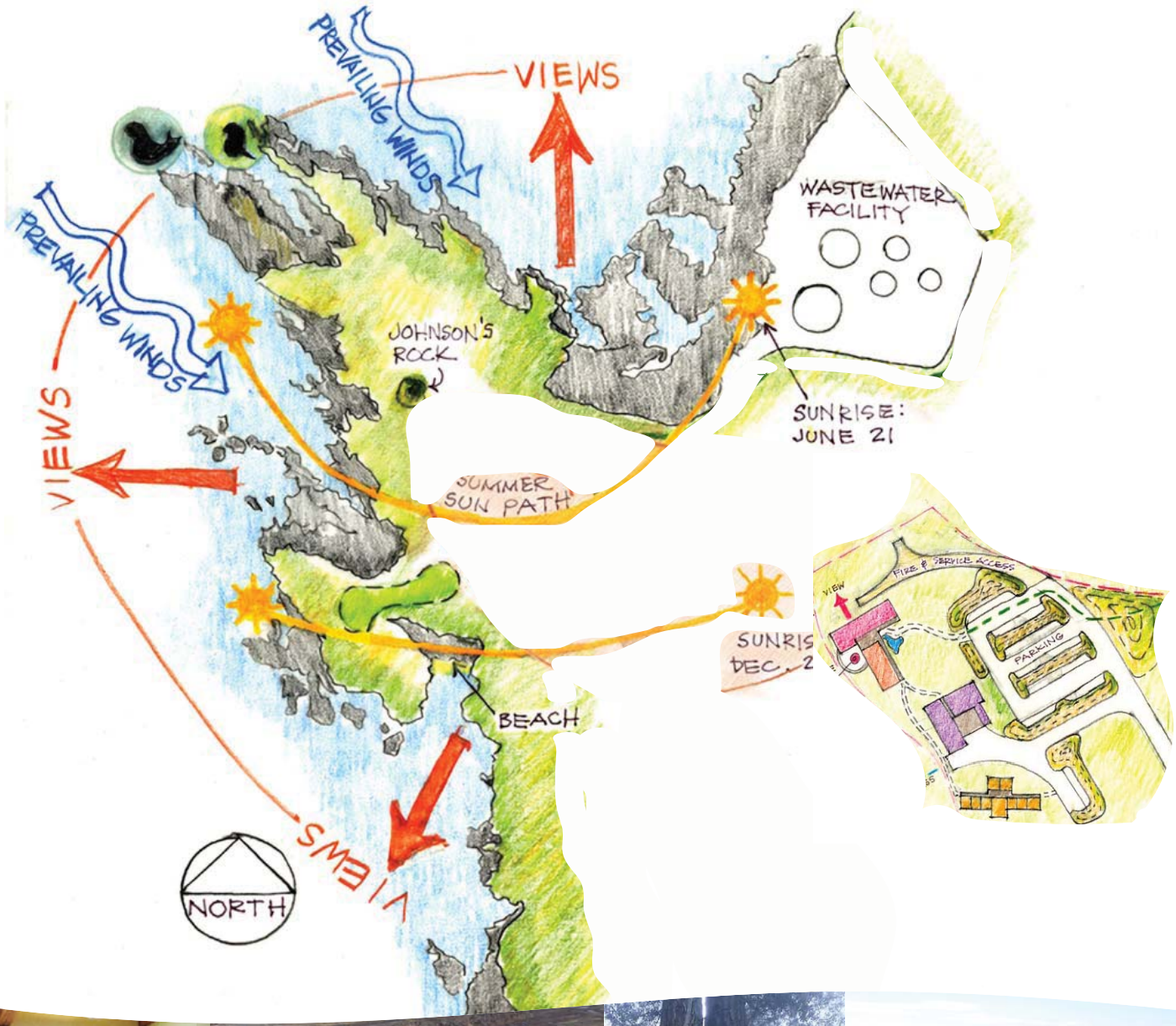
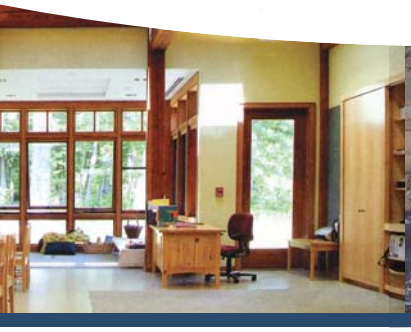
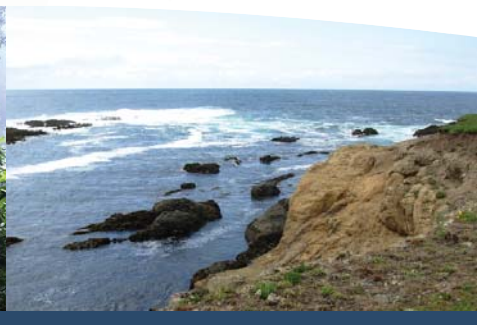
Detailed Project Program
for the
NOYO CENTER FOR SCIENCE & EDUCATION
at Fort Bragg, California





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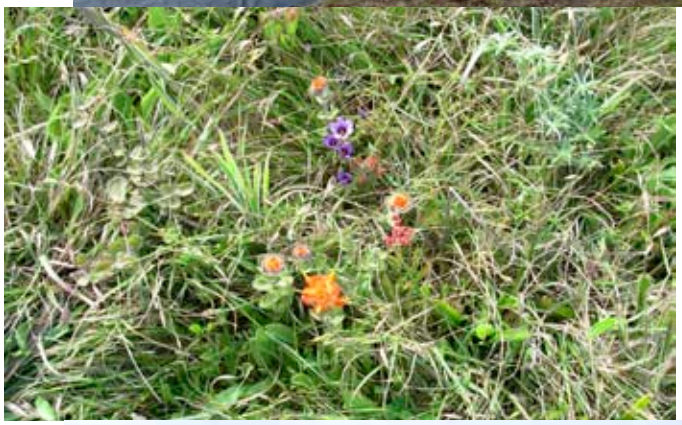

DPP TEAM

Paul Siri
Susan Lohr
Kate Bolton
Mary Dooley
Pete Gang
Natasha Fraley
Laura Lovett

RESOURCE ASSESSMENT TEAM

Vic Chow
Peter Connors

CITY OF FORT BRAGG

Linda Ruffing
Marie Jones
Jennifer Owen
David Goble

STATE COASTAL CONSERVANCY

Sheila Semans

FORT BRAGG CITY COUNCIL

Doug Hammerstrom, Mayor
Dave Turner, Mayor Pro Tempore
Meg Courtney
Dan Gjerde
Jere Melo

for further information:

Marie Jones
Community Development Director
City of Fort Bragg
416 North Franklin Street
Fort Bragg, CA 95437
Phone: 707-961-2823
Fax: 707-961-2802

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1. INTRODUCTION

Fort Bragg's history, economy, and development are inextricably linked to the mill site from which it evolved. While mill operations have ceased, the city has embraced thoughtful and extensive reuse planning. This planning process has identified a marine science and education center as one high priority goal that sets the tone for reuse.

A facilitated process, external reviews, and professional planning have shaped the vision and mission of the Noyo Center for Science and Education at Fort Bragg. The resulting program recommendations embrace sustainable resource management in both the construction and operation of the proposed Noyo Center. Implementing an ecosystem approach to resource management[1] at the Noyo Center will create sustainable forestry, fishery, and ocean energy applications that resonate with regional, state, and federal research and education opportunities.

These program opportunities will contribute to the City's redevelopment. Appropriately, the sustainable design of the Center's facilities will illustrate and inform the Center's sustainable goals, underscoring the operational approach to ecosystem management. In turn, the building design will reflect not only future goals but also pay homage to the town's history, including the important legacy of the coast Pomo. Interpretation programs and exhibits will involve the community and activate public understanding of the Noyo Center's mission and activities.

This Detailed Project Program provides detailed analysis, evaluation, and recommendations for the Noyo Center, reflecting a commitment to the town's future—one where future generations will acknowledge the leadership and community that delivered a living building for living resources.

1. Ecosystem-based management refers to a new but widely endorsed approach to resource management that recognizes all components of ecosystem function—including the role of humans.

INTRODUCTION

The redevelopment of the Georgia Pacific Mill Site has been a focal activity of the City of Fort Bragg for a number of years. Through a series of workshops in 2005 and 2006, the Fort Bragg community identified a science and education center as a high priority to anchor initial Mill Site reuse activities and help generate living wage jobs in the community.

In June 2006, the City Council adopted the Strategic Plan for the Noyo Center, which recommended the analysis and planning of a new marine science center. These recommendations included several important goals:

- Develop the concept of a science center, with a name that would not limit the scope of research and education programs that could utilize the facility.
- Define a mission for the center to take full advantage of regional resources and recognize the region's fishing, lumber, and Pomo tribal legacies.
- Use the science center to express the goals of moving from extraction to sustainable economies and embody the multi-faceted values of ocean and coastal ecosystems. This approach recognizes the importance of ecosystems as well as sustainable fishery and forestry practices.
- Establish "green" building design principles that reflect the Center's goals and adhere to state-of-the-art sustainable design criteria.

Potential site for the marine research center

In June 2006 the City authorized funding for a Detailed Project Program (DPP), developed under the leadership of Paul Siri, a private consultant with extensive experience in planning and operating field stations and a member of the Strategic Plan panel. The DPP would provide the appropriate scope and assessment required to:

Scope of DPP

- ★ *Discover stakeholder's desires for the Center and shape the vision.*
- ★ *Locate the Center's facilities to take full advantage of the natural resources and attributes that would maximize efficient operations.*
- ★ *Identify the primary site development features and mechanical systems that will shape infrastructure requirements.*
- ★ *Define the facility design requirements for sustainable "green" design.*
- ★ *Translate program considerations into facility design requirements, and describe the inventory of facility spaces required for the Center's mission.*
- ★ *Provide interpretive goals and examples ranging from living displays to text and computer-enabled exhibits, including state and federal funding potential.*
- ★ *Create an initial cost estimate for facility development.*

CONTEXT

Historically, the Mill Site was utilized by the Pomo people. A small number of Pomos continue to use coastal areas on the Mill Site for limited harvest of seafood, a practice of many generations. The town of Fort Bragg developed around the Mill Site and for more than a century, lumber and fishing represented the majority of Fort Bragg's economic activity.

Today, multiple interests and issues influence potential Mill Site reuse and the Center's development, including:

- The current environmental remediation by the property owner (Georgia-Pacific) of contaminants related to past mill operations
- Resource attributes, including anthropological, historical, and natural resources (terrestrial, intertidal, and coastal)
- Open space and coastal trail development considerations
- Positioning the Center to leverage emerging local, regional, state, and national programs that foster coastal ecosystem initiatives.

PROJECT HISTORY

In response to City Council and community interest in attracting an institutional use to the Mill Site, and at the recommendation of the State Coastal Conservancy, the City hired Lohr Associates led by Susan Lohr, a consultant skilled in assessing marine laboratory and field station development and operations. Community workshops and additional public process between July 2005 and June 2006 culminated with a Strategic Plan developed by Ms. Lohr. The Strategic Plan process included the involvement of an external panel of experts who conducted an intensive multiple-day site visit to Fort Bragg.

Susan Lohr continued outreach activities with stakeholder groups during the DPP process. This ongoing communication provided valuable community input for, among other issues, facility and trail siting.

As part of the DPP development, Paul Siri engaged a team of consultants with appropriate expertise in marine and coastal field ecology, field station experience, science education and exhibit development, architectural planning, and sustainable design. This team visited Fort Bragg at various times from Fall 2006 through 2007, assessed the Mill Site, and evaluated other relevant facilities. Additionally, a consultant was recruited to define the current concepts and technologies proving most successful in the field of marine resource interpretation, programming, and exhibit development. The draft DPP content, facility siting, and trail siting issues were reviewed and discussed with the City Council in June 2007.

While not a specific design document, this DPP is a planning tool that provides a physical vision and design guidance for facility development. The DPP sets the stage to develop the Center's detailed design while organizational development and fundraising proceed. It presents an inventory of the spaces required for Noyo Center activities and includes specific site requirements and recommendations to optimize success for the Center's goals.

As described in the Strategic Plan, the Center will function optimally as a not-for-profit entity. This document will assist the development of the Center by identifying site potential and analyzing program elements and requirements. The DPP reconciles the Center's program requirements with natural resource issues and site considerations for facility development and architecture.

The design concepts for the Center will evolve simultaneously with its planning. After site acquisition, a subsequent document will need to be prepared in order to obtain development entitlements; the document should include a final site plan, floor plan, grading plan, and environmental review. The DPP will make the planning process more efficient by establishing goals and parameters.

1. MISSION AND VISION

Discover stakeholder's desires for the Center, and shape the vision.

The mission of the Noyo Center is to promote understanding of marine and terrestrial environments in the Mendocino Coast Region by providing a natural laboratory and appropriate infrastructure for scientific research, innovative education, and natural resource stewardship. (from *Strategic Plan for the Noyo Center*)

A broad vision for the center will position it to take advantage of emerging regional, state and national priorities to reshape science and education, to address natural resources management, and create the capacity to understand ecosystems and global change. The Strategic Plan recommended changing the name of the "Science and Education Center from the Marine Science Institute" to the "Noyo Center" (shortened from a formal legal name of the Noyo Center for Science and Education at Fort Bragg). This unique name is evocative of the region, is of local origin, and not limiting in connotation or description so it will evoke the full range of potential programs.

Ocean literacy is an understanding of the ocean's influence on humans—and humans' influence on the ocean. Ocean literacy resonates with the concept of ecosystem based management which is both a state and national goal. Ecosystem based management is an integrated approach that considers the entire ecosystem, including humans.

The Noyo Center's primary goal is to foster activities promoting research and education that support ocean and coastal ecosystem restoration. This complements a number of state and national research and education goals. Other goals of the Center are:

- Develop education and research that support sustainable forestry and fishing practices, and
- Increase ocean and ecological literacy.

Currently, there is a growing awareness that proper ocean stewardship will not be possible without a population that is well-informed about the issues affecting the ocean and its management. This area of specialized education focused on ocean issues is called "ocean literacy."

The Center's vision is broad enough to assist in recruiting community and stakeholder participation—and importantly, the donors necessary to realize the Noyo Center's potential. The Center will contribute to Fort Bragg's sustainable reuse of the Mill Site and serve as a regional center of expertise in marine and coastal education and research. As a regional center, the Noyo Center will help local, state, and federal agencies to implement appropriate ocean and forestry stewardship programs.

The Fort Bragg community has participated in many formal and informal discussions about what the Noyo Center facility might look like. A consensus has emerged that the buildings should be appropriate to the dramatic and rugged beauty of the Mendocino coast, where forests and coastal prairies meet the dynamic Pacific Ocean. Even though the buildings might be smaller in scale than the historic lumber mill buildings that came before, everyone agrees that the new structures should reflect the region's timber and fishing history.

The Noyo Center facility should evoke the forests, oceans, native history, recent natural resource industries, and a hoped-for future of sustainable economic activity based on ecosystem management and tourism. But beyond everything else, the observer should receive a spiritual impression of soaring beyond current limitations to a future of hope, light and optimism, which will be achieved through seeking greater understanding of the forests, the sea and the land that joins them. Some features of the facility should impart this sense of pride, elation, and wonder.

2. SITE SUMMARY AND SITING RECOMMENDATIONS

Locate the Center's facilities to take full advantage of the natural resources and attributes that would maximize efficient operations.

RESOURCE ASSESSMENT

In November 2006, the Mill Site was assessed by a team of biologists with experience in marine biology, education, environmental monitoring, coastal terrestrial ecology, land management, and field station development and operation. Additionally, this team has an understanding of agency, academic, and non-profit field station development. They conducted a qualitative assessment using the following criteria to determine the location's value as a field station:

- Quality of intertidal and coastal bluff natural resources in terms of representative north coast species;
- Relative utility of the site as a teaching and educational resource including access issues; and
- Potential of the location for becoming a center of expertise and infrastructure support to address state resource management goals.

This focused assessment is unique because it focused on the coastal bluff and intertidal resources in the context of the Center's mission; the assessment viewed resources through the lens of informal and undergraduate education along with the science of ecosystem management applications.

Using the site assessment criteria, the resource team established

> "that the marine habitats represent a combination of physical and environmental factors and a rich assemblage of native marine plants and animals making this locale an ideal site for research and education."

Additionally, the assessment team stated:

> "The north end of the site juts out into the Pacific Ocean and is particularly valuable, from a research and education perspective, for its variety of microhabitats and the complexity of the ecological influences."

The natural resources of the upland habitats were also judged to be an attractive resource with a diversity of native grasses and forbs exemplifying "a fine example of northern California bluff top coastal prairie." The contrast of disturbed and undisturbed habitats was also thought to have good potential for illustrating comparison, disturbance history and recovery process.

ACCESSIBILITY OF INTERTIDAL SITES

Intertidal zones present valuable habitat for research and education. Access to the intertidal zone on the south end of the Mill Site is dangerous due to loose soils and steep cliffs. The Blow Hole area, which will attract public attention, is especially dangerous and physical barriers should be installed to control public access.

The best mix of habitat and interesting study sites occurs in the intertidal zone south of Johnson's Rock where the isthmus of a small peninsula separates two coves, one facing north and one south. There are a number of good access points along the peninsula due to a few bluffs that have solid rock and secure footing (see photo below).

Site aerial

Peninsula with coves on north and south

During days of low to moderate wave energy, the coves are protected by an outer reef of rock islands that serves as an effective breakwater. A few sites on the peninsula would enable access with the addition of railings or an extension ladder that could be deployed on minus tides. The existing dirt ramp access to the southern cove could, with modest improvements, allow light vehicle access appropriate to launch and retrieve small inflatable vessels. On days of low wave energy, the southern cove offers easy access with entry possible in waders or wet suits for scuba divers and snorkelers.

RECOMMENDATIONS FOR FACILITY PLACEMENT

The site evaluation recommends:

1. Locate the facility where the natural resources, both upland and intertidal, are diverse and relatively undisturbed by human impacts;
2. Provide convenient and safe access points to intertidal and subtidal field sites;
3. Allow access to intertidal and subtidal field sites that are relatively safe to visit because they are sheltered from most waves;
4. Include possible access points to the waterline for the launching of small boats or for emergency and safety operations;
5. Locate a building in such a way that the access to sensitive coastal bluff and intertidal habitats can be monitored and controlled.

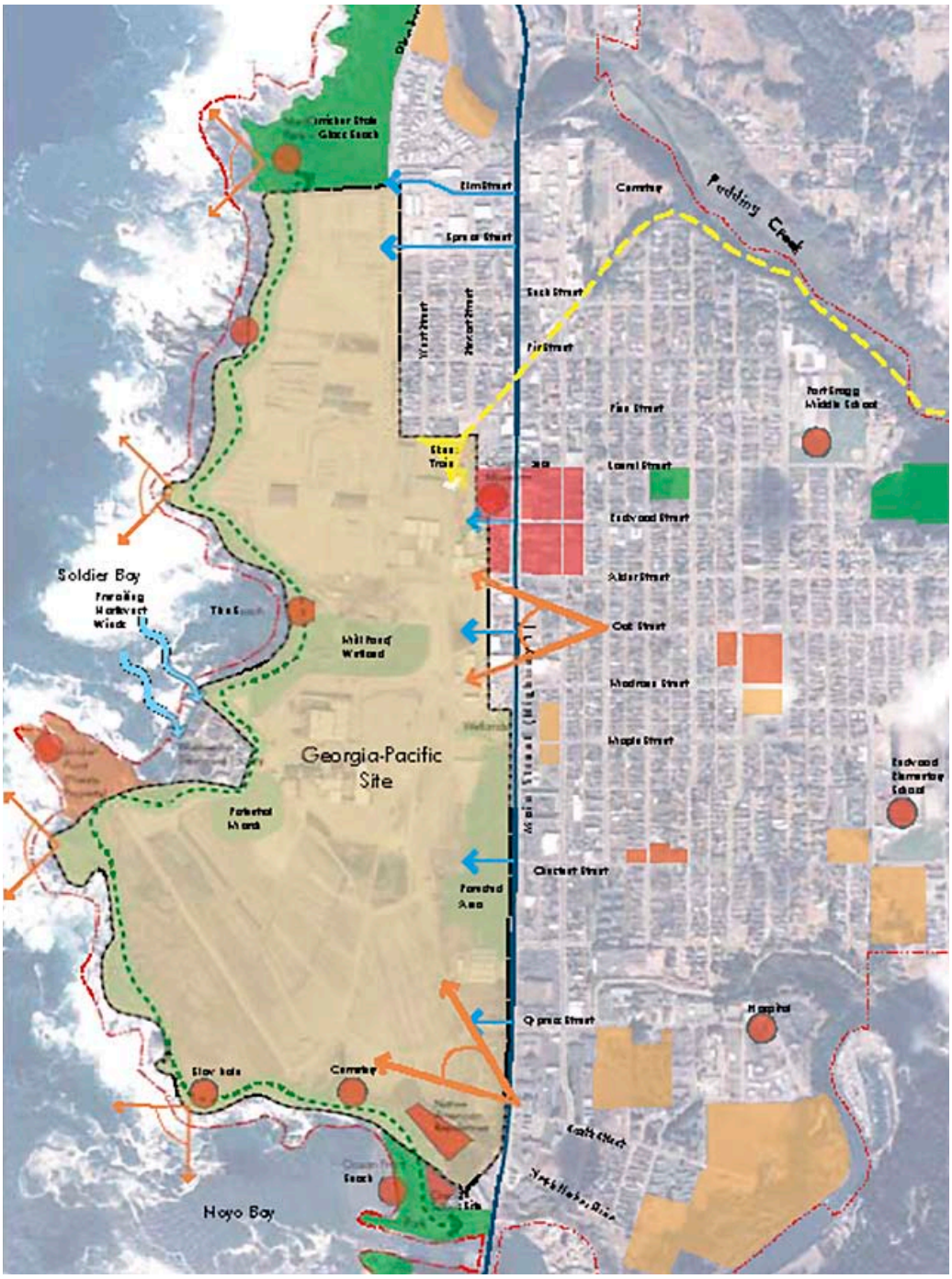
Proposed Site Reserve
Black border indicates the Terrestrial and Marine Reserve. White border indicates approximate conceptual envelope of a five acre facility. The final location is still to be determined.

The infrastructure envelope proposed for facility siting encompasses approximately 5 acres at the north end of the old runway, south of Johnson's Rock and southwest of the existing sewage treatment plant (see Site Map). An associated Marine and Terrestrial Reserve with limited access will encompass additional area to provide the Noyo Center with appropriate natural coastal resources (shown in black at left). The actual facility site and reserve areas will be defined more precisely in the site acquisition process. Together the Center's future facilities and reserve create a functional resource conservation envelope.

In addition to the goals listed in the site evaluation, the facility and program will need to address the scale of protection and management required to sustain these resources for teaching, research, and future generations. Biological field stations routinely serve multiple agency functions by overseeing protection of important biological resources and habitat. Establishing a small reserve for the coastal prairie and intertidal zone adjacent to the facility will be essential for the Center to achieve its goals and sustain program potential. Otherwise, the wearing effects of a large number of visitors will gradually diminish the natural resource values currently inherent in the site. The consultants recommend that the most important natural resources be protected in perpetuity for future generations by allowing access only for authorized research and education. Appropriate interpretive exhibits at the Center will provide public education and serve as important resources to mitigate protection measures.

The following map shows the broad site context and illustrates considerations and opportunities for future development on the Mill Site.

[still need hi-res version]



Site Context Map

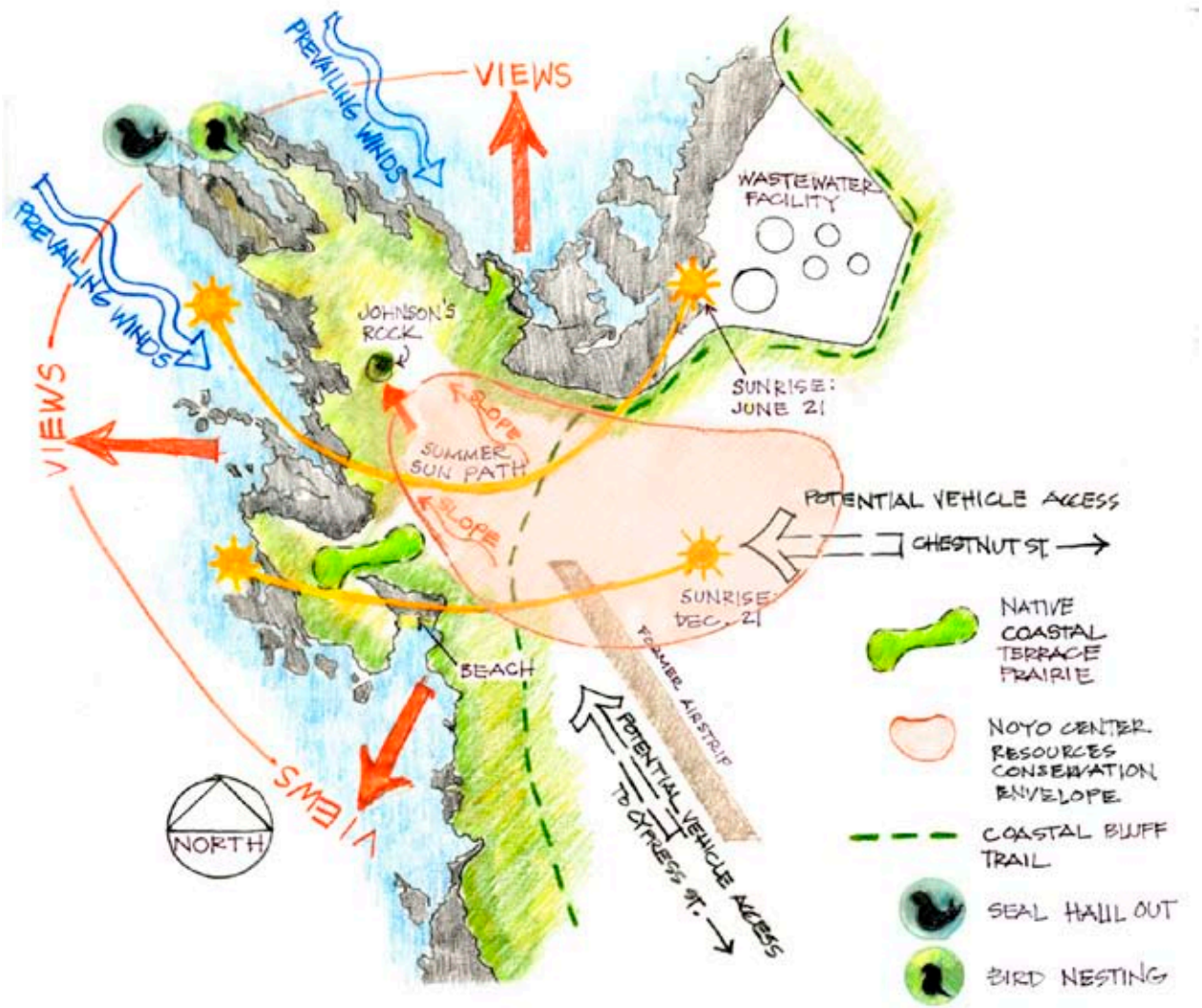
Source: *City of Fort Bragg Georgia-Pacific Mill Site Reuse Study – Land Use Principles and Concepts, September 2004*

3. ARCHITECTURAL OBJECTIVES

Identify the primary site development features and mechanical systems that will shape infrastructure requirements. Define the facility design requirements for sustainable "green" design.

In addition to sustainable design objectives, the facility's design should respond to the functional, educational, and research needs defined in this document and consider future needs as well. A successful design will meet high architectural goals supporting all the program elements of education, research, interpretation, and infrastructure support with a strong, unifying sense of architecture that is also adaptive to future needs.

The proposed site itself offers a great deal of information to consider.



Site Analysis Diagram

BUILDING GOALS

The first phase of the Noyo Center development should provide facilities that are large enough to accommodate a "critical minimum" of programs for 20 years. All functions that might take place at the Noyo Center over the next 20 years or more should be incorporated, which means that flexibility and adaptability will be basic to the physical design. Some fundamental goals for facility development include:

- Access to the site should consider traffic patterns and connections from town to the site and relationships to the Harbor and the Noyo River; these will be defined during the Specific Plan process.
- Total building size for the initial construction phase would be about 11,000 assignable square feet of core facilities with approximately 6,000 sq. ft. of support buildings, some of which can be contained in a complementary designed corporation yard.

Moss Landing Marine Laboratories

- The Noyo Center complex should be a sustainable, environmentally-compatible facility. This includes energy efficient heating/cooling systems, water use, waste disposal, and so on. LEED Certification at the highest level (Platinum) should be sought. Where possible, the facility should attain the further design goal of meeting the more stringent "Living Building" criteria.
- In general, flexible adaptable spaces that accommodate multiple functions will be better than large, use-specific spaces with fixed furniture.
- Research and public uses should share common spaces to maximize building use and efficiency, e.g., public reception, administrative functions, the lecture hall, restrooms, etc.
- Interpretive exhibit space needs should influence the design.
- The architecture should reflect the cultural heritage of Fort Bragg while incorporating appropriate sustainable design materials to attain building efficiency.
- Facilities should be as cutting-edge as possible, while keeping to a scale appropriate for the location and size of the potential user community: a maximum of about 20 simultaneous research projects, 60 personnel on site, 16 overnight guests, and 600 public visitors per week.
- Noyo Center facilities should be of high quality to encourage long-term intellectual and personal commitments to the Center.

- Housing and lab/administration buildings need to be separate from each other to maintain privacy for the residents and visitors. Nevertheless, the furthest walking distance should be about five minutes, or 1,000 feet. Otherwise, travel between buildings is likely to be by vehicles rather than on foot.
- Finishes must be suitable to the coastal marine location, and include resistance to corrosive salt air and moisture.
- Building placement should help protect the site's natural resources from undesignated uses.
- Seawater systems should be engineered through a close collaborative design process between the education and research arms of the Center.
- Back-up power generation is required and thought should be given to its location, noise and fuel impacts. Marine organisms require power constantly as a lack of oxygenated water will result in their quick expiration.

DESIGN CONSIDERATIONS

As part of promoting eco-literacy, the facility should be designed to create and allow for sensory experiences of the forces of nature. For example, the wind off the ocean can make song, the sun's light can be discovered deep in the building's interior, the fog's moisture can be felt, the natural pattern of waves and beach formation can become visible, rain can be caught and its travel to a sculpture or pond can be seen during a storm. Many of these environmental factors at the Noyo Center could become part of the human experience creating delight by exposure to nature's interactions.

Architecture and design can improve social conditions. The Noyo Center should promote healing the community as well as the land. Responding to the impact of the site's history and the hopeful future of the community will be an important aspect of the design solution. These concepts are more about the spirit of the architecture than functional requirements and will be part of the future design team's challenge.

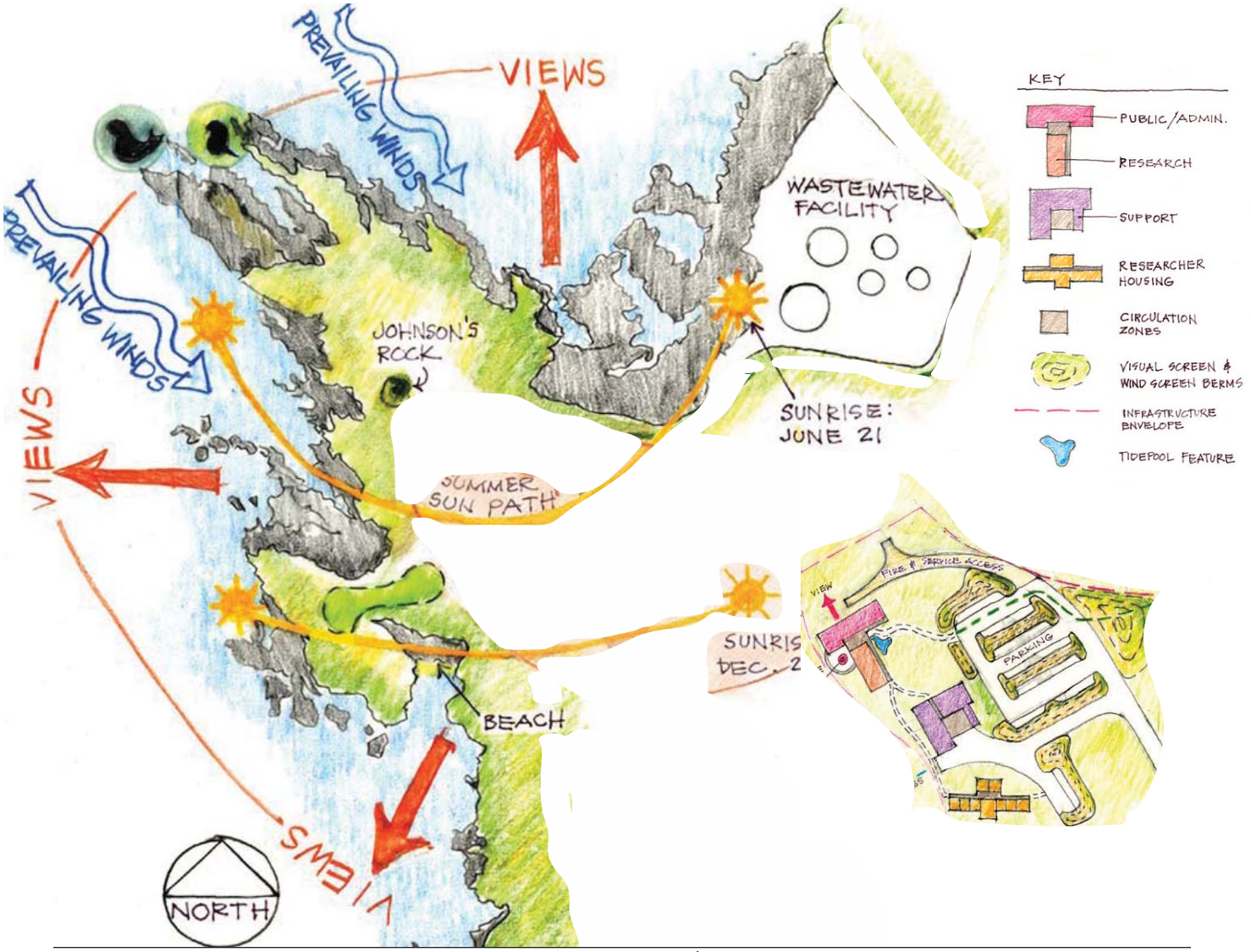
Expressed Building and Land Forms should respond to:

- Wind patterns—to create outdoor spaces that are protected and to passively cool the building
- The solar path—for passive heating, solar collecting, natural lighting, protection from excessive heat gain and glare, and artful light play into the building
- Rainfall and the collection of runoff—in the landscape and from the building in a visible or measurable experience
- The views up the coast and to the ocean, as well as the immediate bluffs—to connect the facility to its sense of place
- The physical context of bluffs and natural patterns observed in the landscape
- The community's wish for a space for the spirit—of remembrance and contemplation for individual interpretation

- The required functional spaces with a logical and appropriate scale—without housing everything under one roof or one fixed shape or scale
- Form a gateway to the areas of stewardship—at Johnson Point and at the hammerhead-shaped peninsula
- Provide a sense of approach and orientation to the Noyo Center for Coastal Bluff Trail users.

The site itself offers a great deal of information to assist in locating specific functions of the facility. The following Site Concept Drawing presents a possible vision of the Noyo Center layout. The drawings are a beginning rather than a solution to a very complex design challenge. While many assumptions were made at this early stage, the goal of a Site Concept is to show opportunities for development in a visual format.

Site Concept Drawing



SUSTAINABLE DESIGN

Conventional building design views the environment simplistically, without regard for the myriad interrelationships that are the strands of the web of life. This has resulted in a long list of environmental ills that now characterize planet Earth, including global climate change.

In sharp contrast, sustainable design acknowledges that all human activity—all development, indeed all aspects of our human existence—takes place within the context of the natural world, within the ability of a finite biosphere to function as a source for all of the needed resources and as a sink for the resulting wastes. In simplest terms, Sustainability can be thought of as not taking more than can be provided on an ongoing basis, or "living within the means of Nature."

Sustainable Building = Green Building = Environmental Building = High Performance Building

As the first step in the redevelopment of the Mill Site, the Noyo Center will be a physical expression of Fort Bragg's vision of the future, in terms both real and metaphorical. The community of Fort Bragg has expressed a clear intention that sustainability be an integral part of the design process for all aspects of the Noyo Center; both community-wide workshops designated green facility design a high priority. A sustainable facility dovetails with both the community's desire for and Native American interests in appropriate resource stewardship.

In 1995, the U.S. Green Building Council (USGBC) began to develop LEED, or Leadership in Energy and Environmental Design, to establish a common definition of Green Building and create a Green Building standard.

LEED certifies the "green" qualifications of buildings through a points-based checklist divided into six sections: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation in Design. LEED recognizes four levels of "green:" Certified, Silver, Gold, and Platinum. In the United States and internationally, LEED is the standard by which Green Buildings are evaluated, rated, and certified. For this project the minimum goal is LEED Platinum.

The State of California has taken bold steps in promoting sustainable development. The Governor's Green Building Action Plan requires that all new and remodeled State buildings over 10,000 square feet be designed, constructed, and certified at or above the level of LEED-NC Silver.

According to a study funded by the California Public Utilities Commission (CPUC), titled *Costs and Financial Benefits of Green Building,* the average LEED building costs 1.84% more to build than a conventional, code-compliant building, but the incremental additional investment is repaid 15-fold over an assumed 20-year life of the building. Most of the additional cost is due to additional architectural and engineering design and documentation costs, not construction costs. The greatest financial benefits are in the area of human health and productivity (70% of total), followed by reduced operations and maintenance costs (16%), energy savings (11%), reduction in water use, solid waste, and other emissions (3%).

Every new LEED building requires that the larger environment provide additional energy, fresh water, and other resources on an ongoing basis and requires that the larger environment process additional wastes—wastewater, solid waste, and atmospheric pollutants—on an ongoing basis.

The highest expression of sustainable design, usually referred to as Restorative Building, Regenerative Building, or Living Building, involves taking full responsibility for ongoing needs and placing no net demands on the larger environment.

Examples of airy, well-lit interiors in buildings that have green credentials and create positive, cheerful spaces supporting healthy working environments.

The Living Building Standard, released in November of 2006, is an evolving framework of understanding, whose stated purpose is to:

> "...define the highest measure of sustainability possible in the built environment based on best current thinking—recognizing that 'true sustainability' is not yet possible."

Islandwood Nature Center
Bainbridge Island, WA

The Living Building Standard surpasses LEED in its scope and purpose. In contrast to LEED's 69 possible points and reliance on accounting and documentation, the Living Building Standard has 16 "simple and profound prerequisites" that each building must meet. Currently in this evolving framework, there is no certification or requirements for specific or numeric standards as with LEED. The 16 prerequisites alone guide all aspects of design, construction, and operation.

As a simple and comprehensive approach that views sustainable building as much more than building in a "less bad" way, use of the Living Building Standard will result in a truly sustainable Noyo Center together with an underpinning of ethical practice that will guide the community of Fort Bragg toward a sustainable future.

Willow School
Gladstone, NJ

Adam Joseph Lewis Center
Oberlin College, OH

4. FACILITY DEVELOPMENT

Translate the elements of program considerations into facility design requirements, and describe the inventory of facility spaces required for the Center's mission.

PROGRAMMATIC ELEMENTS

The Center's functions will shape its detailed design. To become a regional and statewide resource, the Center will require thoughtful planning to incorporate teaching and research resources that range from natural elements, such as flora, fauna, and trails, to built infrastructure such as satellite communications. A non-exhaustive list of important resources, interpretive considerations, and building uses that should be folded into the design process includes:

1. Research

a. Research and teaching lab space. Small private spaces for researchers. A larger teaching lab. Design these with flexibility of configuration for different classes, class sizes, and functions.

b. Appropriate shared lab equipment for student research. It is envisioned that scientists would provide most of their own equipment.

c. Computer room for visiting researchers and short course use.

d. Overnight accommodations for 16 people. Housing should be flexible enough to provide privacy for couples, families, and students. Sleeping units of small size (1–2 people per room) are best, with private access to bath facilities. Kitchenettes could be shared, possibly with a commons. Private space is important for visitors who reside at the Center for more than a few days.

e. Detailed biological and physical inventories of the site and region, which will become a resource available for research and education programs.

f. Research plots that can be guaranteed secure for mid- to long-term projects.

2. Public/Administration

Outdoor fireplace at the Ocean Institute at Dana Point

a. Office spaces that can be rented by compatible organizations or small businesses when not needed by Noyo Center programs.

b. Public reception space.

c. Library and collections facilities.

d. An inviting meeting area, with a fireplace or fire pit, that will encourage friendly interactions.

e. A medium-sized lecture hall seating approximately 120–130 people that can fill a gap in the available meeting space within the community of Fort Bragg.

f. A prep kitchen associated with the lecture hall, for catered events, food warming, refrigeration, and clean up.

g. Storage for general use as well as additional storage for chairs, tables, and interpretive resources.

'Jewel Box' aquaria at Ocean Institute

3. Education/Interpretation

a. Maps and a trail system as part of access and interpretive information.

b. A moderate-scale teaching aquarium to accommodate public visitation and education programs.

c. Mobile specialized ("jewel box") aquaria plus holding space to minimize stress on living organisms and provide versatility in teaching and public education.

4. Infrastructure

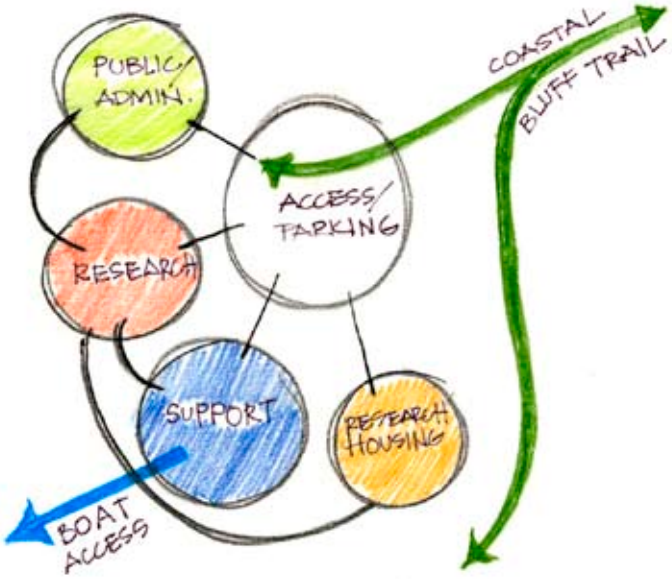
a. Expensive mechanical systems and finishes typical of a seawater facility with wet labs.

b. Satellite communications and high-speed Internet connections.

c. Backup power required.

d. Equipment necessary to implement a long-term monitoring program, based on participation in existing and emerging ocean and earth observing networks. This would include infrastructure to communicate with instruments and sensors in intertidal and subtidal areas.

e. Equipment storage is critical for field stations and marine laboratories and is always under-estimated. Also required is private, lockable storage for visiting researchers.



Functional Relationships

The Programmatic Elements described above are inter-related among four areas: (1) Public/Administration, (2) Research, (3) Support and (4) Housing. All program areas require vehicular access or access to parking. This organization of program elements is shown graphically in the Functional Relationships diagram (at left) where the strongest relationships are connected by a black line.

SPACE NEEDS AND FUNCTIONAL RELATIONSHIPS

The Center's facility requirements include an inventory of spaces whose need and function have been validated by many years of review by the Organization of Biological Field Stations (OBFS). Over the years, the consultants for the Strategic Plan and DPP have worked closely with OBFS in developing program, operations, and facility requirements with sponsorship by the National Science Foundation. The Noyo Center's facility requirements were developed with the national experience of OBFS, and represent hundreds of years of collective expertise.

ALL FACILITIES

Buildings

1. Center Core: 7,140 SF
2. Support Facilities: 6,000 SF
3. Housing: 3,600 SF

Total: 17,000 assignable SF

Parking

Cars: 92 spaces
Bicycles: 15 spaces minimum
Plug-in Hybrid Recharge Station: 6 spaces

1. Center Core

Public Space

Lobby/display: 500 SF
Auditorium: 1,200 SF
Prep kitchen: 300 SF
Restrooms: 400 SF
Fire pit meeting area: 800 SF

Total: 3,200 SF (plus 480 SF non-assignable circulation)

Administration

Offices: 530 SF (1 @ 125 SF, 1 @ 180 SF, 3 @ 75 SF)
Conference/Library: 450 SF
Workroom/IT: 100 SF

Total: 1,080 SF (plus 165 SF non-assignable circulation)

Labs/Research/Teaching

4-person labs: 1,260 SF (4 @ 315 SF)
2-person labs: 800 SF (4 @ 200 SF)
Large multi-use lab: 800 SF

Total: 2,860 SF (plus 430 SF non-assignable circulation)

2. Support Facilities

    Mud/Wet Room: 100 SF
    Storage: 425 SF
    Shop: 875 SF
    Seawater pumping & treatment: 200 SF
    Back-up power generation: 500 SF
    Exhibit maintenance & development: 400 SF
    Electronics shop: 200 SF
    Submersible vehicle maintenance: 400 SF

    Corporation Yard

    Diving Locker (with restrooms & showers): 1200 SF
    Air station: 200 SF
    Boat and vehicle storage: 1,000 SF
    Greenhouse: 400 SF
    Hazardous material storage: 100 SF

    Total: 6,000 SF (plus 900 SF non-assignable circulation)

3. Housing

    Lodge

    Private rooms with bath: 3,120 SF (8 @ 390 SF)
    Kitchen/living: 400 SF
    Utility/mechanical: 80 SF

    Total: 3,600 SF (plus 540 SF non-assignable circulation)

Some of these spaces are interchangeable and it is possible that, as the program is refined and the Center's governance structure evolves, some areas may grow or contract during the design process. For instance, the fire pit meeting concept may become a covered outside space integrated with an event area. Additional options, where appropriate, include finding suitable space for specialized activities in Noyo Harbor for some vessel functions.

5. NOYO CENTER PROGRAM OPPORTUNITIES

Recommend state and federal program potential.

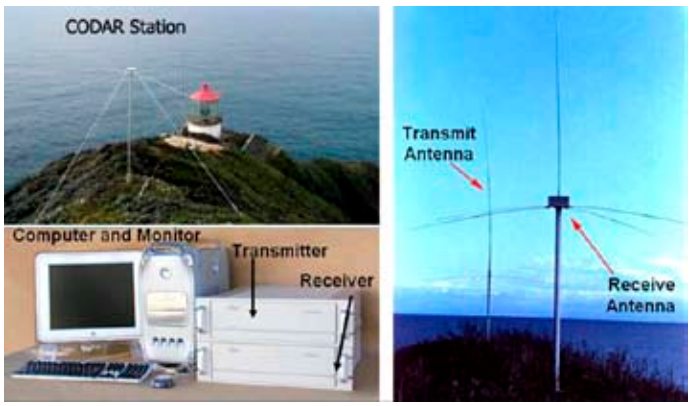
In order for the Center to achieve success and become a viable entity, its facility will require thoughtful integration of planning and program development, with close attention to facility siting and the way the physical facilities support the Center's mission and goals. The Strategic Plan and successive conversations with numerous stakeholders emphasized sustainable or 'green' design. Green design resonates with the Center's vision to move fishing and forestry to an economically sustainable future while providing formal and informal education supporting ecosystem-based management.

Several viable, near term program opportunities for the Noyo Center are emerging from national, regional, and statewide agendas regarding ocean monitoring and ecosystem management of coastal areas. Some of these programs are likely to come to fruition well before the Noyo Center facility is built on the Mill Site. For that reason, a phased development scenario is proposed that will provide interim staffing and facilities so that no opportunity is lost for the Noyo Center to become an integral part of these emerging research, monitoring and technical training opportunities (see Appendix V: Phased Development Plan).

Four programs in particular could initiate capacity within the next 18–24 months for future Noyo Center programs:

1. **Surface Current Mapping** The State Coastal Conservancy has funded a $21 million state-wide Coastal Ocean Currents Monitoring Program (COCMP). Using shore-based High Frequency Radar (actually 55 watt am radio signals), COCMP creates real time, web-based surface current maps showing current direction and velocity. COCMP products are valuable tools for responding to oil spills, increasing maritime operations efficiency, search and rescue, and fishery recovery applications. High Frequency radar infrastructure being deployed in Fort Bragg at Pomo Park in 2007 represents a node in the state's investment in ocean observing. The equipment could be relocated to the Noyo Center site after site acquisition and its operation integrated into Center functions.

High frequency radar components



2. **Technical Training for Ocean Observing Development and Operations** There is a significant shortage of trained technicians for servicing the ocean observing equipment. The Marine Technology Program at the College of the Redwoods, Fort Bragg campus, is an ideal location for an in-depth career-path training program. The various federal and state agencies that fund the instrument arrays are eager to receive a viable proposal for increasing the number of trained technicians, not only in the North Coast area but throughout the country. Noyo Center could support and/or provide such training programs.

3. **Collaborative Research for Salmon Recovery** The State of Oregon has developed a pilot program to involve the commercial fishing fleet in scientific data collection about the salmon fishery. In return for receiving disaster relief funds, the fishermen take some basic sampling data from fish caught and from the ocean environment. These data enable scientists to establish essential fishery information that is necessary for salmon recovery and management. This kind of collaborative approach with contributions from industry and academia is a good niche for the Noyo Center. California is investigating this model, enhanced by ocean observing tools, for use in salmon recovery. The fishing fleet in Noyo Harbor could assist these activities with support from Noyo Center researchers.

4. **Ocean Energy Development** Pacific Gas & Electric filed applications with the Federal Energy Regulatory Commission for permits to install and test wave energy generation equipment off the Mendocino coast. The coast off Fort Bragg is potentially a viable location because it has consistently strong wave patterns and capacity in the local power grid to transmit new electricity; the energy developer may be able to use the City's wastewater outfall to collocate electrical conduit; Noyo Harbor is a convenient facility for launching service personnel and equipment. The Noyo Center location, in conjunction with potential agency and academic collaborations, would make an ideal physical and intellectual hub to support and evaluate this pilot energy technology.

On-site energy production for the Noyo Center from wave action is an option that should be investigated. The Center can contribute to state and national initiatives seeking energy security while addressing global warming by evaluating ocean energy for its practical uses.

Longer-term program opportunities for the Center include potential synergies with Jackson Demonstration State Forest (JDSF), which is developing sustainable forestry practices. In addition, a collaboration of donor organizations and state agencies are creating sustainable practices at the Salmon Creek and Big River Forests. These sustainable forestry projects represent important education and research opportunities. Integrating innovative forestry and ocean projects into a coastal science and education program is an ideal fit for the Noyo Center.

Exploring the intertidal habitat

The North Coast Integrated Regional Water Management Program (NCIRWMP) represents seven north coast counties, including Mendocino, and provides a unified regional framework for beneficial uses of water, salmonid enhancement, and intra-regional cooperation. The program, which integrates local, state, and federal priorities with adaptive management goals, has six primary objectives:

1. Native salmonid habitat enhancement,
2. Protection and enhancement of drinking water,
3. Adequate water supply with minimal environmental impacts,
4. Implementation and support for statewide water initiatives,
5. Address environmental justice issues, and
6. Provide an inclusive framework for intra-regional cooperation.

STATE AND FEDERAL CONSISTENCY

The science-based ecosystem management proposed for the Noyo Center is consistent with a number of state laws, including the Marine Life Management Act, the Marine Life Protection Act, and the California Ocean Protection Act, which established the California Ocean Protection Council. The Noyo Center's Ecosystem Based Management (EBM) goals resonate well with the overarching direction of the Ocean Protection Council (the Governor's Ocean Action Plan cabinet-level ocean management team). That Council's June 2006 Five-Year Strategic Plan includes EBM and ocean observing as high priority objectives.

Additionally, the January 2007 executive summary of the U.S. Commission on Ocean Policy, which directs all federal ocean management goals across agencies, identified three central elements as national goals:

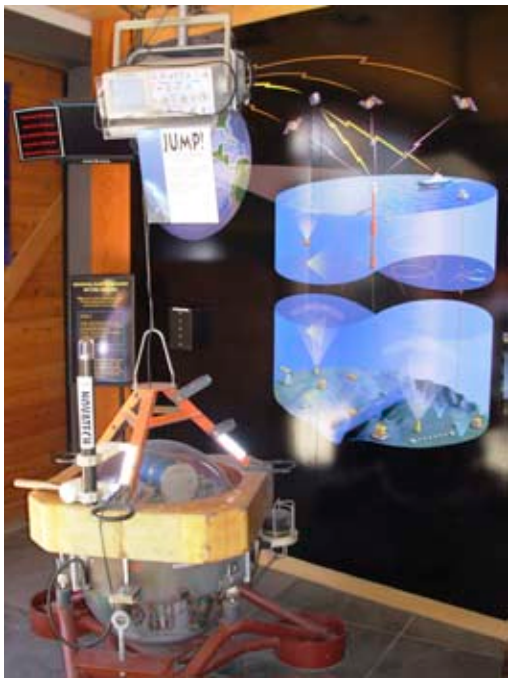
- Capability to forecast key ocean and ocean-influenced processes and phenomena,
- Scientific support for ecosystem-based management, and
- Deployment of an ocean observing system.

Regulatory compliance will be administered by a number of agencies and will require adherence to the Local Coastal Program. Intertidal infrastructure must be assessed by the California Coastal Commission, which looks at siting, planning, and design issues, and by the State Lands Commission, which addresses subtidal requirements. The design and scale of a seawater system will require specific and additional regulatory compliance. Depending on whether the seawater system includes a permanent intertidal piping and pumping structure, the State and Regional Water Quality Control Boards will play a role in permitting the system and requiring various degrees of biological and physical monitoring.

6. INTERPRETATION AND EDUCATION OPPORTUNITIES

Provide interpretive goals and interpretation examples ranging from living displays to text and computer-enabled exhibits.

The Noyo Center design requires attention to multiple program functions of education and research. With the goal of increasing ocean and ecological literacy, the education program will be shaped for two audiences: undergraduate education and a general public audience. Additionally, the Center's sustainable design can itself be an interpretive element, creating a thematic string of ecosystem management defining applications from the scale of science concepts for appropriate ocean and forest stewardship to building construction and function. The Center will have ecosystem management themes delivered by specific design to several audiences.



Ocean observing exhibit at Dana Point

For a general audience, including drop-in visitors during scheduled hours, the Center would focus on exhibits and programs to interpret elements and processes such as:

- The dynamic ocean: currents, variation in natural cycles, how scientists monitor changes,
- How energy organizes biological communities,
- Local marine and coastal environments,
- The interconnectedness of the land and the sea and unique attributes of the land/sea interface,
- Ocean science and technology representative of the Noyo Center's mission—with a goal to make it real with live data feed, and personal by highlighting scientists and programs,
- Recovery stories of salmon, near shore fisheries, and forests,
- Sustainability: fishing, salmon, forest management, ocean management, the economic benefits of a healthy ocean and coastal environment,
- Climate change: how it might impact the area, the visitor's role, the community's role in solutions,
- Green building design and function: what the Noyo Center is doing to achieve a small ecological and carbon footprint, including interpretive features that allow the visitor to visualize building functions such as water flows and heating/cooling cycles, and
- The role of ocean energy in achieving energy security and addressing global warming.

Interpretive features such as a well-designed tide pool, (technically a tidal mesocosm if functional tide and waves are incorporated) can also contribute to good stewardship of natural resources. Natural tide pools open to the public have been 'loved to death' by the

trampling and sampling activities of well-intentioned visitors. A tidal mesocosm can serve not only as a surrogate for natural tide pools, but the experience can be enhanced by better viewing access, greater physical safety, and the ability to maximize animal diversity in a variety of habitats.

Tide pool feature at Bodega Marine Lab

In order to achieve successful and stimulating interpretive features, the facility design process must flow from a premeditated and well-planned integration of educational, interpretive, and architectural goals. There is strong community consensus that the interpretive function of the Center should reflect the goal of creating a destination of regional significance. As such, Noyo Center can contribute importantly as an economic engine in Mill Site redevelopment, and accordingly, emphasis should be placed on exhibit development as a critical component of a detailed architectural program.

Important points to incorporate in the design process are:

- Activity planning, exhibit planning, and architecture need to develop simultaneously.
- The leadership of the Noyo Center should determine interpretive criteria based on the Center's mission and incorporate interpretive needs from the start of facility design.

7. COST ANALYSIS

Create a cost estimate process that provides a basis for facility development.

The Noyo Center vision and development plan provides a basis to estimate cost so that staff can initiate fundraising. However, significant uncertainty exists at the time of DPP production. These uncertainties include:

- Unidentified Noyo Center site acquisition funding,
- Lack of a comprehensive Mill Site Specific Plan,
- City of Fort Bragg water supply and waste water treatment capacity,
- Water and waste water connection fees,
- Final Noyo Center design,
- Usable amount of Georgia Pacific Mill recycled lumber, its potential application as non-load bearing or structural timber that would require engineering certification,
- Seawater system design options, ranging from an open system with permanent pumping infrastructure (and the concomitant regulatory monitoring costs) or a less expensive recirculation option,
- PG&E's Wave Connect program that has the ability to provide some utility services such as electrical and seawater supply as part of the wave buoy test program,
- Coastal trail development and the Center's potential contribution to it,
- Final interpretation design of aquaria, signage, and computer applications for grades K through 12 and public education.

Although this range of uncertainty is not insignificant, the DPP cost analysis allows for a range of expense considerations. This analysis will serve as a useful starting point to identify design options that optimize the Center's programs. Several cost variables that drive expenses are inescapable and common to all coastal facilities, including:

1. The windy, salty environment is highly corrosive. Construction materials for exposed fixtures will require high quality stainless steel fixtures (as opposed to aluminum) and other highly resistant finishes.
2. In addition to the naturally corrosive environment, seawater supporting living exhibits will be pumped throughout many parts of the facility, creating an additional corrosion factor.
3. Proposed Noyo Center programs require costly specialized equipment such as water tables, aquaria, significant computer infrastructure, and diving support facilities.
4. LEED certification or the higher Living Building Standard goal represent a slightly higher construction cost than conventional construction.
5. The rural location adds to transportation costs.

NOYO CENTER COST CONSIDERATIONS

(November 2007)

Site Work and Infrastructure Costs	LOW	HIGH
Domestic Water	$45 / LF	$55 / LF
Waste Water	$55 / LF	$65 / LF
Fire Line	$55 / LF	$65 / LF
Underground Utilities (joint trench)	$45 / LF	$55 / LF
Access Roads (paved)	$3.5 / SF	$4.50 / SF
Parking (gravel)	$2 / SF	$3 / SF
Solar Energy System	$914,000	$914,000
Initial Cost of System	$1,430,000	$1,430,000
State Rebate Program over 5 years (.37 per kwh)	- $516,000	- $516,000

Building Construction Costs	SQUARE FEET	COST PER SQ FT	COST RANGE
Core Facility	7140	$350 – 500	$2,499,000 – 3,570,000
Housing	3600	$250 – 350	$900,000 – 1,260,000
Support	6000	$200 – 300	$1,200,000 – 1,800,000

Seawater System	
Interior Aquaria	$600,000 – 1,200,000
Tidal Mesocosm	$1,500,000 – 2,500,000

K–12/Public Education	
Signage	$100,000 – 150,000
Instructional Equipment & Interpretive Materials	$960,000 – 1,300,000

Soft Costs	
Architecture/Engineering Fees	8% – 12%
LEED	1.5% – 3%
Furniture, Fixtures, and Equipment	$200,000 – 300,000

Building Permits & Fees	
Building Permits	$52,765 – 99,450
CDP	$1,220 – 2,000
Design Review	$1,220 – 2,000
Environmental Review	TBD
Connection Fees	TBD
Capital Improvement Fees	TBD

RECOMMENDATIONS / NEXT STEPS

This DPP advances and refines the Center's facility in concert with an evolving program, providing the guidance necessary to integrate trail alignment and facility siting with resource use and protection needs. This integration will allow the emerging elements of the entire south end of the Mill Site to be complementary. Such concurrent planning underpins a cohesive framework that sets the stage for a master plan once acquisition funds confirm final open space, trail, and Center demarcations.

Several next steps are needed to move the Noyo Center forward:

- Create the Noyo Center as an organizational entity, a 501.3C non-profit organization.
- Create a Governing Council composed of appropriate community and City representatives. The Council's initial tasks will be to develop the non-profit organization, pursue funding, and assist the site acquisition effort.
- Recruit an Executive Director on a schedule sufficient to lead site acquisition and move the DPP into detailed design. The Executive Director should be an individual with a dedicated and focused role to establish the Noyo Center, develop the Center's potential, integrate community resources, and ensure the facility is properly characterizing the program.

thank you

The DPP team would like to thank Harry Helling and Sarah Wilson of the Ocean Institute at Dana Point, Heather Kerkering of the Central and Northern California Ocean Observing System, and Kenneth Coale of the Moss Landing Marine Laboratories. In addition, we thank the community of Fort Bragg for all who participated in the years of meetings during the planning process—the Noyo Center's vision is a result of their passion, industry, and dedication.

Appendices

appendix i.

Natural Resource Assessment for the Fort Bragg Noyo Center: Research and Education Potential

Ocean Discovery!
Teaching Science Using The Ocean's Wonders
6575 Burnside Road
Sebastopol, California 95472
(707) 823-9121
www.discovertheocean.org

Ocean Discovery! is a 501(c)3 nonprofit organization whose mission is to support marine science education and the conservation of marine habitats and resources in the north coast counties of California.

By Victor Chow, Ph.D., and Peter G. Connors, Ph.D. April 2007

Introduction

A marine science institute has been identified as a high-priority, re-use project for the Georgia-Pacific Mill Site that would serve to anchor Mill Site re-use goals. The working label for the facility and its management organization is the Noyo Center. A Detailed Project Program (DPP), an initial planning task defined in the strategic plan for the Center and adopted by the Fort Bragg City Council in June 2006, would be developed to define the facility and site requirements that would maximize efficient function and opportunities. An assessment evaluating the natural resource attributes of the site is one of the DPP tasks.

This portion of the site evaluation was performed by coastal ecologists, Victor Chow and Peter Connors. Dr. Chow's expertise is in intertidal and invertebrate ecology, and he manages the Bodega Marine Laboratory's automated environmental monitoring systems; he has taught university field courses in marine ecology for more than 25 years and now also serves as associate director of Ocean Discovery!, a non-profit organization that supports K–12 classroom and public science education. Dr. Connors is a specialist in land management, shorebird ecology, and coastal grassland ecology; he has been associated with the Bodega Marine Laboratory for more than 35 years as a researcher and reserve manager for the Bodega Marine Reserve. Our evaluation included qualitative observations of the coastal prairie, bluff, intertidal, and easily-visible offshore environments on 31 January 2007, a day that included an afternoon low tide of -0.7 feet (below mean lower low water) when ocean conditions were fairly calm.

We have evaluated the quality of the intertidal, bluff top, and coastal prairie habitats based on the presence, abundance, and spatial relationships of representative, North Coast species present at this location. We have been particularly attentive to the occurrence of native species in the terrestrial environments. The relative utility of the site as a teaching and educational resource, including several issues related to access, has been considered. We also address the potential importance of the site as a regional center of expertise and infrastructure support for state resource management goals.

Site-Specific Attributes

Our assessment of the site's natural resources focuses on an area most likely to be of value for research and education, the strip of coastline seaward of the existing airstrip from north of Johnson's Rock to south of the Blow Hole (Figure 1). This portion of the shore provides aesthetically pleasing panoramas of the ocean and of the coastline to both the north and the south. Harbor seals and whales, kelp beds, shorebirds and cormorants, raptors, boats

Figure 1

entering and leaving Noyo Harbor, and waves breaking on the rocks and small offshore islands provide immediate visual interest to the casual observer as well as to marine educators and scientists.

Marine Habitats

The intertidal and nearshore subtidal environments are excellent representative examples of northern California's wave-exposed coast which lies in one of only six major upwelling regions in the world. Upwelling is caused by seasonal northwest winds that drive ocean surface waters offshore and bring cold, nutrient-rich water up from the depths. These nutrients support a food web that results in the great abundance and diversity of life found in these habitats. Productivity in the kelp beds is further enhanced by the high wave energy that (1) delivers nutrients through reduced boundary layers around kelp fronds, and (2) improves the efficiency of photosynthesis by allowing sunlight to reach all kelp fronds as the waves toss the kelp to and fro. This particular combination of physical environmental factors and a rich assemblage of native marine plants and animals makes this locale an ideal site for research and education.

Extensive rocky benches and surge channels form the intertidal zone about 40-60 feet below the bluff top. The rocky intertidal shore is the predominant habitat and it exhibits classic zonation patterns related to the steep physical gradient from land to sea (Figure 2). Some areas of freshwater seeps and run-off from the bluffs above support green and other ephemeral algae in the high splash zone. High intertidal limpets, barnacles, and rockweed (Pelvetiopsis) give way to anemones, turban snails, the red alga Endocladia, the boa kelp

Figure 2

Figure 3

Figure 4

Egregia, occasional sea stars (Pisaster), and patchy mussel beds in the middle intertidal zone (Figure 3). Both purple (Strongylocentrotus purpuratus) and red urchins (S. franciscanus) are strikingly visible in the low intertidal and subtidal zones adjacent to communities of organisms associated with coralline algae, surfgrass (Phyllospadix), and kelp (Laminaria). Extensive subtidal beds of bullwhip kelp (Nereocystis) exist 10-100 m offshore.

The north end of the site juts out into the Pacific Ocean and is particularly valuable, from a research and education perspective, for its variety of micro habitats (Figure 4) and complexity of the ecological influences. The rocky shore is punctuated with several sand or cobble beaches, and large boulder fields occur in some of the open coves (Figure 5). As a result, variations in the substratum type (sand, cobble, boulder, rock bench) and in the exposure to sun and waves (compass direction, exposure to the open ocean) create opportunities for habitat specialists to colonize this section of the coastline. Organisms that differ in their tolerance to desiccation, temperature, osmotic stress, currents and wave energy, turbidity, sand scour, oxygen availability, wind stress, and visible and ultraviolet radiation live in very close proximity—giving researchers a convenient study area for ecological comparisons.

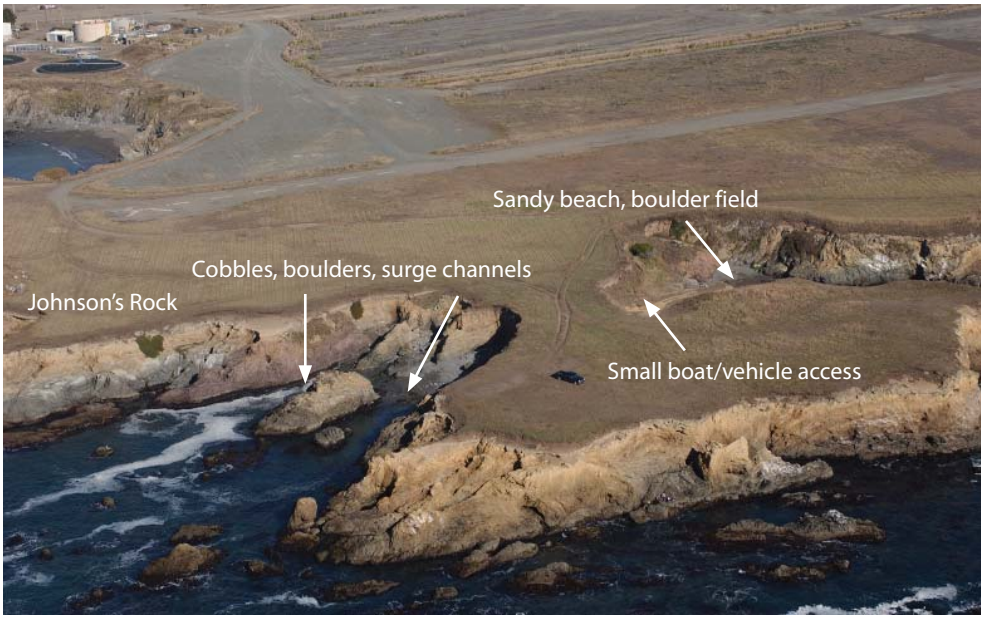


Figure 5

Ecological disturbances are of great interest to scientists and are known to be important processes in structuring communities of organisms in these nearshore habitats. Severe disturbances, whether natural or human-induced, typically decrease population densities and biological diversity, but moderate disturbances can sometimes increase diversity by creating spaces for colonizing organisms amongst competitively-dominant species. Several sources of potential disturbance are present at this site, including high wave energy that overturns boulders and causes scouring of surfaces by sand. Seasonal flows of freshwater from the Noyo River may alter the dispersal and recruitment of invertebrate and fish larvae, and influence species composition on the shore, in kelp forests, and in the plankton. Large drift wood in the surf zone (from the Noyo River and nearby streams) may bash against the rocks and create open space for new recruitment (Figure 6).

Figure 6

Upland Habitats

The plant communities of the northern portions of the site, particularly the narrow-necked peninsula between the sandy beach and the cove south of Johnson's Rock (Figure 5), present a fine example of northern California bluff top coastal prairie. The dominant plants of this community are primarily native grasses and forbs, with many species characteristic of this restricted bluff top community, such as sea thrift (Armeria maritima), coastal gumplant (Grindelia stricta), sand spurrey (Spergularia macrotheca), seaside plantain (Plantago maritima), seaside dudleya (Dudleya farinosa) and the rare Blasdale's bentgrass (Agrostis blasdalei). Many other species add diversity and color to this attractive flowering plant community.

The bluff top prairie at this peninsula site shows relatively little disturbance, and it is not badly invaded by non-native species, making it an excellent site for appreciation and teaching about our native plants, and for monitoring and teaching about the changes that our grassland communities have experienced from invasive species over the past 200 years. Nearby sites present an interesting and instructive contrast in terms of disturbance and extent of invasion by non-native plants. The southern portion of the area we surveyed supports a much less native community, with most areas dominated by introduced species. In some areas there is evidence of past gross disturbance, with items of abandoned cable, iron pieces and timbers buried in the soil. This disturbance history and current plant community will be occasionally instructive as a comparison, but we deem the northern portion of the site to be much more diverse, interesting, and aesthetically pleasing as the site of an educational center.

If a center is constructed at the northern site, careful planning should precede construction to minimize disturbance to the surrounding grasslands. A botanist should be involved in selecting a construction site and in delineating the most sensitive and valuable habitats for preservation near the construction zone. Creation of trails and access near the center should optimize educational opportunities while minimizing disturbance. Zonation of uses

Figure 7

with potentially different impacts is a good way to achieve the desired balance. The narrow-necked topography of the peninsula may provide a natural way to control or direct access to or away from some sensitive upland areas.

Accessibility of intertidal sites: South End

Even during relatively calm ocean conditions, powerful waves, slippery rocks, and cold water pose a serious danger for visitors and researchers near the waterline. The threat is greatest during high tides at the south end of the site where there is very little protection from "sneaker or sleeper" waves (Figure 7).

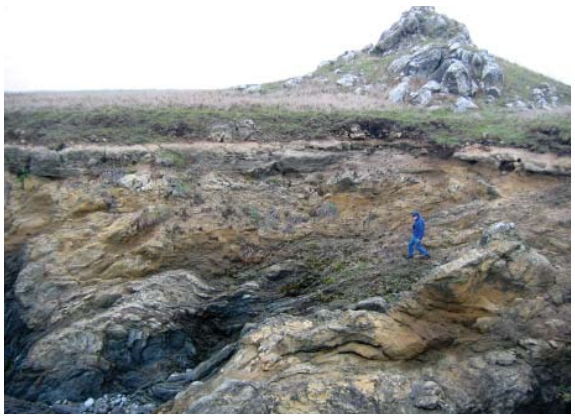
Loose soils and steep cliffs create treacherous footing along most of this coastline. Although the Blow Hole at the south end of the site would attract public attention, access from the bluff is especially dangerous and would require physical barriers to control public visitation.

Accessibility of intertidal sites: North End

The north end of the site provides the easiest access points to the intertidal habitats that are some of the most interesting research and education study sites. At these locations, the bluff edge is less steep and solid rock provides secure footing (Figure 8). Access would not require special gear or apparel, but some minimal aids in the form of railings, cables, or stairs would further increase the degree of safety and would help to direct traffic to the most suitable entrance points to the intertidal zone.

On days of low to moderate wave energy, an outer reef of rock islands acts as an effective breakwater during low tides to allow relatively safe access to much of the intertidal zone in this area. Under these conditions, even subtidal waters are sufficiently protected in some locations to allow entry by waders, snorkelers, and scuba divers. In particular, modest improvements to an existing dirt ramp at an especially protected sandy beach would allow light vehicles to load and unload small boats or equipment at the waterline in support of diver and offshore projects or emergency medical and safety operations (Figure 5).

Figure 8



Despite the accessibility advantages of the north end of the site, human safety and protection of the habitats would still need to be carefully considered. Intertidal access should require the supervision of qualified Center personnel who are biologists with specific training in the use of this environment for research and undergraduate and graduate education. Under special circumstances and with appropriate permissions, small groups of high school students might be accompanied into the intertidal zone should the Center's programs support such activities.

Site Summary and Recommendation

We suggest that the best location for construction of the Noyo Center would be near the neck of the small peninsula south of Johnson's Rock (Figure 5). To use the site for research and education, it would be ideal to manage and protect as large an area as possible, but this specific placement would:

- Locate the facility where the natural resources, both upland and intertidal, are diverse and relatively undisturbed by human impacts;
- Provide convenient and safe access points to intertidal and subtidal field sites;
- Allow access to intertidal and subtidal field sites that are relatively safe to visit because they are sheltered from most waves;
- Include possible access points to the waterline for the launching of small boats, or for emergency and safety operations;
- Locate a building in such a way that access to sensitive coastal bluff and intertidal habitats can be monitored and controlled.

Site-Specific Research Opportunities

The quality and accessibility of the intertidal and nearshore habitats make this location ideal for marine and ecological research. These environments support an abundant and diverse assemblage of organisms influenced by a complex array of interacting physical and biological factors that would be attractive to scientific investigators. Such coastal field sites that are free from major human impacts are becoming increasingly rare. The building of a marine science institute to support and protect field research in this area would only enhance the suitability of this particular site.

Fort Bragg is also strategically located to play an important scientific role in regional collaborations to monitor the coastal ocean. Some of the most important environmental research presently being conducted involves ocean and climatic processes that occur at regional, national, and global scales. Investigations that arise concerning global climate change, changes in fisheries and ocean productivity, and loss of biodiversity require continuous observations and quantitative data from wide geographic areas over long periods of time. Because no single researcher or research institution can effectively address these issues, networks of scientific partners have recently been formed to collect the environmental data of interest.

Ocean.US, the National Office for Integrated and Sustained Ocean Observations, was established in 2000 to facilitate development of the Integrated Ocean Observing System (IOOS), the United States contribution to a Global Ocean Observing System (GOOS) and to the Global Earth Observation System of Systems (GEOSS). IOOS is composed of regional ocean-observing systems and, in northern California, the Central and Northern California Ocean Observing System (CeNCOOS) is the regional association of institutions interested in monitoring that part of the ocean and coastline that includes Fort Bragg.

The Coastal Ocean Currents Monitoring Program (COCMP) is a state-wide initiative to develop and deploy systems and infrastructure necessary for real-time monitoring of surface

currents in California coastal waters. Information on surface currents is valuable for understanding upwelling and ocean productivity, the dispersal of plankton and larval fish, and the spread of toxic spills, and can be useful to mariners and marine rescue operations. A complete map of currents requires the continual maintenance of radio transmitters and receivers at regular intervals along the entire California coast.

Regional projects such as COCMP and collaborations such as CeNCOOS suffer for the lack of a supporting institution between the Bodega Marine Laboratory (Sonoma County) and Humboldt State University (Humboldt County). The establishment of a centrally-located Noyo Center in Fort Bragg would potentially resolve some of the logistical difficulties of large-scale research projects on the northern California coast. In addition, the nearby availability of a safe harbor (i.e., facilities at Noyo Harbor) could be useful for projects that require a boat as a platform for ocean observations or the deployment of equipment and sensors; future research, whether locally- or regionally-oriented may require shipboard support for deployment of remote-sensing instrumentation such as remote-operated or autonomous underwater vehicles.

Site-Specific Education Opportunities

The need to educate students and the general public regarding coastal issues is critical to building ocean stewardship, strengthening the nation's science literacy, and creating a new generation of ocean leaders, according to the U.S. Commission on Ocean Policy's report Ocean Blueprint for the 21st Century and the California Ocean Protection Council's five-year strategic plan A Vision for Our Ocean and Coast. Yet, the National Science Foundation notes that ocean science is nearly absent from K–12 (and undergraduate) curricula. It is unique in its under-representation in the National Science Education Standards where chemistry, life sciences, physics, astronomy, geology, and meteorology are all included more than ocean sciences.

However, in recent years, the state of California has taken the lead to recognize the importance of protecting and managing ocean and coastal resources through education. The California Ocean Protection Council has set three action items in the Education and Outreach section of its 2006 strategic plan that have been underscored by recent events. Increasing ocean awareness and literacy among the public is a key priority in the West Coast Governors Agreement on Ocean Health, signed by the governors of California, Oregon, and Washington in 2006. The California Ocean Communicators Alliance (established in 2005 by the NOAA National Marine Sanctuary Program, the California Resources Agency, and aquarium partners) is developing and implementing a California Public Awareness Campaign (see http://ThankYouOcean.org). And, California is actively implementing the CalEPA Education and the Environment Initiative (Assembly Bill 1548) to bring education about the environment, including the ocean, into primary and secondary schools through modifications to California's Academic Content Standards and the development of new curricula and instructional materials.

The California Ocean Protection Council aims "to promote ocean and coastal awareness and stewardship" as its education and outreach goal; by 2011, most Californians are expected to be aware of their individual impact on the coast and ocean, and to practice conservation principles in their home, work, and recreational activities. Local marine science education

centers have an important role to play in meeting this goal, and may soon have access to new sources of financial and logistical support for the development and implementation of innovative programs, curricula, textbooks, exhibits, and teaching materials. Frequently, marine educators are now forming collaborations (e.g., California Centers for Ocean Sciences Education Excellence—COSEE-CA) to obtain funding and to create programs that have significant impact on students and the general public.

Local K-12 schools and the College of the Redwoods, in particular, are obvious potential participants and partners. Curriculum development that enhances marine science education for local elementary through secondary school students is likely to be valuable for dissemination throughout the state. For college students, the Noyo Center could be a facility supporting new courses in the College of the Redwoods' physical and coastal oceanography program. Students from the College of the Redwoods are already involved in studies of ocean currents and long-term monitoring of field sites near Glass Beach; similar projects associated with the Noyo Center would provide baseline environmental data for the Center's habitats while providing students with access to exceptional research sites. The Noyo Center could also provide technical training and career opportunities for local students and residents; for example, internships and courses in marine technology could train students to deploy and operate the environmental instrumentation and data systems that are core to the growing network of regional, national, and global ocean-observing programs.

For its natural setting and its proximity to pristine coastal habitats, the Noyo Center would be an ideal facility for promoting ocean and coastal awareness, management, and protection. For residents, students, and visitors alike, it would provide an opportunity for place-based learning that uses the local environment and community as the context for learning. Fort Bragg has a long, rich socio-cultural-economic history connecting it to the coast and ocean; education that enhances participant understanding for the place where they live will improve their knowledge of local natural processes and resources, and will encourage action that benefits both people and the environment.

appendix ii.

Interpretive Planning for Informal Science Learning at Noyo Center

By Natasha Fraley, Interpretive Planner

Noyo Center for Science and Education will provide an opportunity for the community of Fort Bragg, and visitors to the community, to visit a marine science center on their coast. Interpretive exhibits in the building and on the grounds will give visitors a chance to learn about what scientists are doing at the Center; the ecosystem of the coastal land and sea; and about how the ocean and what scientists are learning about the ocean connects to their lives. And the building itself will be a model for sustainability in this era of climate change that visitors can better understand and experience through interactive exhibits.

Audience

Design of the Noyo Center requires attention to the multiple functions involved in education and research. The education program should be integral to the building and be shaped to two audiences:

- Undergraduate education (formal education) with the possibility for extending to K–12 as the Center develops
- A general audience (informal education) with the goal of increasing ocean and ecological literacy.

Formal science education is learning within the school environment from kindergarten through college. Informal science education is learning outside a school environment for people of all ages. The exhibits in the and around the building should be targeted to a general audience engaged in informal learning, and also could be useful as a teaching tool for students of all ages.

Goals

"Ocean literacy is an understanding of the ocean's influence on you and your influence on the ocean."

For a general audience, including drop-in visitors during scheduled hours, the Center's informal education goals would focus on increasing ocean and ecological literacy.

Bringing together senior experts in science education (formal and informal) and senior government officials, the National Conference on Ocean Literacy held in June 2006 identified seven essential principles of ocean literacy:

1. Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of Earth.
3. The ocean is a major influence on weather and climate.

4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably linked.
7. The ocean is largely unexplored.

The Conference also identified several paths for success, including:

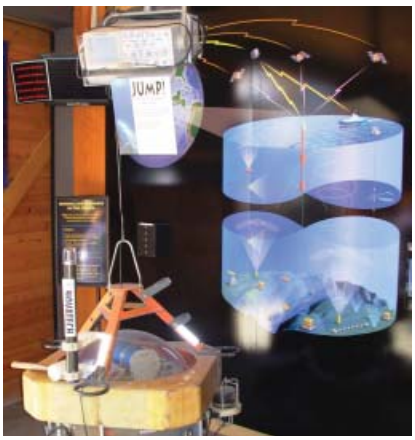
Become a storyteller. Make the ocean more personal and create a sense of excitement by telling stories about marine animals, biodiversity, shifting baselines, and climate change so as to create a better understanding of the individual's role in nature.

Coordinate formal and informal education programs. Formal and informal education programs have similar objectives yet operate independently to leverage each sector's strengths and maximize impacts.

Ecological literacy, often referred to as ecoliteracy, another vital area of education for an informed populace. Ecoliteracy is the endeavor "to understand the principles of organization that ecosystems have developed to sustain the web of life . . . Teaching this ecological knowledge—which may be called 'principles of ecology,' 'principles of sustainability,' 'principles of community,' or even the 'basic facts of life'—will be the most important role of education in the next century." (http://www.21stcenturyschools.com/Ecoliteracy.htm)

Potential Interpretive Subjects

Dana Point Exhibits



- The dynamic ocean: Currents and their changes on a natural cycle; how scientists monitor changes; how the ocean is key to understanding both global and local climate change. Monitoring and observing the ocean allows scientists to understand the nature of the impacts of climate changes and other human activities on ocean productivity, fisheries, and biodiversity.
- Local marine and coastal environments and their inhabitants, including native coastal plants (see live animal component below).
- The interconnectedness of the land and the sea and the unique attributes of the land/sea interface.
- Ocean science and technology representative of the Noyo Center's mission with a goal to make it real with live data feed, and personal by highlighting scientists and programs.

•Sustainability: Fishing, salmon, forest & ocean management, the economic benefits of a healthy ocean and coastal environment, highlighting local recovery programs; collaboration with Jackson Demonstration Forest to develop interpretation of sustainable forestry.

•Climate change: How it might impact the local area; the visitors' and the community's role in adapting to change and finding solutions.

•Energy could tie exhibits together as a theme: Energy in the natural

world, especially the intertidal at the site; in the green building; in visitor's lives; energy use and its connection to global climate change.

- Wave energy as an alternative energy source: Pacific Gas and Electric is exploring the potential of wave energy and the Mendocino coast at Fort Bragg is a prime area of testing interest. Research into this alternative energy source ties into education about climate change solutions.

  "The development of this new type of energy resource, which generates electricity from the movement of water near the surface of the ocean, is one of the many sources of clean, non-polluting, renewable energy that PG&E is aggressively pursuing." (http://www.pge.com/news/news_releases/q1_2007/070228.html 5.19.07).

- Green building design and function: What the Noyo Center is doing to achieve a small ecological and carbon footprint; interpretive features that allow the visitor to visualize building functions such as water flows and heating/cooling cycles through the seasons.

  Examples of possible exhibit methods:

  Building Dashboard. A kiosk that makes the building's environmental performance visible, so visitors and occupants can learn from the green building features about saving energy and resources. (http://www.luciddesigngroup.com/index.php).

  Building Experience. Show how the building performs in experiential ways, such as sounds/music generated by wind or shafts of light.

Living Exhibits

The Noyo Center site has a combination of rocky shore and sandy beach habitats, some of which might be used for field activities for school groups. Live animal exhibits could feature animals from these habitats and possibly subtidal fishes and invertebrates (depends on staffing). A touch tank for hardy intertidal invertebrates brings visitors of all ages a connection to the coast that is difficult to get in any other way.

In addition to a tidepool touch tank, smaller tanks featuring organisms related to current research would bring the work of the Center to life. An outdoor interpretive walk could highlight native plants and make connection to native people who once lived here. Outdoor panels could interpret the geology and other aspects of the natural history of the site.

Touch tank, Monterey Bay Aquarium

Planning Process

To achieve successful and engaging interpretive features and exhibits, the exhibit design process must flow from a premeditated and well-planned integration of education and architectural goals.

Program and exhibit planning and architecture need to develop simultaneously, in coordination with each other, in an ongoing, creative dialogue. Exhibit elements that require close collaboration with architecture are:

Ceiling-based equipment at Dana Point

- live animal life support
- opportunities for lighting as well as protection from sunlight
- requirements for electronic exhibits and live data feed
- ability to use floor and ceiling for exhibits
- flexibility

Interpretive Planning is a multi-step process requiring vision, collaboration, and time:

1. Initial phase—develop messages and communication goals for the exhibits that support the Center's Mission and will guide the design and development of exhibits.
2. Research phase—messages are ranked and topics under each message are developed.
3. Development phase—creation of an interpretive plan and conceptual design (by an exhibit design firm/consultant).
4. Implementation phase—Once the creative phase products have been approved, final exhibit design and development proceed, making the abstract concrete.

The process is iterative, starting out with many more ideas on the table than can be realized, refining the exhibits in collaboration with the architect, media producer, and content specialist.

Models

Centers for Ocean Sciences Education Excellence (COSEE): A Mix of Formal and Informal Science Education.

COSEE is an affiliation of centers around the country, funded by the National Science Foundation with a mission to improve K-12 ocean science education through activities that provide high quality science content and resources for K-12 teachers and Informal Educators. COSEE serves as one model of formal and informal education working to expand ocean programs as a platform for developing ocean literacy strategies.

The COSEE network promotes a better understanding of the key role the ocean plays in global environmental cycles and processes. COSEE activities highlight the contributions ocean science researchers make to scientific knowledge in these important areas. The

National Science Foundation is encouraging the ocean-science research community to become more involved in education at all levels.

COSEE goals:

- Promote partnerships between research scientists and educators,
- Disseminate best practices in ocean sciences education, and
- Promote ocean education as a charismatic, interdisciplinary vehicle for creating a more scientifically literate workforce and citizenry.

The primary role of the COSEE network is a catalytic, multi-faceted collaboration to integrate ongoing research in the ocean sciences with K-12 education and outreach. Each COSEE represents one or more ocean science research institutions, an informal science education organization, and at least one affiliate organization representing the formal education community.

Native plant walk at Dana Point

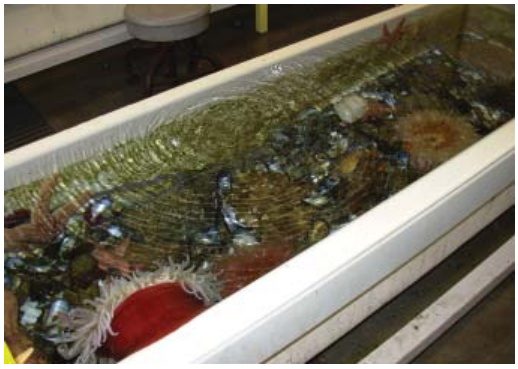
The Ocean Institute at Dana Point is a COSEE partner and a good example of a center with state-of-the art-exhibits for both formal and informal education. It is s designed for teaching about the ocean but is not, however, a research facility with scientists on site.

Some aspects of the Ocean Institute are appropriate for Noyo Center:

- Exhibits for students and general public
- Partnerships with scientists from nearby institutions
- Partnerships with informal and formal science educators
- Lecture series for teachers and general public

The Noyo Center could look into joining COSEE, which would both enlarge the potential for partnerships and extend the reach of the Center. COSEE is supported by the National Science Foundation, so being affiliated could bring in grant money for programs.

Seymour Discovery Center at Long Marine Lab, UC Santa Cruz



Long Marine Lab tank

The Seymour Discovery Center's Mission Statement is: educating people about the role scientific research plays in the understanding and conservation of the world's oceans.

The Center is adjacent to research scientists working at Long Marine Lab, and the Center features exhibits on the Lab scientists and their work. Exhibits are designed for both an informal and formal science education audience. Several aquaria represent local species and smaller tanks highlight some that the researchers are studying. This model would be a possibility for the Noyo Center and should be looked at in the planning phase.

Recommendations

1. The non-profit that will run Noyo Center should create a committee to oversee the planning, design and production of the exhibits at the Center.
2. The non-profit exhibits committee should hire an Interpretive Planner or an exhibit design firm that does Interpretive Planning and Exhibit Design as a first step, so exhibit planning can proceed in collaboration with the architecture as outlined above.
3. The committee should create a mission and goals for the exhibits, with the help of the Interpretive Planner.
4. The committee should hire a staff person dedicated to the education and interpretive programs.
5. The Noyo Center should look into the possibility of being a COSEE. Partners might include the Fort Bragg Unified School District and the Mendocino County Unified School District.

appendix iii.

Considerations for a Fort Bragg Marine Science Institute

Michelle Chow, M.Sc., Executive Director, Ocean Discovery! and Marine Educator, Bodega Marine Laboratory

Vic Chow, Ph.D., Secretary, Ocean Discovery! and Research Data Manager/Marine Educator, Bodega Marine Laboratory

Introduction

The community of Fort Bragg in Mendocino County, California, has expressed an interest in establishing a local marine science institute. Current existing facilities in California are incredibly diverse, but provide us with templates or models for a marine facility appropriate for the Fort Bragg area. Existing institutes vary greatly in their mission statements, objectives, and areas of expertise—some focusing on marine research, others on education, public service, or community interests. Some are affiliated with academic institutions, government agencies and non-profit organizations, while others operate as private businesses. Even the organization's physical site varies from as small as a one-room nature interpretative center to as large and complex as a college campus (e.g., Scripps Institution of Oceanography). The number of paid staff, volunteers, and community supporters can fall between a dozen to several hundred employees. It also goes without saying that the budget provided for each organization can be staggeringly different.

After visiting several facilities in California to experience a variety of research and educational offerings, we summarize below some of the basic considerations for designing and operating a sustainable marine science institute. Our intent is to identify the range of realistic alternatives to assist the residents of Fort Bragg in their discussions of a future marine science center that will appropriately meet the community's needs and resources and to create a science center highlighting Fort Bragg's unique marine habitats, including its historic ties to those habitats. We also hope that this document will provide an initial framework for choosing among those alternatives.

Types of Marine Science Programs

Marine institutions provide ideal environments for blending research and education. However, depending upon the primary mission of the organization and its staff, one area is almost always emphasized over the other.

Research-Oriented Laboratories. Marine research laboratories are well known for their capacity to foster collaboration. Frequently, researchers from different fields of expertise convene at marine laboratories to work on critical scientific questions and problems. A particular marine laboratory might attract a certain group of elite scientists because: (1) local

environments and organisms provide unique opportunities for field research; (2) resident expertise or exceptional facilities facilitate and attract specific types of research; or (3) research solutions are needed to support local industries, community interests, or environmental quality issues. For example, a particular institute might be located where there are ideal research sites to study ocean productivity or population fluctuations of a commercially-important or endangered species. It might invest in one state-of-the-art (= expensive) technology or research tool that makes it the best place in the world to answer certain scientific questions. Or, its research goal may be to restore and manage a local environment or industry. The science is either primarily basic research (designed to advance the general knowledge of a field) or applied research (designed to answer a specific question or solve a specific problem related to human activities). Most often the research results are disseminated in scientific journals, seminars, and conferences directed at other scientists.

Some examples of primarily research institutions are listed below, representing facilities that differ greatly in size and purpose:

Bodega Marine Laboratory, www.bml.ucdavis.edu

Hopkins Marine Station, www-marine.stanford.edu

Hubbs-SeaWorld Research Institute, www.hswri.org

Monterey Bay Aquarium Research Institute, www.mbari.org

Moss Landing Marine Laboratories, www.mlml.calstate.edu

NOAA Southwest Fisheries Center, swfsc.nmfs.noaa.gov

Point Reyes Bird Observatory, www.prbo.org

Romberg Tiburon Center for Environmental Studies, rtc.sfsu.edu

Scripps Institution of Oceanography, sio.ucsd.edu

Education-Oriented Institutions. The diversity and allure of ocean organisms and habitats provides a rich educational experience for students of all ages. Marine science facilities operated by academic institutions typically serve undergraduate or graduate students by providing specialized courses and training. These programs are typically aimed at students planning to pursue academic or scientific careers. In some cases, students are in full-time residency for a semester and the marine institute provides student dormitories or other housing for program participants. University-operated marine institutes may have some programs for K-12 students and the general public, but often these programs are few in number and are lead by docents and volunteers rather than marine educators.

Marine education institutions that cater specifically to elementary, middle and high school students and teachers are often run by private or nonprofit organizations. There are at least two distinct types of learning models that these institutions employ in their programs. The first type is committed to student participation in inquiry-based learning that emphasizes "hands-on" experiences in marine science, ideally aligned to California State Science Standards. Institutions of this type offer after-school programs, field trips, exploratory activities, and interactive exhibits for visiting classes. In-school curriculum and professional training for teachers are additional services that are frequently provided. Some institu-

tions offer overnight, week-long, or semester-long programs targeted not only for classes, but also for student-based groups such as the Boy and Girl Scouts, 4-H, summer camps, and other youth clubs.

The second type of model used by marine education institutions is the self-directed learning method designed for mass public visitation and tourism. These facilities include some aquariums, maritime museums, nature interpretative centers, and entertainment-oriented theme parks. The goal of these institutions is often to interpret local natural habitats, regional culture and history, and environmental issues for drop-in visitors, but their services often lack direct educator-visitor learning. A few on-site naturalists may be the only personal interaction a visitor receives. Instead, displays and exhibits are the primary mode of education with a few scheduled lectures and workshops.

Examples of primarily education institutions include:

Cabrillo Marine Aquarium, www.cabrilloaq.org

Don Edwards San Francisco Bay National Wildlife Refuge, desfbay.fws.gov/basic.htm#Visitor

Marine Science Institute, www.sfbaymsi.org

Monterey Bay Aquarium, www.mbayaq.org

Ocean Institute/Ocean Education Center, www.ocean-institute.org

Pacific Coast Science and Learning Center at Point Reyes National Seashore, www.nps.gov/pore/educate_pclc.htm

Seymour Marine Discovery Center, www2.ucsc.edu/seymourcenter

Telonicher Marine Laboratory, www.humboldt.edu/~marinelb

Facilities and Staffing

Special consideration must be given to the infrastructure required to support marine research and/or education. The precise design of marine facilities varies drastically depending upon the specific types of programs and clients being served, but generally includes some of the following facilities and services.

Location. Access to the appropriate natural environments is critical. Regardless of whether an institute is research or education-oriented, programs are severely disadvantaged if participants lack easy access to the habitats and organisms of interest.

Buildings. Marine facilities will include most, if not all, of the following types of rooms and working spaces:

Laboratories (both wet and dry spaces)

Classrooms (wet and dry, indoor and outdoor spaces)

Administrative offices

Lecture hall, meeting, and conference rooms

Library

Computer laboratory

Marine operations (boat house/dock, diving, instrumentation/electronics)

Supply, inventory, and storage rooms

Physical plant and mechanical rooms

Support Equipment and Services

Aquaria and seawater tables

Freezers, refrigerators, temperature control rooms

Phone, computer network, and Internet access

Uninterruptible and conditioned electrical power, backup electrical generators

Basic laboratory or education tools and instruments (microscopes, balances, etc.)

Baseline environmental monitoring (meteorological and ocean sensing)

Seawater. Running sea water (pumped directly from the ocean) may be an absolute necessity for some types of research and education. However, it requires (permitted) access to a clean source and is expensive to install, operate, and maintain both in terms of materials and labor. Closed or semi-closed seawater systems offer a less expensive alternative if water quality can be maintained.

Marine Operations

Research vessels, trailer-able small boats, sampling gear and instrumentation

Diving facilities: SCUBA support and dive lockers

Specialized staffing, maintenance and safety issues, insurance

Residential Housing/Food Services. Supporting resident staff, students and visiting researchers, and perhaps public visitors.

Operational Support and Funding. Obviously, programs at marine laboratories require expert researchers and educators. Support personnel include administrative and physical plant staff, and individuals with special expertise to oversee operation of scientific instrumentation and technologies, research vessels, diving operations, etc. The cost of operations may be supported wholly, or in part, by grants and donations, user or visitor fees, endowments, and product development and marketing.

Is a Marine Science Institute Appropriate for Fort Bragg?

Fort Bragg's location on the Mendocino County coast provides enormous potential for a new marine institute for either science research or education. Scientists, educators, students and visitors would be naturally drawn to the pristine local marine and coastal environments and to the community's historic and cultural ties to the ocean.

From a research perspective, Fort Bragg is ideally positioned between existing marine laboratories in Sonoma County (Bodega Marine Laboratory) and Humboldt County (Telonicher Marine Laboratory). At present, enormous international, federal and regional efforts are being made to develop sophisticated ocean monitoring systems along all coasts of the United States. A new marine institute at Fort Bragg would be strategically located to participate in a California association of marine laboratories—to serve as an outpost for national ocean observations, or possibly to take a lead role in promoting nearshore oceanographic research in northern California. In any case, these national initiatives might eventually provide some financial support for an ocean observing system at Fort Bragg.

An education-oriented institute could potentially serve a diverse audience that includes local K-12 schools and youth organizations, college students from the College of the Redwoods, area visitors and tourists, and the general public. Youth and adult programs, teacher resources and professional development, and other public outreach activities all lead to an enhanced awareness of the ocean environment and a better understanding of ocean sciences. Community ties and involvement throughout California are typically much stronger with education institutes than with research laboratories. Marine education institutes deliberately focus on outreach to the community and encourage widespread participation, while research laboratories frequently must limit public access to minimize negative impacts on research activities. A purely educational facility might be less expensive to operate than a research facility and might recruit more employees, volunteers and organization members from the local community.

We suggest that any marine science institute at Fort Bragg should be built with flexibility and expandability in mind, both for the physical structure as well as for its programs. Even at existing marine institutes, research and education programs change over time and the infrastructures must be able to accommodate these changes. A new marine institute might need to evolve in its early years even more quickly than a mature organization as it develops its science expertise and identifies its continuing sources of funding. Especially in a community that itself may be experiencing significant change and growth, a new marine institute should be prepared to alter its activities to meet the needs of its staff, participants, and patrons.

We suggest that a hybrid organization that combines research and education might be most appropriate for Fort Bragg. These days, research grants are often contingent upon the inclusion of major education components that can communicate the results and importance of the research to students and the general public. Conversely, science education at marine institutes is at its best when it allows participants to experience for themselves the creative, exploratory, and discovery aspects of science. A marine laboratory that specifically focused on making the connections between science and education might prove to be a model for all future marine facilities throughout the United States.

Education programs can be established relatively quickly and there is an immediate audience among community residents, local and regional schools, and Mendocino County visitors. While these education programs are operating, the new marine institute might emphasize service to "visiting" researchers who use the facility as an extension of existing study sites. Many biological field stations all over the country successfully serve scientists who, as their primary clients, only use their facilities for days to months at a time. The new marine institute's research agenda could then be molded over time, and physical facilities expanded as needed, once the appropriate research directions have been made clear by the goals and needs of the first visiting scientists.

The design of a marine institute's facilities will depend essentially upon its mission and objectives. We have provided a checklist of options to consider which we hope will serve as a starting point for designing a new marine institute at Fort Bragg. The list includes options for the types of programs and activities to be supported as well as for the physical structure. It is neither comprehensive nor detailed, but might assist interested persons in deciding whether a sustainable marine institute would be compatible with community needs and goals. Omitted completely from the current discussion are considerations for the initial cost of constructing a marine facility, for determining an annual operating budget, and for finding suitable personnel to operate the facility.

We are certainly willing to make ourselves available for additional discussions and clarifications and, for now, offer our very best wishes to the Fort Bragg community in support of their future endeavors.

Sincerely,

Michelle Chow, M.Sc.
Vic Chow, Ph.D.

Ocean Discovery! is a 501(c)3 nonprofit organization whose mission is to support marine science education and the conservation of marine habitats and resources in the north coast counties of California.

Bodega Marine Laboratory is a marine science research and teaching facility operated by the University of California, Davis.

Checklist for a Fort Bragg Marine Science Institute

Types of Programs

"Applied" Marine Research

- ❑ Applied Ocean Sciences
- ❑ Aquaculture
- ❑ Coastal Zone Policy and Planning
- ❑ Conservation Biology
- ❑ Environmental Toxicology
- ❑ Fisheries Biology
- ❑ Marine Pathology
- ❑ Marine Products Development (e.g., pharmaceuticals, food additives)
- ❑ Marine Resource Management
- ❑ Marine Technology (e.g., remote sensing, robotics, remote-operated vehicles)
- ❑ Pest (Invasive Species) Management
- ❑ Pollution Ecology
- ❑ Restoration Ecology (i.e., habitat restoration)
- ❑ Veterinary Medicine
- ❑ Watershed Management
- ❑ Other:

"Basic" Marine Research

- ❑ Coastal Anthropology
- ❑ Coastal Oceanography
- ❑ Developmental Biology
- ❑ Marine Chemistry
- ❑ Marine Ecology and Population Biology
- ❑ Marine Genetics
- ❑ Marine Geology
- ❑ Marine Neurobiology, Physiology, and Behavior
- ❑ Molecular and Cell Biology
- ❑ Other:

Marine Science Education

- ❑ College / University Instruction and Training
- ❑ Formal Science Education (K-12 classroom instruction)
- ❑ Informal Science Education (marine institute and field programs; after-school)
- ❑ Public Exhibits and Interpretative Displays
- ❑ Public Visitation / Tourism
- ❑ Residential Programs (i.e., overnight)
- ❑ Shipboard Programs
- ❑ Other:

Community Service

- ❑ Community Center (e.g., community meeting rooms)
- ❑ Consulting Services
- ❑ Docent and Volunteer Programs
- ❑ Interpretative Naturalists
- ❑ Marine Advisors
- ❑ Other:

Types of Facilities and Services

Special-Purpose Buildings or Rooms

- ❑ Administrative Offices
- ❑ Animal Care Facilities
- ❑ Aquarium Rooms or Exhibits
- ❑ Cafeteria
- ❑ Classrooms
- ❑ Collections (e.g., zoological, botanical, artifacts, teaching aids)
- ❑ Computer Laboratory
- ❑ Conference Center
- ❑ Conference / Meeting Rooms
- ❑ Culture Facilities (e.g., larval rearing)
- ❑ Dormitories (with cafeteria) or Resident Housing
- ❑ Environmental Rooms (e.g., temperature-controlled)
- ❑ Fabrication Facilities / Machine and Tool Shop
- ❑ Food Preparation Rooms (e.g., to support conferences)
- ❑ Gift Shop
- ❑ Greenhouse
- ❑ Information Desk / Visitor Services
- ❑ Interpretative and Interactive Displays, Exhibits, Signage
- ❑ Laboratory Instrumentation Rooms (shared equipment)
- ❑ Lecture Hall
- ❑ Library
- ❑ Physical Plant
- ❑ Public Gathering Spaces
- ❑ Research Laboratories
- ❑ Storeroom / Inventory Room / Storage
- ❑ Wet Laboratories (e.g., “mud room”)
- ❑ Other:

Seawater Facilities

- ❑ Running Seawater System (ocean intake and outfall, pump house, plumbing)
- ❑ Closed Seawater System (water storage tanks, filtration and processing)
- ❑ Semi-Closed Seawater System (running sea water with significant recycling)

Marine Operations

- ❑ Boat House and/or Dock
- ❑ Diving Facilities (equipment room and storage, changing rooms and lockers)
- ❑ Research Vessel
- ❑ Small Boats

Baseline Environmental Monitoring

- ❑ Meteorological Instrumentation (e.g., air temperature, winds)
- ❑ Ocean Instrumentation (e.g., sea temperature, salinity, currents, waves)
- ❑ Water Quality (e.g., required for seawater intakes and outfalls)

appendix iv.

Sustainability / Sustainable Building

By Peter Gang, Architect

What is Sustainable Design?

The most commonly-cited definition of Sustainability is the one featured in the 1987 publication Our Common Future, usually referred to as The Brundtland Report. That report defined sustainable development as ". . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

In simplest terms, sustainability, or sustainable design, acknowledges that all human activity—all development, all building, all aspects of our human existence—takes place within the context of the natural world, within the ability of a finite biosphere to act as a source for all of the needed resources and to act as a sink for the resulting wastes. The environment is not an 'externality' that we can omit from our balance sheets. In terms that are both metaphorical and real, our human economy is a subset—a wholly-owned subsidiary—of the environment.

If conventional design and development is underlain by a view of Man in control of Nature, sustainable design is underlain by a vision of Man as a part of Nature.

As the terms are currently used, Sustainable Building = Green Building = Environmental Building = High-Performance Building.

A number of shorthand phrases embrace the flavor of sustainability quite ably. Sustainability can be thought of as:

- Living lightly on the Earth.
- Good stewardship of the Earth.
- Not taking more than can be provided on an ongoing basis.
- Living within one's means.
- Do No Harm (the Hippocratic oath)
- Saving for your children, instead of spending their inheritance.
- Living off the (natural) interest instead of the (natural) capital.

Applied Ecoliteracy

Within the world community there is a rapidly-growing understanding that humans have exceeded the carrying capacity of the Earth.

The Ecological Footprint is one of the most widely respected sustainability analysis tools in use today. It takes into account the surface area of the planet (both land and water) needed

for growing agricultural crops, for forests and pasture, for fisheries, for building buildings, energy production, ecosystem functions, and sustaining other species and the biosphere on an ongoing basis.

According to the Ecological Footprint model, the early 1980's was the turning point where humans first exceeded the capacity of the Earth to provide the resources and absorb the wastes generated. If we imagine the Earth as an immense trust fund, we are no longer able to living off the interest alone. We are fast depleting the natural capital that we have inherited from past generations and that we owe to future generations.

Globally, there exists 39 acres per person. The 'ecological footprint' of the average citizen is 54 acres. On a global basis, we would need 1.4 Earths to maintain our current standard of living. The average American, however, has a far greater ecological footprint: at 269 acres per person, our 'footprint' is nearly five times the world average. If all citizens of our planet were to live as we live, we would need almost seven Earths to support us all.

Integrated Design Process

Because land, energy, and other resources appeared to be without limit, we have come to design and engineer conventional buildings are using a linear and compartmented process, one specialist looking at one piece of the puzzle, one at a time.

But Sustainable Design requires that we look at design from a generalist's perspective and to keep looking at things from a generalist's perspective all the way through the design and building process. Since the many participants in the process are necessarily specialists, we can only achieve the highest level of sustainable building with a design team that is committed to an integrated design process.

An integrated design process:

- Must be designed consciously and evaluated as the process proceeds
- Solicits the input of all participants and stakeholders
- Encourages communication between the participants and stakeholders
- Acknowledges that big changes can most easily be effected early in the design process
- Seeks synergies where the whole is greater than the sum of its parts
- Seeks 'stacked functions' where each built solution serves as many purposes as possible.

Sustainable Building Standards

Until as recently as seven years ago, there was no commonly-accepted definition of Sustainable Building, no single standard. The U.S. Green Building Council (USGBC) was founded in 1993 as a broad coalition of stakeholders in the building industry with a stated mission to "transform the way buildings and communities are designed, built, and operated." In 1995, the USGBC began to develop LEED, or Leadership in Energy and Environmental Design, as a way of putting in place a standard for, or a common definition of, Green Building.

LEED is a voluntary system that certifies the 'green' qualifications of buildings through a points-based checklist approach. LEED recognizes four levels of "green": Certified, Silver, Gold, and Platinum. There are currently LEED versions for Existing Buildings, Core and Shell, Commercial Interiors, Homes, and for new Neighborhood Development.

In the United States and globally, LEED is the current standard by which Green Buildings are evaluated, rated, and certified.

Shades of Green

There currently exist many interpretations of Sustainable Design, or Green Building. The lighter shades of Green Building involve painless adjustments to conventional building and result in buildings that are slightly less wasteful, slightly less bad, than ordinary, Code-compliant buildings.

At the other end of the spectrum are the deepest shades of Green Building, commonly referred to as Restorative Building, Regenerative Building, or Living Building. These buildings involve a conscious and committed effort toward taking full responsibility for their ongoing needs and placing no net demands on the environment.

The Living Building Standard, version 1.0, was released in November of 2006 by the Cascadia Region Green Building Council, an affiliate of the U.S Green Building Council (USGBC). The Living Building Standard is an evolving framework of understanding, whose stated purpose is to ". . . define the highest measure of sustainability possible in the built environment based on best current thinking—recognizing that 'true sustainability' is not yet possible."

Though not intended as competition, the Living Building Standard far surpasses LEED in its scope and purpose. In contrast to LEED's 69 possible points, numerous credits, and reliance on accounting and documentation, the Living Building Standard has 16 "simple and profound prerequisites" that must be met. This is the standard that will ensure the Noyo Center achieves the highest manifestation of Sustainable Building.

Global Climate Change and Sustainable Building

It is the consensus of world's leading climate scientists that we are fast approaching a 'tipping point' beyond which humans will no longer be able to affect runaway climate change. Humankind has perhaps a decade within which to drastically reduce its emissions of CO2 and other greenhouse gases. Placed in context, global climate change is an issue that easily dwarfs all others.

2006 was the year when debate global climate change ceased to be a subject open to debate. An overwhelming majority of American citizens, members of the mainstream press, and politicians at all levels of government have finally caught up to the scientific community. We have finally come to an agreement that climate change is real, the likely consequence of 'business as usual' is a planet that is virtually unlivable, the burning of fossil fuels is the primary cause of climate change, and time is not on our side.

- The Kyoto Protocols formally entered into force on February 16, 2005. In signing the Kyoto Protocols, 156 of the world's nations, including all of the developed nations except the United States and Australia, have demonstrated their understanding that concentrations of atmospheric CO2 must be stabilized below 1990 levels as quickly as possible.
- The first volume of the United Nations' Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, released on February 2, 2007, representing the work of 600 authors from 40 countries, reviewed by over 620 experts and governments, and reviewed (in summary) by representatives from 113 governments, gives new momentum to the immediacy and the urgency of global climate change.
- On June 1, 2005 Governor Schwarznegger signed Executive Order S-3-05 calling for statewide reduction in greenhouse gas emissions, saying "We know the science, we know the time for action is now. Global warming, pollution and the burning of fossil fuels that caused it are threats we see here in California and everywhere around the world."
- On September 27, 2006, Governor Schwarznegger signed AB 32, the landmark California Global Warming Solutions Act of 2006, that establishes a comprehensive program of regulatory and market mechanisms to achieve a State-wide reduction of greenhouse gas emissions to 1990 levels by 2020.
- To date, 514 Mayors of American cities, representing over 65 million citizens, have signed the U.S. Mayors Climate Protection Agreement calling for participating cities to meet or surpass the Kyoto Protocol targets in their own communities.

And 2006 was the year when it was acknowledged that buildings, consuming just under half of America's energy (including two-thirds of the electricity), together with the transportation that results from land use decisions that are part of the design process, represent the area of human activity with the single greatest contribution of human-generated greenhouse gas emissions responsible for global climate change.

Interest in Sustainable Building grows apace with interest in global climate change.

- In 2006, the U. S. Conference of Mayors unanimously adopted the 2030 Challenge, which calls for all new buildings and major renovations to immediately reduce their fossil-fuel greenhouse gas-emitting energy consumption by 50%, with increasing phased reductions in order to be completely carbon-neutral by the year 2030.
- The 2030 Challenge has been adopted by the American Institute of Architects (AIA), the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), the Construction Specifications Institute (CSI), the U.S. Green Building Council (USGBC), and integrated into the U.S. Environmental Protection Agency's Target Finder.

Current State of Sustainable Building in the U.S.

Here are some benchmarks marking the rapid spread of Sustainable Building within the United States:

- All branches of the US military build all of their housing accordance to a set of Green Building guidelines developed by the Army Corps of Engineers and modeled after LEED.

- The ongoing Pentagon Renovation Program (totaling over 4 billion dollars) will be LEED-certified.
- As of January 2007, a total of 19 federal agencies had signed a Memorandum of Understanding committing themselves to "…federal leadership in the design, construction, and operation of High-Performance and Sustainable Buildings." The list of agencies includes: Departments of Agriculture, Defense, Energy, Homeland Security, Interior, Justice, State, Transportation, EPA, GSA, HUD, NASA, TVA, and Veterans Affairs.
- A total of 16 State governments now require LEED (or encourage Green Building) for all state-funded buildings. The growing list includes: AZ, AR, CA, CO, CT, MA, MD, ME, MI, NJ, NY, NV, OR, PA, WA, WI.
- In California, in December, 2004 Governor Schwarzenegger signed Executive Order S-20-04 which called for all new and renovated state facilities to be built to the standard of "LEED-Silver or higher."
- Over 50 large cities in the US require LEED for all publicly-funded buildings. The list includes Atlanta, Boston, Chicago, Dallas, Houston, Kansas City, LA, New York City, Phoenix, Salt Lake City, San Francisco, Seattle, Washington, DC, and scores of others.
- A growing number of major American corporations are publicly aligning themselves with Green Building. The list includes: Kaiser Permanente, Bank of America, Ford Motor Company, Goldman Sachs Honda America, PNC Financial Services, Citigroup, Herman Miller, Toyota, Starbucks, Wal-Mart, and many others.
- A growing number of American college and universities have committed to Green Building. The list includes: Carnegie-Mellon, Dartmouth College, Duke University, Georgia Tech, Harvard University, Middlebury College, MIT, Northwestern University, Princeton University, Stanford University, Williams College, the University of California system, and many others.

Financial Costs and Benefits

When the subject of Green, or Sustainable, Building is discussed, the first question to surface is usually "How much more is it going to cost?"

A 2004 study by the construction services and cost consulting firm Davis Langdon Adamson, titled "Costing Green: A Comprehensive Cost Database and Budgeting Methodology," compared costs for 45 LEED projects with those for 93 conventional projects and found that a majority of the green buildings included in their study database were able to achieve their LEED rating with no additional budget.

A 2003 study commissioned by California's Sustainable Building Task Force and funded by the California Public Utilities Commission (CPUC), titled "Costs and Financial Benefits of Green Building," examined cost data from 33 LEED Green Buildings in California and benefits data from over 100 Green Buildings nationwide. Based on very conservative economic assumptions, the report concludes that:

- The average LEED Green Building costs 1.84% more to build than a conventional, code-compliant building, but the incremental additional investment is repaid 15-fold over an

assumed 20-year life of the building. (Most of the additional cost is due to additional architectural and engineering design costs, not construction costs).

- The greatest financial benefits are in the area of human health and productivity (70% of total), followed by reduced operations and maintenance costs (16%), followed by energy savings (11%), reduction in water use, solid waste, and other emissions (3%).

Numerous other studies released in recent years have reached similar conclusions. When the true costs and benefits of Green Building are explained to government decision-makers and corporate board members, the realization quickly emerges that they can't afford to not build green.

Green Goals for this Project

1. The project will be designed, built, and operated with an understanding that the site that it occupies is an integral part of a vast and complex ecosystem and that the future of humankind is intricately entwined with the health of the ecosystem.
2. The entire project will serve as a teaching tool. Similar in spirit to a living history museum, the buildings and the surrounding site/landscape will be a living exemplar of the principles and practices necessary to advance the human community toward a sustainable future.
3. The project will be inclusive of, and supportive of community at many levels.
4. Longevity is an important green goal. In order to ensure that the facility has a long life, flexibility/adaptability to changing uses and durability in a harsh coastal environment will be considered at every step in the design process.
5. The project will be net-zero energy, first through a concerted application of passive solar design that minimizes the need for energy on an ongoing basis, and then supplying the energy that can't be avoided through the use of non-fossil-based renewables.
6. In order to make responsible materials choices, all materials used in the project will be evaluated against a clearly articulated set of criteria that include the following: environmental impacts during extraction and manufacture, embodied energy, transportation energy, recycled content, renewability, recyclability, lifetime toxicity, and level of appropriate technology.
7. The demand for fresh water will be minimized, all water use will be carefully considered, and all of the fresh water needed will be supplied on site through rainwater harvesting or on-site reuse.
8. Through good design, selection of materials, and recycling, the amount of material sent to landfills will be kept to a bare minimum.
9. All waste water will be treated on site.
10. The indoor environments will be non-toxic, inspiring, and uplifting.

Phased Development Plan

By Susan Lohr
President, Lohr Associates, Inc.

Program	Objectives	Tasks: Year 1	Year 2	Year 3	Year 4	Year 5
Administration	1. Hire Interim Dir. (consultant) 2. Create nonprofit Noyo Center 3. Hire Executive Director 4. Hire other staff 5. Appoint advisory committees	Fill position Use attorney Adm. Mgr. (0.25) Steering Committee Finance and Devel.	Candidate search Adm. Mgr. (0.5) Sci. Tech. (0.5) Sci. Advisory Comm. Citizens Ad. Comm.	Hire candidate Adm. Mgr. (1.0) Facility Mgr. (0.5) Prog. Mgr. (0.5) Ad hoc Constr. Comm.	Sci. Tech. (1.0) Facility Mgr. (1.0) Fin. Mgr. (0.5)	Prog. Mgr. (1.0)
Planning	1. Approve Strategic Plan 2. Complete DPP 3. Develop Facility Master Plan	Adopted 6/06 Completed 3/08 Use DPP results	Annual evaluation Use for A&E plan	Annual evaluation	Annual evaluation	Five-Year Review Five-Year Review
Facilities	1. Acquire land 2. Complete A&E and LEED 3. Regulatory Compliance 4. Build facilities	Negotiate P/S contract	Complete purchase Hire consultant Develop Plan	Plans completed Continue Compliance Hire contractor Break ground	Monitor construction	Substantially complete
Research	1. Encourage research collaborations 2. Encourage visiting scientist use 3. Involve citizen/student RAs 4. Environmental monitoring	Ocean observing Advertise	BLM CA Gateways Habitat inventories Seek funded programs Improve res. sites Seek grad students	Informal brown-bags Land use history Res. policies Monitoring Seek funding Program established	Field day Res. interns Res. collaborations Set up program Long-term plots Funding secured	At least 5 projects At least 10 projects Host regional meeting At least 10 local RAs Data sets available

Program	Objectives	Tasks: Year 1	Year 2	Year 3	Year 4	Year 5
Learning	1. Local learning programs			Survey faculty Admin. Procedures	Field study plots Env. Sci. courses	At least 10 classes
	2. Summer coursework program				Seek funding	Set up program
	3. Encourage minorities				Seek funding	Set up program
	4. Host educator training activities					Seek funding
	5. Host K-12 classes			Host classes on-site	Develop curriculum	Sponsor programs
	6. Specialized short courses					Sponsor one event
Outreach	1. Promote Noyo Center	Create website	Links to other orgs.	Seek PR assistance		
	2. Host outreach events		Host one event	Host two events	Host three events	Host four events
	3. Respond to info. requests				Develop info sheets	Respond to inquiries
Funding	1. Land acquisition	Coastal Conservancy				
	2. Interim Director	Solicit funds				
	3. Executive Director	Solicit funds				
	4. A&E/LEED plans	Solicit funds				
	5. Facility construction		Capital funding plan	Solicit funds	Secure funds	
	6. Ongoing operations				Budget, fees, grants	
	7. Routine facility maintenance					(after Year Five)
	8. $5 Million campaign					(after Year Five)

appendix vi.

Reference Documents

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