would also allow younger students to view tidepool animals without having to walk on the slippery rocks of the intertidal zone.

We believe that this type of outreach effort will have greater long-term effects on Little Corona State Beach by educating more students and local residents about the sensitivity of the resource, by providing a physical presence near the tidepools for monitoring and enforcement, and by building greater community support for the potential closure of the tidepools for rehabilitation. In addition, the staff at the Ocean Institute was excited about the potential of having an effective outreach van in the area and felt it would be ideal for the City of Newport Beach's program at Little Corona State Beach.

The Back Bay Science Center on Shellmaker Island will serve the tidepool program in several ways. The center will provide state-of-the-art holding facilities for live specimen rotation and recovery; will store displays, materials, and the outreach van; and will house the City of Newport Beach Marine Refuge staff.

We strongly believe that the Back Bay Science Center programs and the Little Corona Tidepool Program will complement each other. Each will benefit through crossmarketing of events and programs, shared information, shared animal care, and shared volunteer recruitment.

Nonpublic Storage Space

Storage space is always at a premium. The current solution of placing metal cargo shipping containers on site is no longer an acceptable option. While the City of Newport Beach has generously offered space at its off-site storage yard, there will be a need for on-island space to house regularly needed equipment and materials. Storage closets will be built into each of the labs, and built-in cabinets and shelves will hold small items.

A large Fish and Game storage bay and workshop will be built into the Orange County wing of the campus. This area of the campus will be posted for staff only, to separate the loading area from the public portions of the island. This loading area will be a shared space, but it should provide adequate space to pick up and deliver supplies.

IX. Evaluation Methodology

In order for the Back Bay Science Center to project a consistent message to the public, it is vital that all the cooperating organizations attempt to follow this interpretive plan. Exhibitry, programs, and outreach efforts must all carry consistent themes and subthemes. Coordinated efforts in marketing, educational programming, and site improvements must demonstrate clarity, thoughtfulness, and planning on the part of all organizations involved. To this end, we suggest the following short-term and long-term evaluation methods to be used at the Back Bay Science Center.

A. Short Term

Clear and coordinated messages about programming, outreach, site improvement, and staffing will be important as this project is launched to the public. Coordinated efforts to create a marketing/outreach plan and operational analysis plan should take priority. As development takes shape at the new Back Bay Science Center, checklists and communication are a simple and effective way to ensure that plans are followed and diversions are limited. A prototype checklist in Attachment D can be used to evaluate how new programs or outreach follow the interpretive plan. This will assist in keeping all programs and outreach on track and demonstrate the value of the Interpretive Plan. The checklist can be modified by other committees to reflect their specific needs.

Prototyping exhibitry and web outreach also can streamline staff efforts. As exhibitry is designed, themes and subthemes of the interpretive plan will guide text writing and graphic design. Consider using front-end surveys before installing permanent exhibitry. This will be especially important in assessing the effectiveness of the hands-on components in the courtyard exhibits. Front-end studies require that focus groups be recruited in order to test and comment on exhibits or programs. A focus group consisting of people who are unfamiliar with Shellmaker can help to make the web site more user-friendly. Online formative surveys will assist as the web page is designed, though these surveys don't always have a high level of accuracy. Users of the web site will be difficult to track and the accuracy of the results will be less reliable.

All new, formalized educational programs should include pre and post tests for participating students to evaluate the programs' effectiveness. Educational programs also should be assessed by teachers who participate in scheduled tours, as well as by members of the educational committee.

Another valuable large-scale method of evaluation would be to compare program outcomes with visitors' perceptions at special events or high-attendance programs.

B. Long Term

The ultimate long-term goal for all programs, exhibits, outreach, and facility is to elicit a change in behavior toward conserving the back bay. Can the Back Bay Science Center influence visitors to conserve the back bay? Will visitors realize that their behavior impacts the watershed? These can be difficult outcomes to measure. Nonetheless, all components of the Back Bay Science Center campus can be evaluated through visitor surveys, observations, and interviews on-site.

One valuable evaluation method would address the key target market, students in grades seven through twelve. Sequential school tours for these students could be used to measure long-term changes in conservation behavior. Students could be tracked anonymously from year to year, classified according to schools and teachers. It is possible that a coordinated effort with the Muth Interpretive Center could start this process for some students at an earlier age. Students in study groups could be queried about the effectiveness of exhibitry, learning stations, and activities.

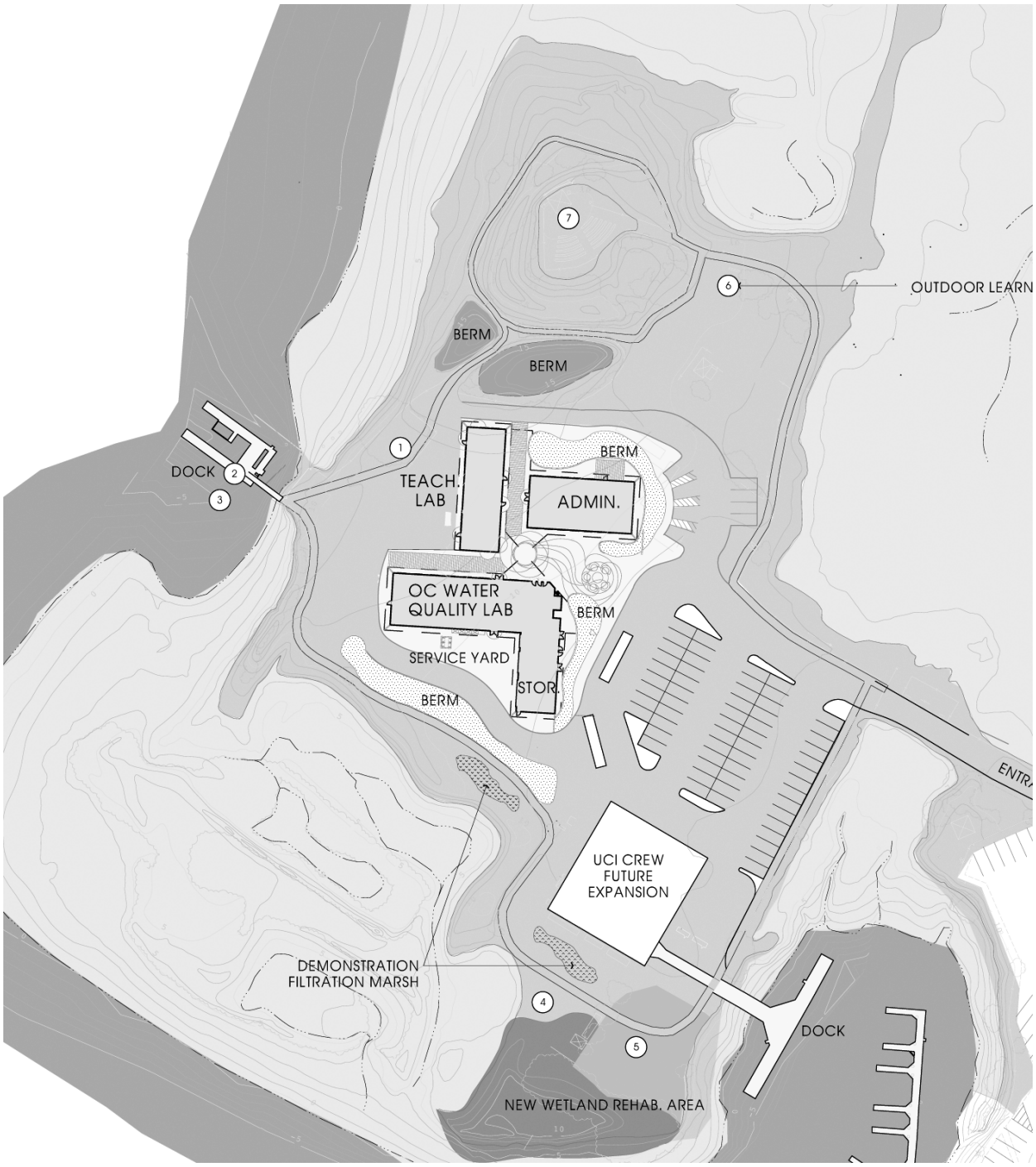
Within five to ten years, valuable information could be gathered and applied to the success of Back Bay Science Center and the interpretive planning efforts, yet it is crucial for a system to be in place as soon as new programs are launched. This is a prime opportunity to apply social science study methods to a science center dedicated to education and conservation.

Attachment A—Associated Facilities

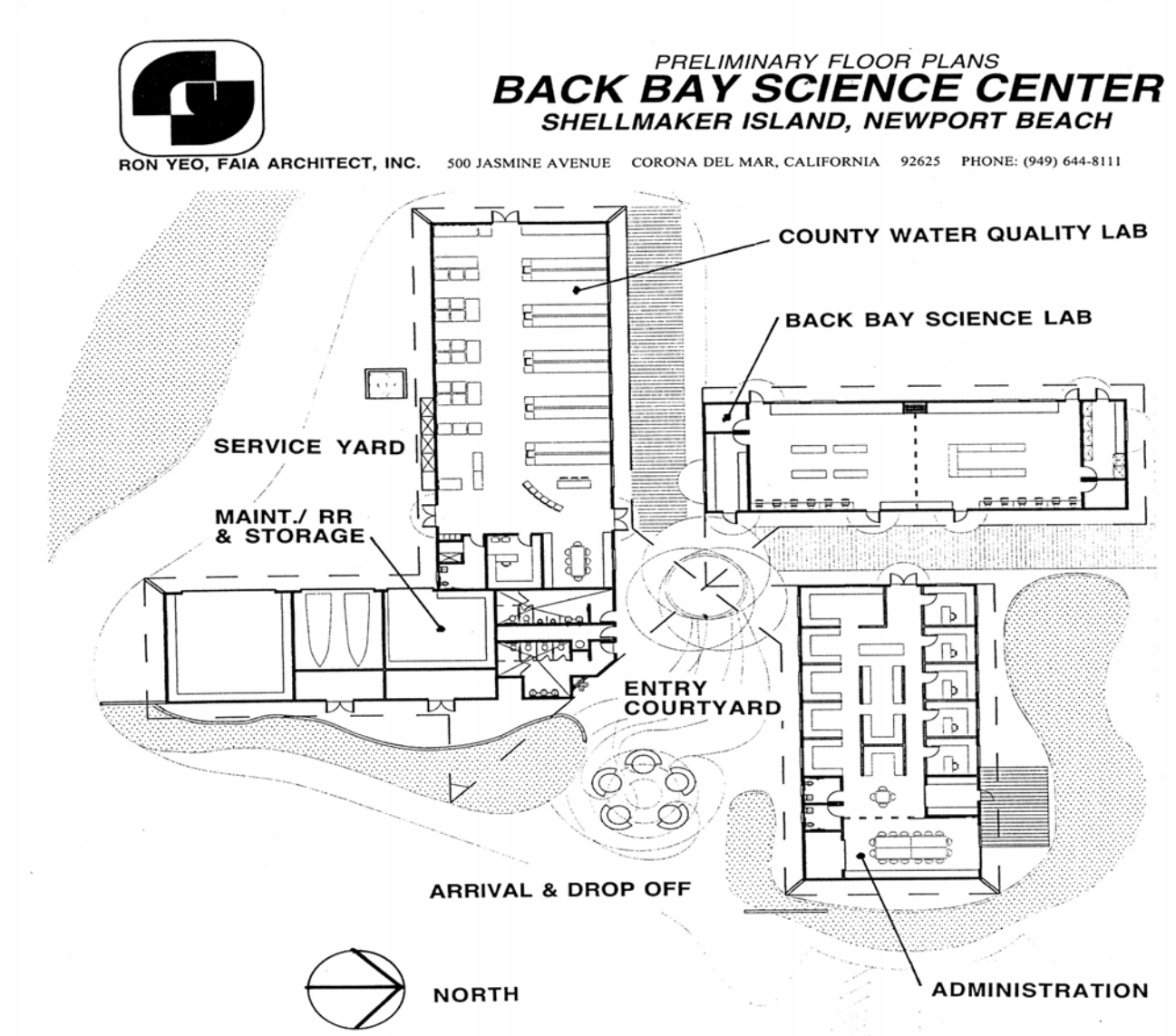
Facilities	Program Focus	Target Audience	Relationship to BBSC
Cabrillo Aquarium 3720 Stephen White Drive San Pedro, CA 90731	Habitat and wildlife of mudflats to open ocean. Programs use aquarium exhibits, classroom lab, and field.	K–4th grade Guide to the Coastal Marine Environment. K–Adult Field/Lab programs. General public weekend programs.	Professional resource. Cabrillo is 45 minutes away. School tours book rapidly because of established market.
Sea and Sage Audubon P.O. Box 5447 Irvine,CA 92626	Marsh Education Programs focus on birding and wetlands of San Joaquin Wildlife Sanctuary. Public programs focus mainly in birding.	4th–6th grade school tours, general public program, and adult field trips.	Birding resource. Education programs are limited and do not focus on high school level.
Peter and Mary Muth Interpretive Center 2301 University Drive Newport Beach, CA 92660	Plants and animals, soils, bird adaptations, and wetlands.	1st–3rd grade and general public weekend programs.	Offers sequential school tour programs with BBSC. Newport Bay Naturalist and Friends share volunteers and docents with BBSC. School and scout programs are coordinated with BBSC.
Aquarium of the Pacific 100 Aquarium Way Long Beach, CA 90802	Focused on marine life. School programs use aquarium galleries and wet/dry labs. Theater programs and sleep-overs.	Pre-K–12th grade school groups. Aquarium presentations for public. Outreach tidepool vehicle travels to schools. Public programs for adults, families, youth, and children.	Professional resource. A visitor attraction with high-quality exhibits featuring over 12,000 animals of Pacific Ocean.
Environmental Nature Center 1601 16th Street Newport Beach, CA 92663	Fourteen California native plant habitats, including a fresh water marsh. Education programs focus on habitats, Native Americans, and science research for 5th and 6th grade.	K–6th grade programs taught by Inside the Outdoors, Mondays–Fridays. Scout programs offered as requested. Public programs.	Professional resource Coordinated scout tours with Muth Interpretive Center and BBSC.

Facilities	Program Focus	Target Audience	Relationship to BBSC
Orange County Coastkeeper 441 Old Newport Blvd, Suite 103 Newport Beach, CA 92663	Well-established community volunteer water-monitoring program. Water-quality testing in Orange County watershed.	5th grade watershed program at Newport Beach Nautical Museum. Cosponsor for *Partnership for Clean Water.* Mandatory program for all 5th grade classes in Newport Mesa School District.	Professional resource and potential education partner. Potential for assisting with water-quality protocol, linking to outreach web site, etc.
The Ocean Institute 24200 Dana Point Harbor Drive Dana Point, CA 92629	Ocean education focused in science, history, and technology. Day and overnight programs.	Pre-K–college level programs on site. *One Tier Back*–5th grade watershed education program on 13 watersheds in Orange County.	Professional resource and potential education partner with *One Tier Back*.
Newport Harbor Nautical Museum 151 East Pacific Coast Highway Newport, CA 92660	Marine and nautical museum focused on current and historic seaworthy vessels, Americup racing, sports fishing, and marine resources.	5th grade watershed program, *Partnership for Clean Water.* Mandatory program for all 5th grade classes in Newport Mesa School District.	Professional resource. Mission and goals are not aligned with BBSC. Mission and goals focus on maritime/nautical perspective of ocean.

Attachment B—Site Plan



Attachment C—Preliminary Floor Plan



Attachment D—Budget Estimates

Staging Area	
Monument Sign	$8,000 (1 sign)
Entry Panel	$5,000 (1 panel)
Directional Signs	$2,000 (20 signs)
Exhibit Courtyard	
Watershed Module	$180,000 (600 SF x $300/SF)
Aquarium Module	$260,000 (400 SF x $650/SF)
Water Quality Lab/ Native Plants Module	$150,000 (600 SF x $250/SF)
Teaching Labs	
Lab A	$137,500 (550 SF x $250/SF) est. ½ of total lab SF
Lab A Culture Lab	$60,000 (200 SF x $300/SF)
Lab B	$137,500 (550 SF x $250/SF) est. ½ of total lab SF
Lab B Aquariums	$120,000 (200 SF x $600/SF)
Outdoor Learning Stations	
1. Recording Station	$150,000 (600 SF x $250/SF)
2. Dock	$10,000 (40 SF x $250/SF)
3. Salt Marsh Restoration	$5,000 (1 panel)
4. Demo Marsh/ Geology	$10,000 (2 panels)
5. Lawn	$0
6. Upper Salt Marsh	$5,000 (1 panel)
7. Amphitheater	$0
8. Bird Observation	$15,000 (3 panels)
9. Activity Area	$0
10. Remote Water Station	$17,000 (equipment)
Total	$1,272,000

SF = Square Foot

Attachment E—Short-Term Evaluation, Checklist

Place a check mark in the left-hand column if the item applies to your program or outreach effort. Use the Comments box to list answers to questions and the Action box to list actions you have taken.

	Questions	Comments	Action
	1. Does the theme of your program or outreach message coincide with themes or subthemes identified in the Back Bay Science Center Interpretive Plan? Identify which themes.		
	2. Is your program in accordance with the mission statement of the Back Bay Science Center?		
	3. Are you reaching the same audience(s) targeted in the Interpretive Plan? Identify.		
	4. Does the program require site use?		
	5. If so, which location(s) will be used?		
	6. Is there a potential conflict with other programs for site use? If so, identify the sites. Is sufficient parking available?		
	7. Is there a potential conflict in the availability of equipment or specimens?		
	8. Have you contacted the staff of a conflicting program about scheduling? If so, what staff member?		

✓	Questions	Comments	Action
	9. Have you informed all on-site staff of your program and public relations efforts?		
	10. Have you contacted the staff of all appropriate off-site agencies about your public relations efforts?		
	11. Have you identified program or outreach staffing needs?		
	12. How does your program impact the operation schedule for the Back Bay Science Center?		
	13. Are program outcomes identified and measurable?		
	14. Is there a program evaluation for participants to complete?		
	15. Is there a peer evaluation of the program?		