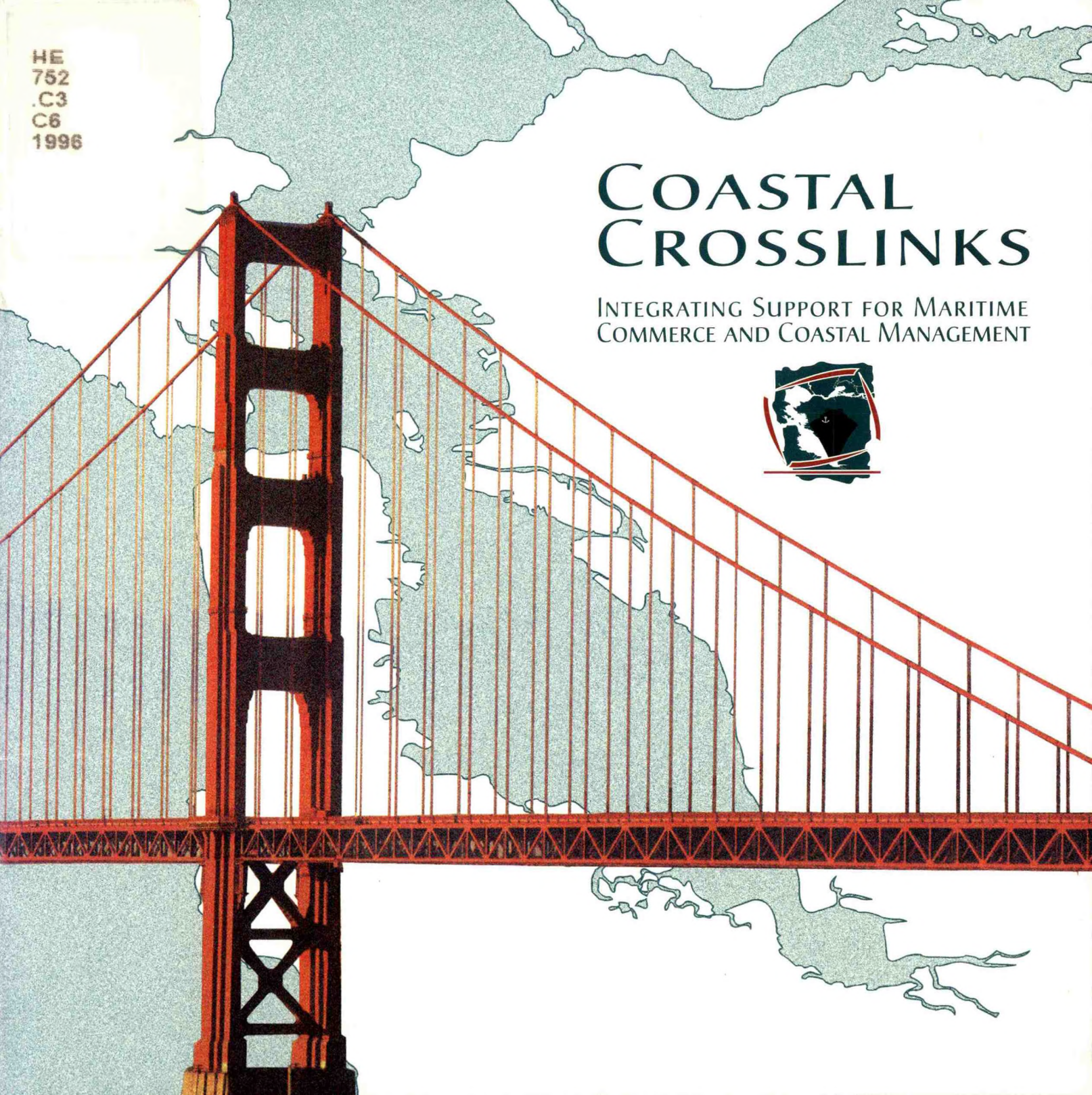


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COASTAL CROSSLINKS

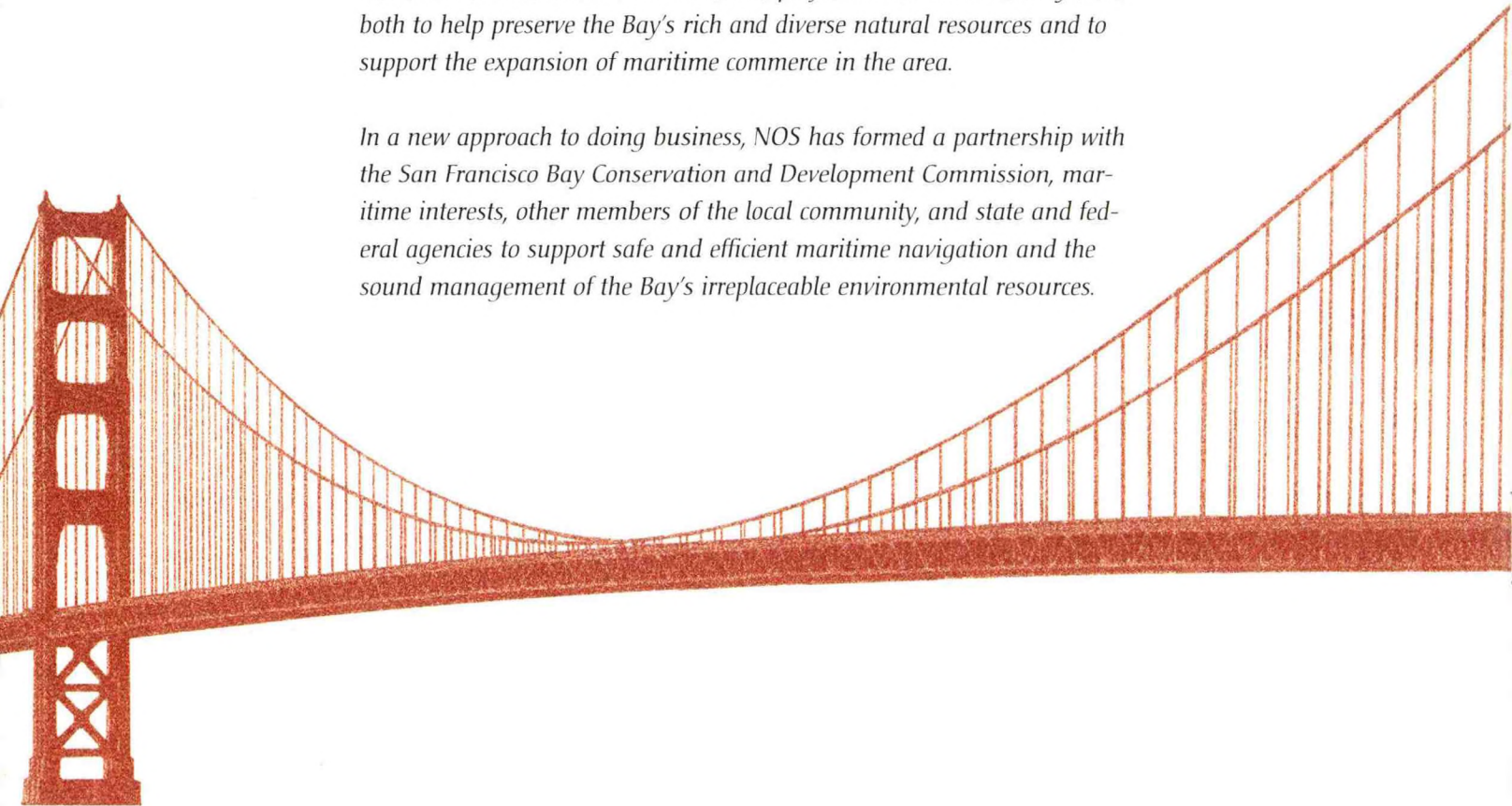
INTEGRATING SUPPORT FOR MARITIME
COMMERCE AND COASTAL MANAGEMENT





NOAA's National Ocean Service's (NOS) project in San Francisco Bay aims both to help preserve the Bay's rich and diverse natural resources and to support the expansion of maritime commerce in the area.

In a new approach to doing business, NOS has formed a partnership with the San Francisco Bay Conservation and Development Commission, maritime interests, other members of the local community, and state and federal agencies to support safe and efficient maritime navigation and the sound management of the Bay's irreplaceable environmental resources.



COASTAL CROSSLINKS

INTEGRATING SUPPORT FOR MARITIME
COMMERCE AND COASTAL MANAGEMENT



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THE BOTTOM LINE

INCHES MATTER

In the shipping industry, inches matter. Economies of scale are pushing companies toward building larger ships that carry more cargo and produce higher returns on their investments.

Inches matter below as well as above the water line. Each additional foot of draft a port can accommodate can generate revenue of \$120,000 or more per transit.

Because ship operators can easily change their ports of call at the turn of a rudder, the competition among U.S. ports to attract and retain their business is fierce. Carriers are constantly on the watch for enticements from other ports that will enhance their efficiency and profitability.

The international trend in commercial shipping is toward fewer but larger, deeper-draft vessels. For container operations, each additional inch of draft can increase revenues by \$8,000–\$50,000 per transit. By providing accurate, real-time information about water levels, currents, and obstructions, NOAA's National Ocean Service (NOS) is helping carriers in the Bay significantly enhance the safety, efficiency, and profitability of their operations.

HOW MUCH IS AN INCH WORTH?



For a Shipper

A container ship's cargo determines the additional revenue the company can earn with one more inch of draft. For example, it can earn:

- \$8,000/ship with a cargo of recycled paper
- \$50,000/ship with a cargo of meat

For a Port

For a port like Oakland, through which 1,637 ships entered and departed in 1995, one more inch can yield hundreds of thousands in additional revenue. For example:

1,000 ships/year
x \$550/ship

\$550,000/year



GOLDEN OPPORTUNITIES

AT THE GOLDEN GATE

Draining over 40 percent of California, the Bay and its Delta comprise the largest estuary on the West Coast. They include 45,000 acres of wetlands that support over 130 species of fish, a \$4 million commercial salmon industry, and resting and feeding areas for 50 percent of the birds that migrate along the Pacific flyway.

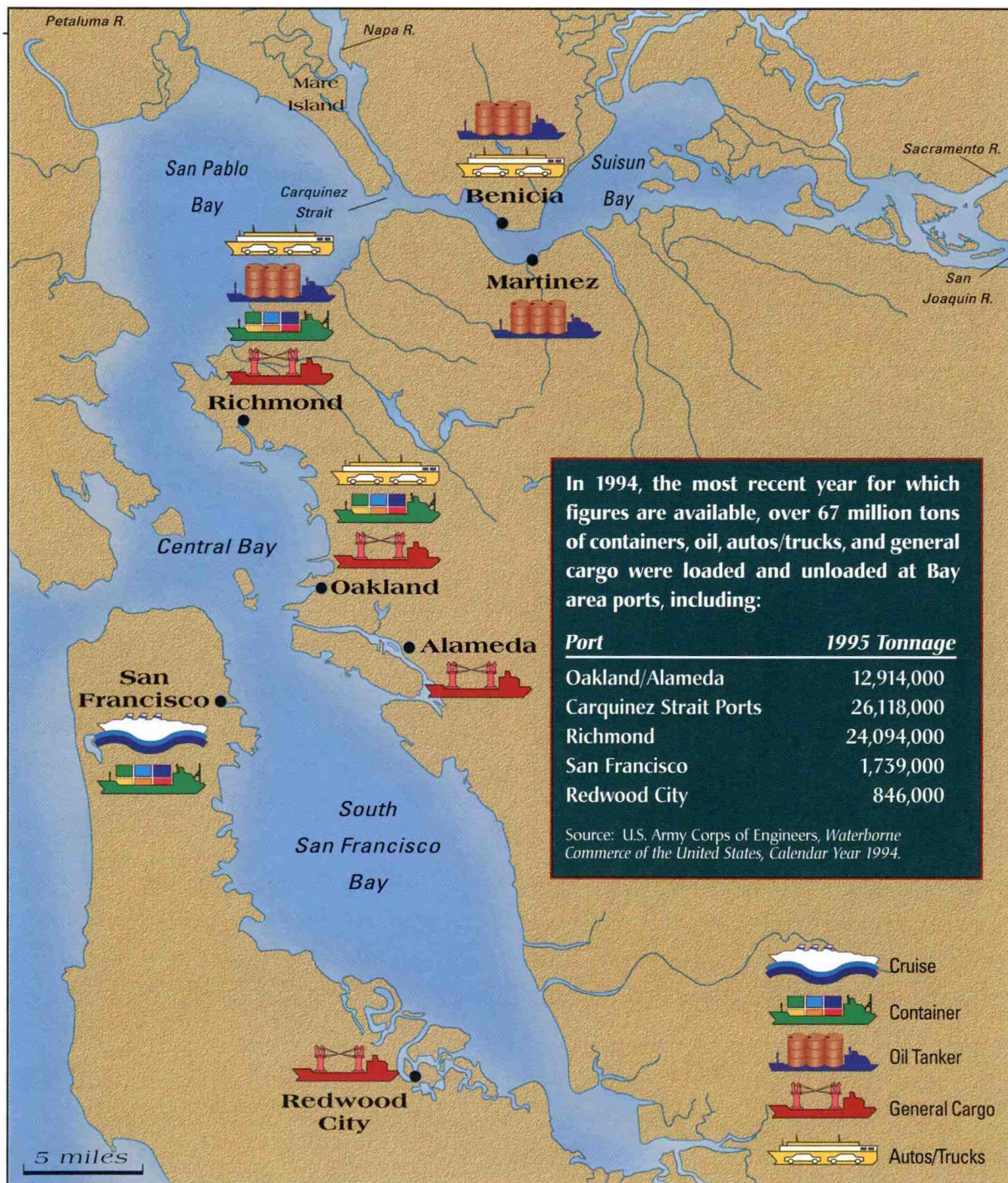
San Francisco Bay is also home to seven major shipping ports, oil refineries, petroleum-blending facilities, and a variety of industries. It is the fifth largest U.S. port in crude oil handling and the fourth largest container port.

The continued growth of maritime commerce is vital to the region's economic health. Dredging is one of the myriad complex issues coastal managers delve into every day in their quest for the optimal balance between developing and sustaining the Bay area's natural resources.

A dredging project under way in the Bay is deepening Oakland's inner and outer harbors from 38 to 42 feet at a cost of \$100 million. Newer proposals would further increase channel depths to 50 feet in the near future. While accommodating wider, deeper-draft vessels is

"The National Ocean Service's Project is providing us with the information we need to support the development of our ports and other maritime commerce needs and to ensure the long-term health of the Bay's ecological resources."

Will Travis, Executive Director,
San Francisco Bay Conservation
and Development Commission



Every day ships carrying a variety of cargo pass under the Golden Gate en route to Bay area ports. The major ports shown on this map employ tens of thousands of people in the area and contribute tens of millions of dollars in annual tax revenues.

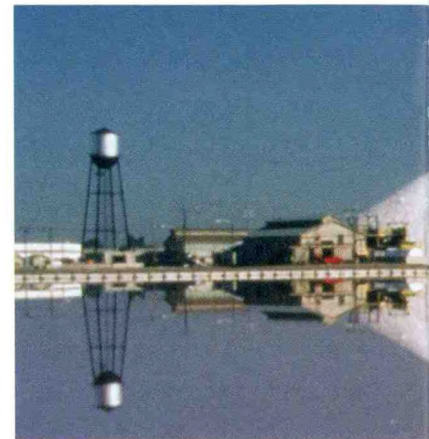


San Francisco Bay National Estuarine Research Reserve



Rhonda Rynex, U.S. Fish and Wildlife Service

Suisun Marsh is a diverse mosaic of tidal marsh and other wetland habitats. Its highly variable mixing zone—between the freshwater Delta and the more saline San Francisco and San Pablo Bays—makes it key to the productivity of the area's estuarine food chains. All 60,000 acres of Suisun Marsh were once natural tidal wellands. Today, most of the marsh has been cordoned off into diked areas. Only 10,000 acres—now under the protection of the San Francisco Bay Conservation and Development Commission—remain subject to the tides.



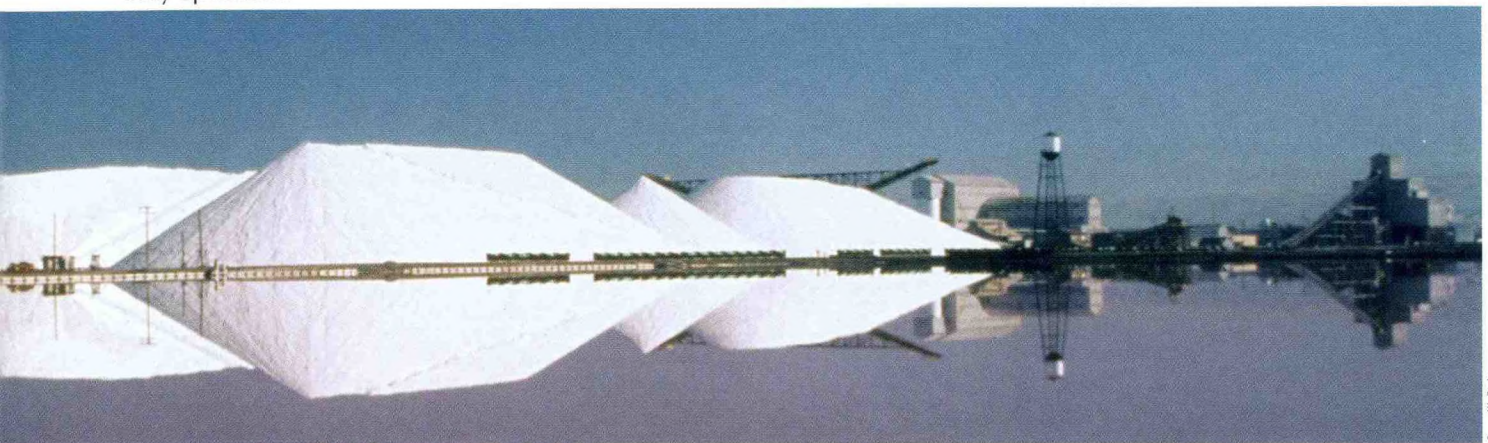
essential for Bay ports to remain competitive on the West Coast, dredging can destroy sensitive benthic habitat, wetlands, and other critical resources, as well as stir up sediment possibly contaminated by heavy metals and other toxins from years of dockside and other activities. A still larger issue is where to dispose of the dredged materials without damaging sensitive ecosystems.



Photo courtesy of Port of Oakland

Dredging is one of the many critical issues coastal managers must weigh in balancing the economic and environmental interests of their communities. The data NOS generates help them determine how to minimize dredging while accommodating deeper-draft ships, and how to dispose of dredged materials beneficially without damaging sensitive ecosystems.

Since 1854, table salt has been harvested from Bay waters. The NOS information base is helping coastal managers work with Cargill Salt and other industries around the Bay to ensure the sustained health and abundance of the resources they depend on for their daily operations.



Cargill Salt

REAL-WORLD PROFITS

WITH REAL-TIME DATA

The installation of a Physical Oceanographic Real-Time System (PORTS) is a centerpiece activity of the San Francisco Project.

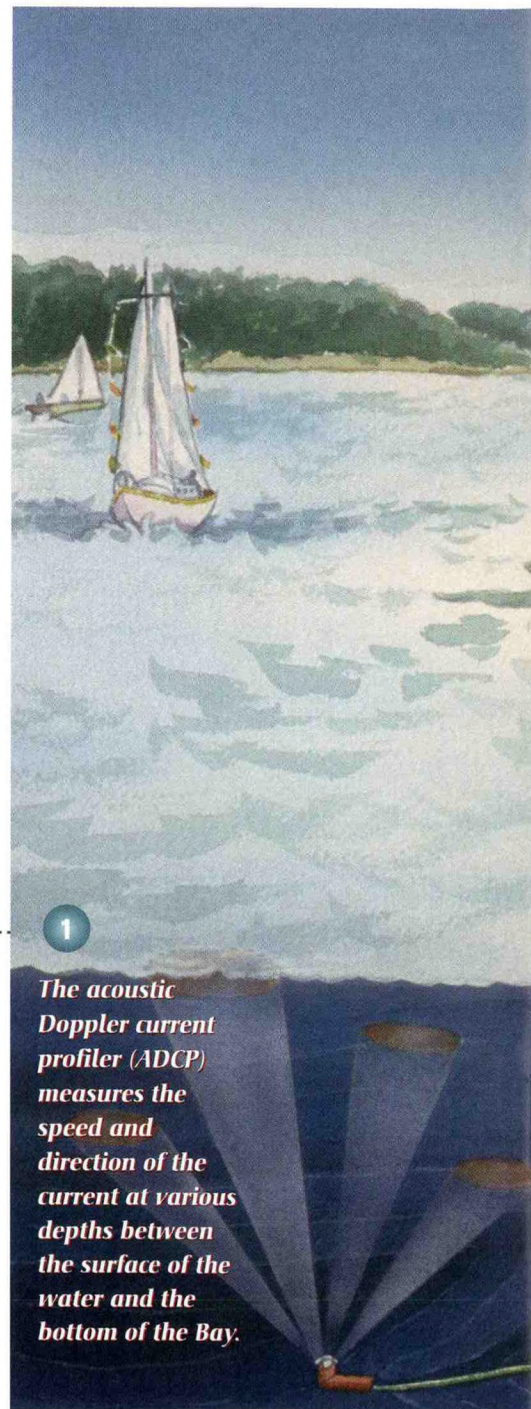
Developed by NOS scientists and engineers, PORTS measures currents, water levels, and other physical conditions. By providing information about actual—instead of predicted—conditions, PORTS allows pilots and masters to use the Bay's channels to their fullest extent, while simultaneously increasing safety and minimizing the need for additional dredging.

Mariners now can access

PORTS information by cellular telephone before entering the Bay. As the system is refined, it will provide near-term forecasts of water levels and currents, which will allow mariners to plan their transit before entering the Golden Gate.

Although designed primarily as a 24-hour-a-day navigation information service, PORTS also serves important coastal management needs. For example, the same information that mariners need is also critical to responding to an oil spill, and to learning how the Bay's physical systems work.

By meeting these dual purposes, PORTS illustrates how



1
The acoustic Doppler current profiler (ADCP) measures the speed and direction of the current at various depths between the surface of the water and the bottom of the Bay.

3

NOAA water-level stations in the Bay automatically relay to computers at the central receiving station information on water levels, winds, and water temperatures.

4

The central receiving station makes this real-time information available to the public via the Internet and telephone circuits.

2

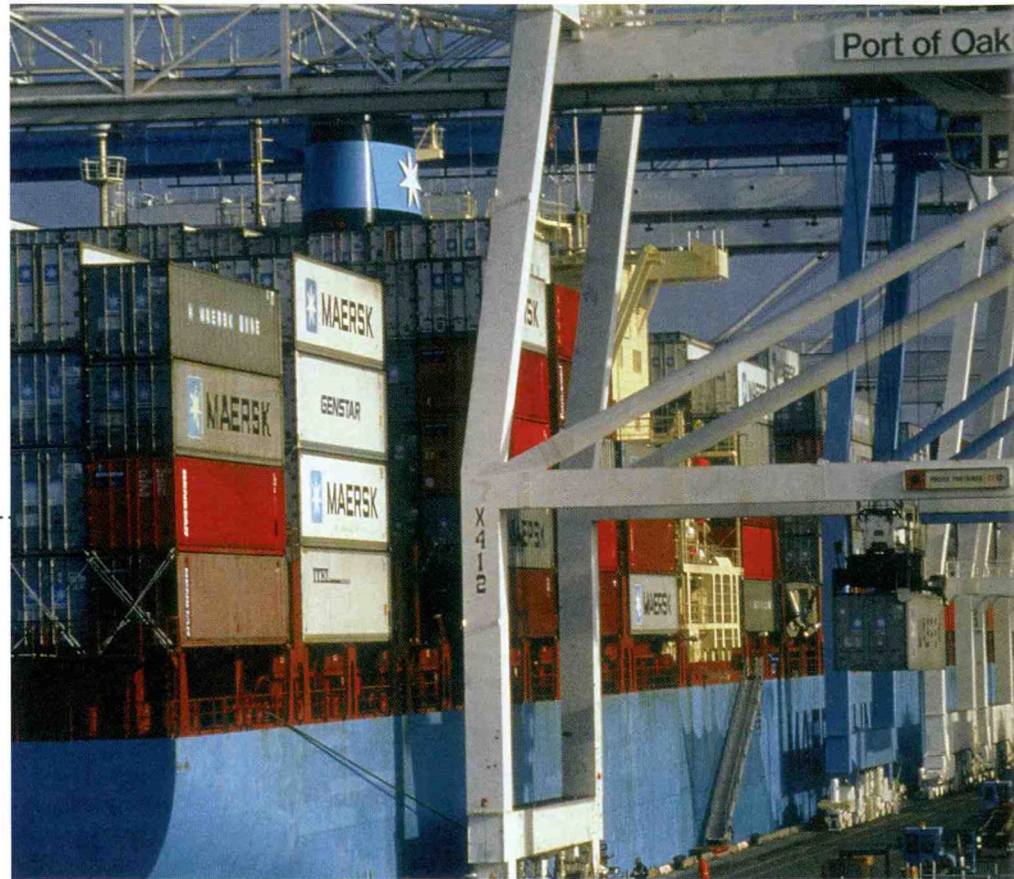
A receiver near the ADCP transmits the information to a central receiving station, which may be many miles away.

The Bay's new Physical Oceanographic Real-Time System (PORTS) allows ships to access real-time nautical data long before they approach the Golden Gate.

Loading and offloading cargo at a port can take 16 hours or more. Sailing conditions can change radically in far less time. NOS real-time tide and current information enables ships' captains to plan their arrivals and departures to maximize the efficiency of their time in port.

"Having accurate, real-time water level and current information and new charting products will greatly increase the safety—and the efficient profitability—of navigating in the Bay."

Capt. Art Thomas,
San Francisco Bar
Pilots Association



NOS can integrate its support for maritime commerce and coastal management efficiently and effectively. But NOS can't do it alone.

The U.S. Geological Survey has been a key partner with NOS in developing PORTS for San Francisco. And the Marine Exchange of the San Francisco

Bay Region has taken on the task of operating and maintaining the system in an ongoing partnership with NOS.

The importance of PORTS to the region was recently illustrated in the port of Oakland. According to tidal predictions, the *Marchen Maersk* had to get under way

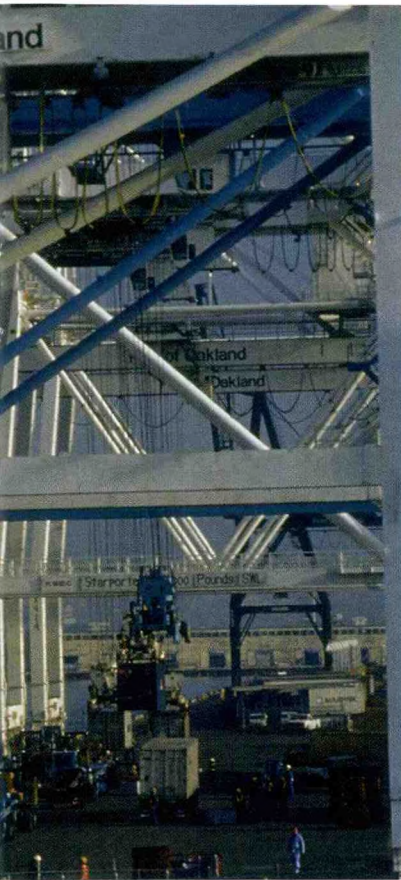
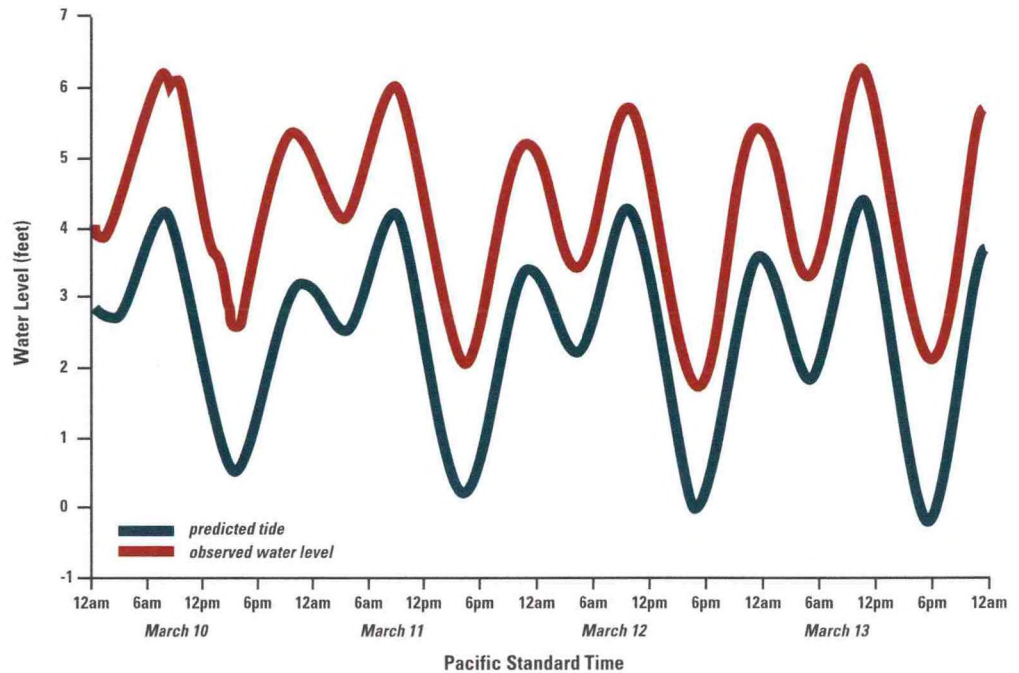


Photo courtesy of Port of Oakland

The great disparity between predicted astronomical tides and real-time water levels can cost shippers hundreds of thousands of dollars a year. As shown here, in March 1995, the actual water level in upper San Francisco Bay was as much as two feet higher than the predicted tide tables, which didn't factor in the extremely heavy winter precipitation and the resulting runoff of Sierra snowmelt.



by noon or wait several hours for the next high tide. Under this timetable, the ship could not offload all the Oakland cargo and arrive on time at its next destination. Its only option was to carry the remaining containers to Los Angeles/Long Beach, and then ship them back to Oakland by truck.

By consulting NOS data from accurate real-time tidal gauges in the Bay, the pilots learned that the tide was running well above the predicted level and that the ship had an extra hour to offload the remaining containers.

This real-time information eliminated custom fees for

offloading the Oakland cargo in LA/LB, plus an estimated \$10,000 in trucking costs for transporting the cargo back to Oakland. Perhaps more important, the company met its obligations to its customers, rather than delivering the cargo two to three days late.

CREATING CROSSLINKS

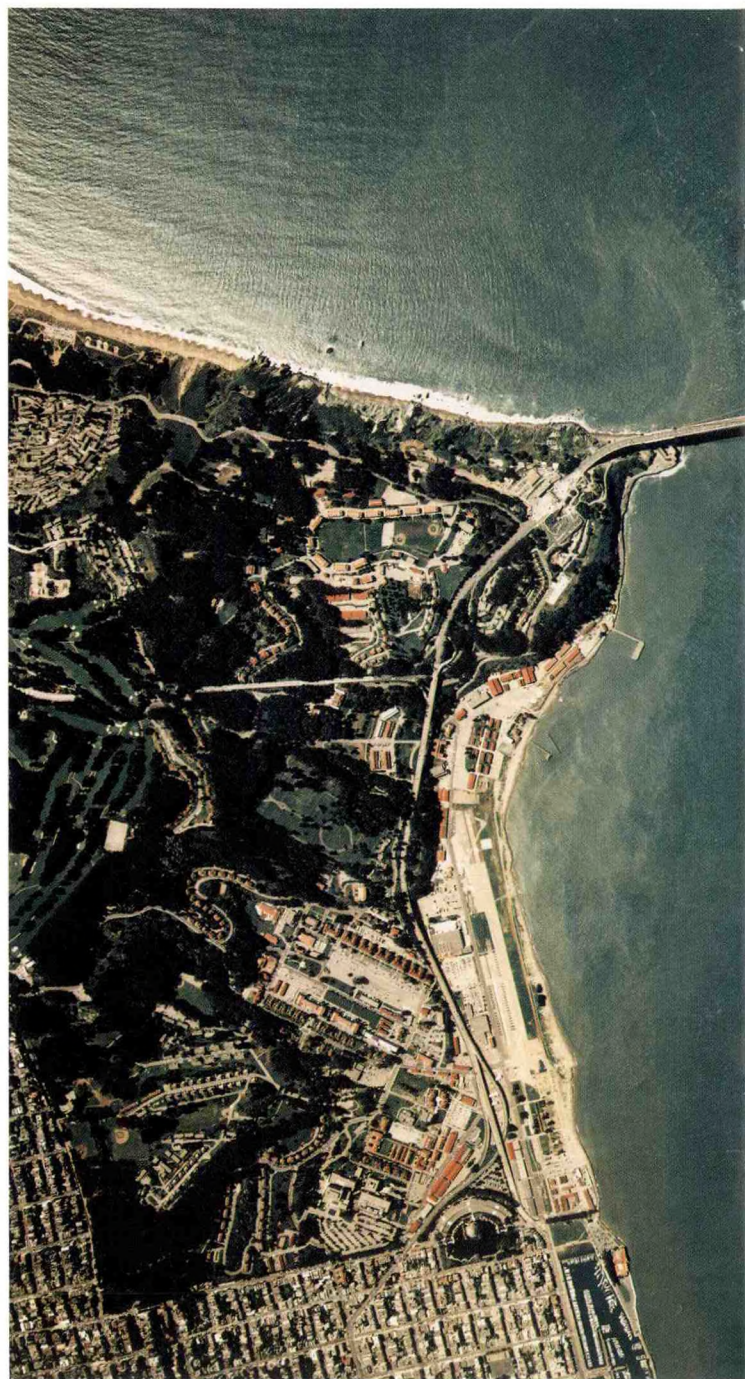
THROUGH COMMUNITY COLLABORATION

Collaborating with the local community, other agencies, and the private sector allows NOS to create efficiencies in its operations by sharing resources, expertise, and knowledge. This collaboration with the coastal management and maritime interests is critical to identifying their needs and to tailoring NOS products and services to address those needs effectively.

NOS is creating

technological bridges so that Project partners can use its rich storehouse of nautical charting data for other activities, such as analyzing and modeling changes in the Bay's ecosystem.

Following are some key local issues besides dredging where NOS information and data are supporting both community decision makers locally, as well as the maritime industry and coastal managers nationwide.



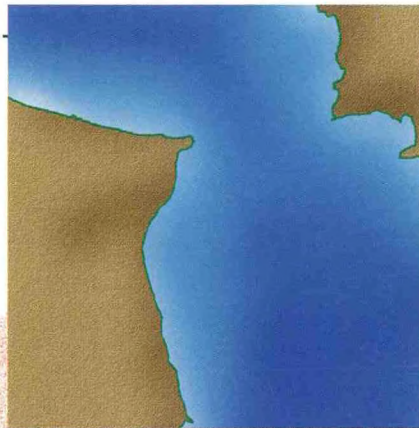
MAPPING THE BAY WITH GIS

Geographic information systems (GIS) store, manage, analyze, and display data related to a particular place, such as this area of San Francisco Bay. Although in their simplest form, GIS can be used to generate electronic "maps," resource managers use them to develop a wide range of information about specific issues affecting that location.

This high-accuracy photograph is a product of the NOS coastal mapping program, which supplies the shoreline and land features depicted on NOS nautical charts. With proper processing, photography such as this can be used in GIS.

Other NOS data collected for nautical charts, such as measurements of the ocean bottom, can also be used in GIS to learn about the historical location of the shoreline, land use, threats to resources, and other information critical to sound coastal management.

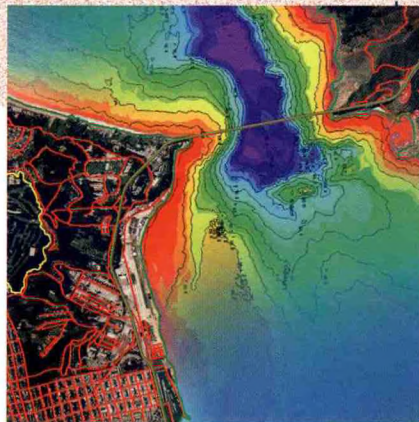
The three graphics accompanying this photography illustrate how a GIS works.



An NOS photograph has been processed and scanned. Land and water features have been delineated from the photograph to create a data "layer" for a GIS.



Here, the corrected, scanned photograph is used as a "back-drop" for other delineated features, such as beaches, green space, and roadways.



An additional bathymetric layer shows the contours of the ocean bottom.

NOS/National Geodetic Survey

NOS, from National Geodetic Survey and Coast Survey data

About 750 tankers passed through the Golden Gate in 1995, carrying fuel to meet the transportation and energy needs of Bay area residents. Floating idly outside the Golden Gate Bridge waiting for the tide to rise can cost operators as much as \$3,000 an hour. Up-to-the-minute NOS information on tides and currents, and updated NOS charts showing depths and obstructions, are increasing the efficiency of shipping in the Bay and protecting its rich ecological resources.



Chevron Corporation

Safe and Efficient Maritime Commerce

Mariners consider the Golden Gate and its approaches to be among the world's most challenging waters to navigate. Confined maneuvering space, submerged rocks, fog, and

strong currents increase the risk of accidents. In the shallower parts of the Bay's shipping channels, some large vessels have less than a foot of clearance.

By providing more accurate charts and real-time tide and current information com-

patible with electronic chart systems, NOS is helping to reduce the uncertainty that can lead not only to costly delays in waiting for ideal sailing conditions but also to collisions, groundings, and irreparable environmental damage.

Habitat Protection and Restoration

Urban development, agricultural runoff, and the diversion of fresh water from the Delta to the Central Valley and southern California are only a few of the many activities that have significantly degraded the Bay's aquatic habitat.

Over time, the Bay's open surface has been diminished by one-third, and 82 percent of its wetlands have been lost. A 70 percent reduction in the salmon run and similar losses for other aquatic species have important implications for the state's

LOCAL COMMUNITY CROSSLINKS

Maritime Community

Service Providers

- Bay ports, especially the Port of Oakland
- San Francisco Bar Pilots Association
- Marine Exchange of the San Francisco Bay Region
- Charting & navigation system developers & manufacturers

Marine Operators

- Tanker and break-bulk operators
- Container operators
- Tug and tow operators
- Cruise ship operators
- Commercial fishing fleet
- Recreational boaters

Public Sector

- U.S. Coast Guard Captain of the Port
- U.S. Coast Guard Vessel Traffic System
- U.S. Army Corps of Engineers
- California Office of Oil Spill Prevention and Response

Coastal Managers

Management and Permitting

- Bay Conservation and Development Commission
- Regional Water Control Board
- Delta Commission
- U.S. Environmental Protection Agency
- Other state and federal management agencies

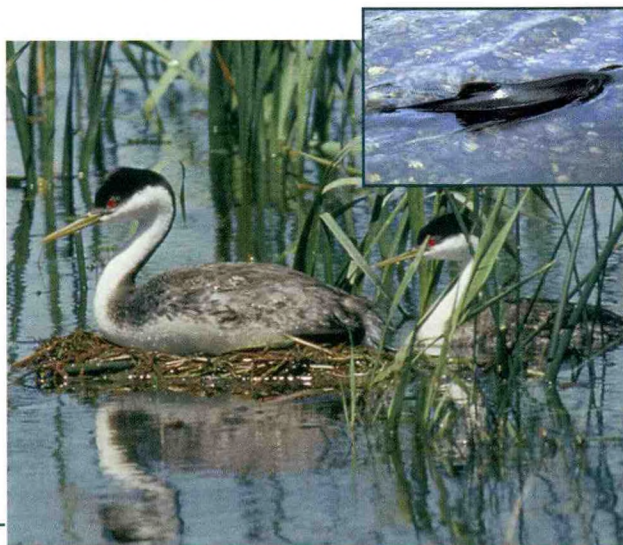
Resource Preservation and Restoration

- Bay Conservation and Development Commission
- California Coastal Conservancy
- San Francisco Bay National Estuarine Research Reserve
- Nonprofit land acquisition and management groups
- State and federal salmon habitat restoration projects

Research

- University of San Francisco
- San Francisco Estuary Institute
- University of California at Berkeley
- U.S. Geological Survey

Current wetland restoration efforts in the Bay area include resurrecting the endangered salmon run and rebuilding marsh elevations to encourage plants to take root. Enhancing the vitality and productivity of the Bay's wetlands will create even greater economic and environmental benefits in the future.



Tim McCabe, U.S. Soil Conservation Service; inset: National Ocean Service

economy, as well as for the health of its coastal and riverine resources.

To help local agencies meet these

coastal management challenges, NOS is providing historical and contemporary data on the Bay and its resources. These

data will allow researchers to track changes in the Bay's ecosystem, will assist in the recovery of endangered species, such as salmon, and will be incorporated into geographic information systems. They will also enable the private sector to create an array of tools for coastal

managers, such as maps that identify wetlands, local sources of pollution, and other data critical for the sustained vitality of the Bay's natural resources.

The Project's involvement of the local community up front is critical to its success. The partnership NOS has formed with the maritime industry and coastal managers will help expand the Bay's maritime economy and preserve its quality of life.

Terry Hunter, Executive Director, Marine Exchange

Enhanced Spill Preparedness

The large number of ships transiting the Bay and the many oil

State legislation requires oil companies to have emergency response plans and cleanup capabilities in place before they enter California waters. Working closely with federal and state agencies to achieve a rapid and unified response to oil spills, Clean Bay, a nonprofit cooperative, conducts frequent emergency response drills in the Bay.



Clean Bay Incorporated

refineries and chemical plants that dot its shoreline are constant reminders that industry and coastal management agencies must be poised for immediate and effective response to spills. While improved NOS information is helping to minimize the possibility of spills, they can still occur.

NOS on-scene technical support staff, environmental sensitivity maps, and spill-response models help spill-cleanup managers identify the most vulnerable ecological areas near the spill and predict how the spill will respond to weather, current, and tide conditions.



Until recently, the port of Oakland had been unable to dredge its channels because it couldn't find an environmentally acceptable site to dispose of the dredged material. An innovative wetland restoration project in the Sonoma Baylands is solving this dilemma by hydraulically pumping clean dredged material onto former marshland that had subsided. As a result, Oakland will be more competitive in the Pacific container trade, and the future marshland will soon be colonized by intertidal plants and animals.

Sustainable Disposal and Reuse of Dredged Materials

Channel maintenance and new dredging require viable areas for disposing of the dredged materials.

Because these areas are extremely limited and can contain contaminated sediments, dredging operations call for a careful, comprehensive management program.

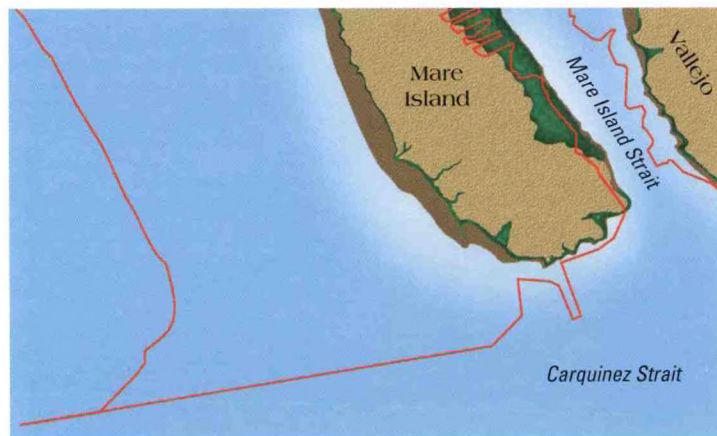
NOS hydrographic,

current, and water-level information can help ports plan sustainable dredging operations. And information derived from NOS photogrammetry and accurate positioning technology

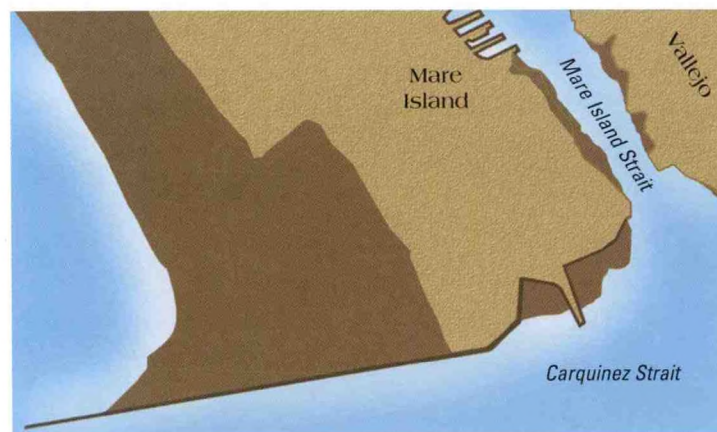
Development of the Bay's cities and ports has significantly degraded the area's aquatic habitat over the past century. To avoid future wetland losses and to help restore the Bay's ecological balance, local partnerships are pursuing innovative projects that marry economic and environmental interests.



In 1851, Mare Island was in its natural state—uplands fringed by productive marsh and mud flats.



The red outline, derived from NOS T-sheets from the 1980s (which were based on NOS aerial photographs), vividly depicts the changes over time from dredging and filling.



Today, none of Mare Island's natural shoreline remains. Much of it is man-made and biologically unproductive, and the remaining wetlands are significantly degraded.

National Ocean Service

gies can help coastal managers identify vulnerable coastal resources, potential disposal and reuse sites, and other information critical to the environmentally sound management of dredged materials.

Delineation of Jurisdictions

Almost every business in the Bay is required to obtain one or more permits from a variety of agencies. Having

consistent, accurate information about the Bay's jurisdictions and coastal resources can significantly minimize the time and expense of the permitting process.

A court recently reinterpreted the original regulatory jurisdiction of the Bay Conservation and Development Commission (BCDC), the nation's oldest coastal management agency. As a result, permit applicants

and regulatory agencies must hire surveyors to make boundary determinations case by case.

As part of its shoreline mapping responsibilities, NOS will delineate an accurate mean high-water line—the new basis of BCDC's jurisdiction. NOS will instruct BCDC, the regulated community, and local surveyors on how to locate the mean high-water line quickly and accu-

rately by using global positioning system (GPS) technology. This common frame of reference will eliminate disagreements over BCDC's regulatory authority, along with the time and cost of resolving them.

“By providing the entire community with recognized jurisdictional limits and quality information about the Bay's coastal resources, the Project will help maximize the efficiency and minimize the costs of permitting activities in the Bay.”

Ellen Johnck, Bay Planning Coalition

SUSTAINABLE DEVELOPMENT

SUCCESS BREEDS SUCCESS

Working with the local coastal management and maritime commerce communities, NOS draws on its national resources and capabilities to tailor solutions to local problems.

The partnership NOS has developed with local communities will allow the San Francisco Project's synergies and efficiencies to continue into the future.

The Project will also have multiplier effects. Its lessons

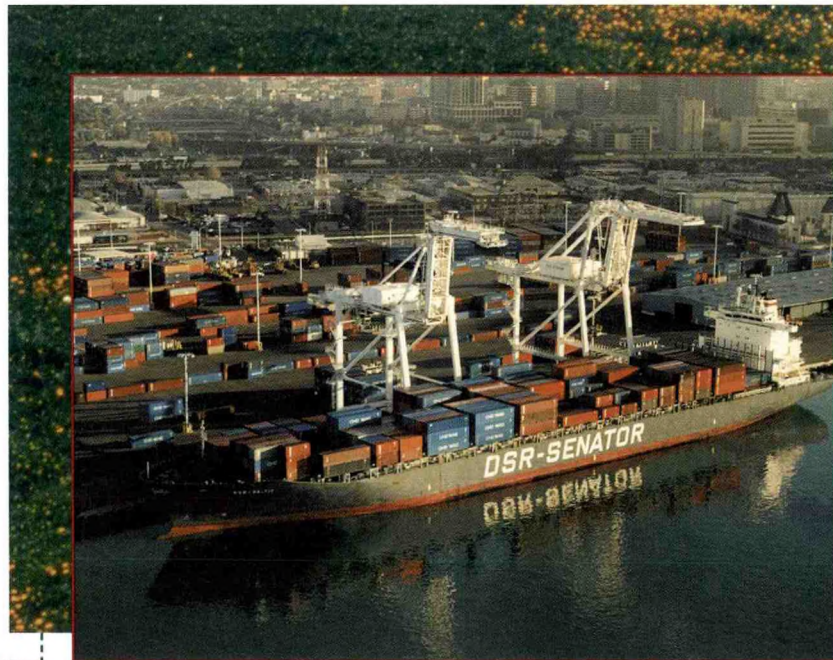
and successes will provide the foundation for building similar support systems in other regions.

By heightening the competitiveness of U.S. ports and the

shipping industry, these projects will help inject new vitality into local economies.

They will also support the environmental stewardship roles of coastal zone plan-

ners and regulatory officials as they work to ensure the safe, sustainable, and efficient development of our coastal and ocean resources.



The innovative partnerships created through the San Francisco Project are helping to fuel economic growth in the Bay, are restoring the Bay's ecological heritage, and are enriching the community's quality of life.





The mission of the National Ocean Service (NOS) is to promote the sustainable use of coastal resources in support of the nation's economic prosperity and environmental well-being. In pursuit of this mission, NOS performs both management functions (coastal zone management, National Marine Sanctuaries, and National Estuarine Research Reserves) and service functions (coastal monitoring and assessment, hazmat response, damage assessment, nautical charting, tides/currents/water levels, and the national spatial reference system).

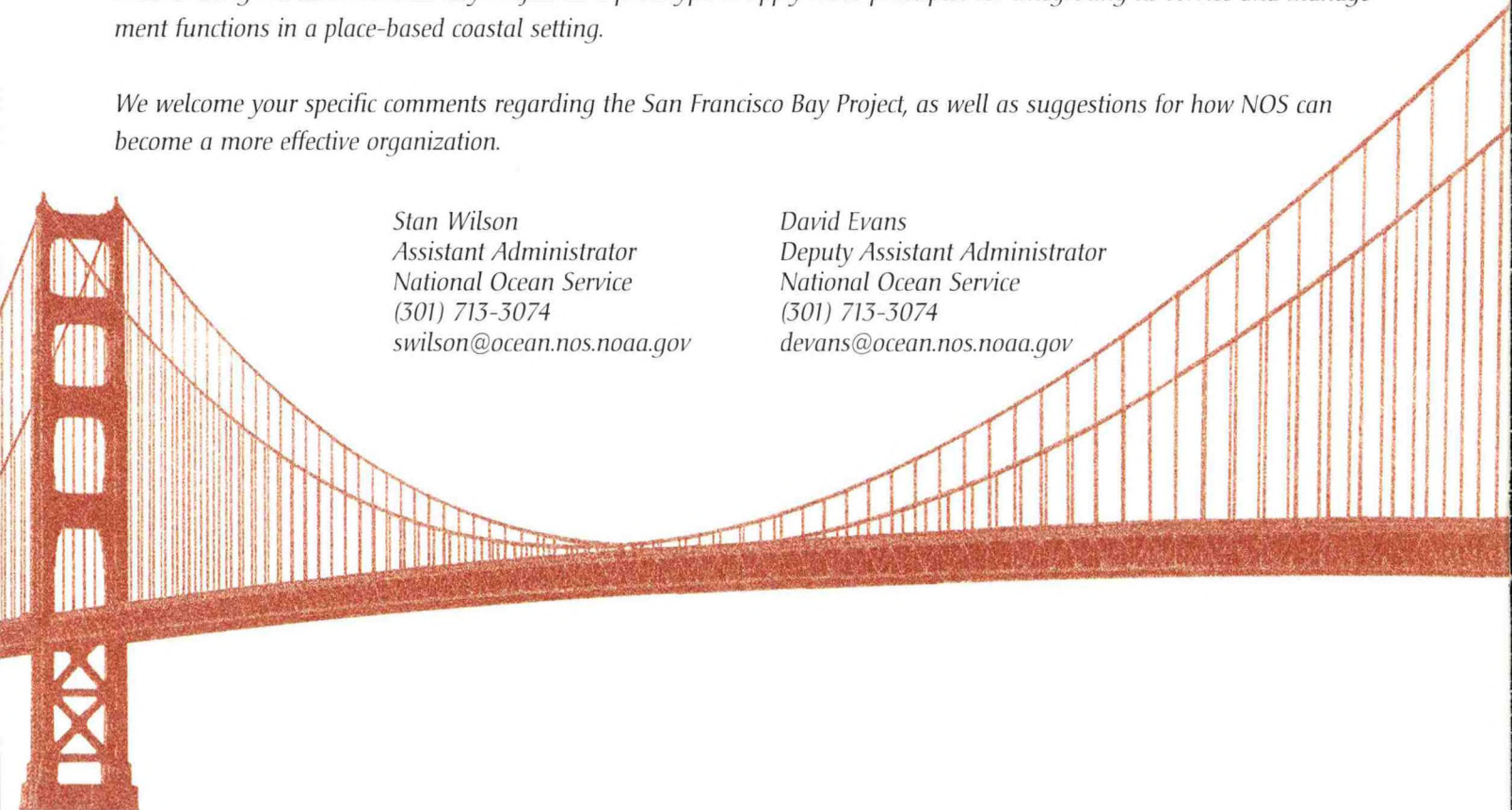
NOS activities are focused on three themes: marine transportation, ecosystem management, and natural hazards. The principles employed in pursuit of these activities include forming partnerships and consensus building among the different levels of government (federal, state, and local), between the public and private sectors, and spanning the range of interests from conservation to development; considering coastal lands and waters as a coupled system and addressing associated issues holistically; and striving to ensure that the best science and technology underpin the services that NOS provides to meet the needs of coastal resource managers.

NOS is using the San Francisco Bay Project as a prototype to apply these principles for integrating its service and management functions in a place-based coastal setting.

We welcome your specific comments regarding the San Francisco Bay Project, as well as suggestions for how NOS can become a more effective organization.

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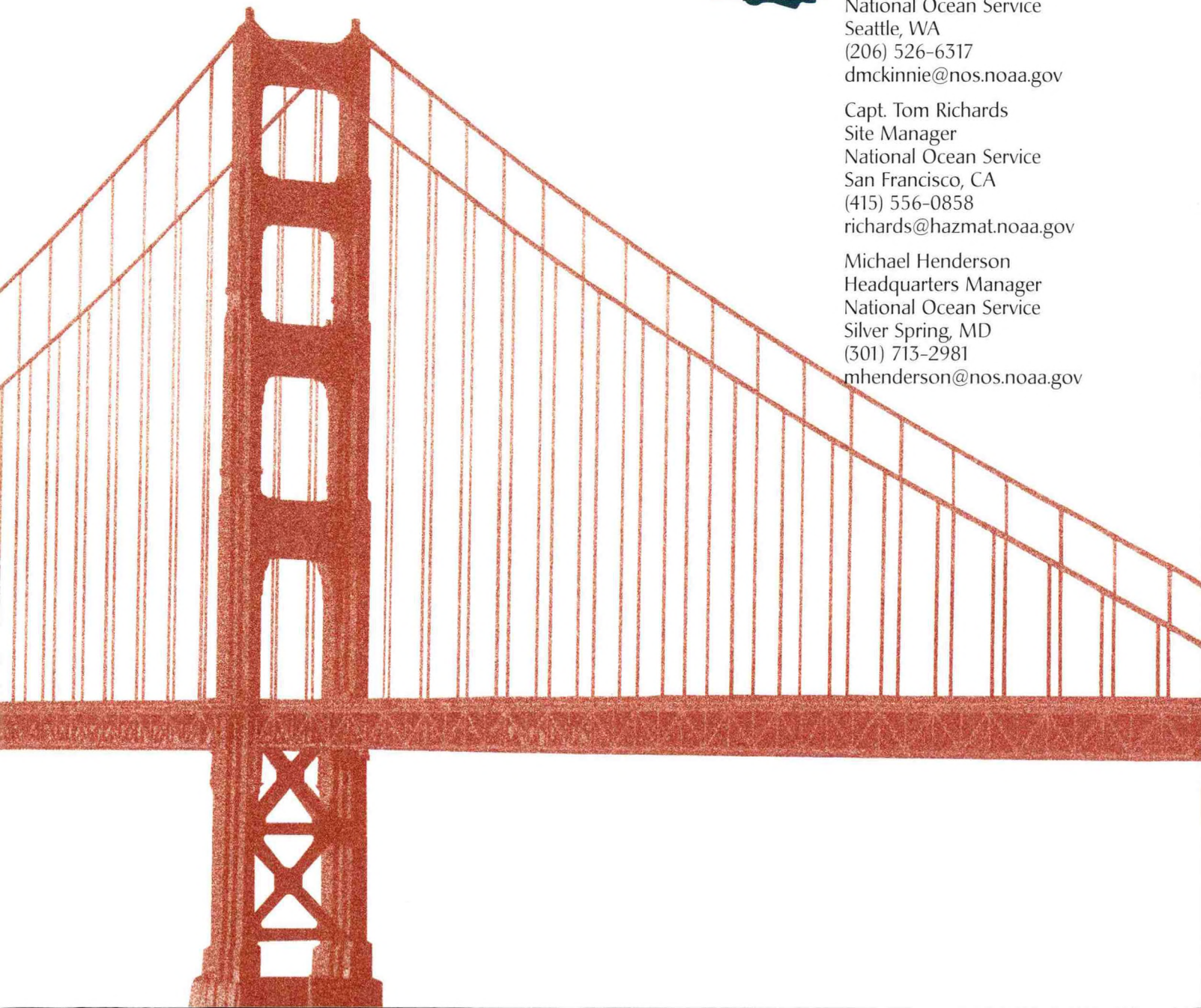


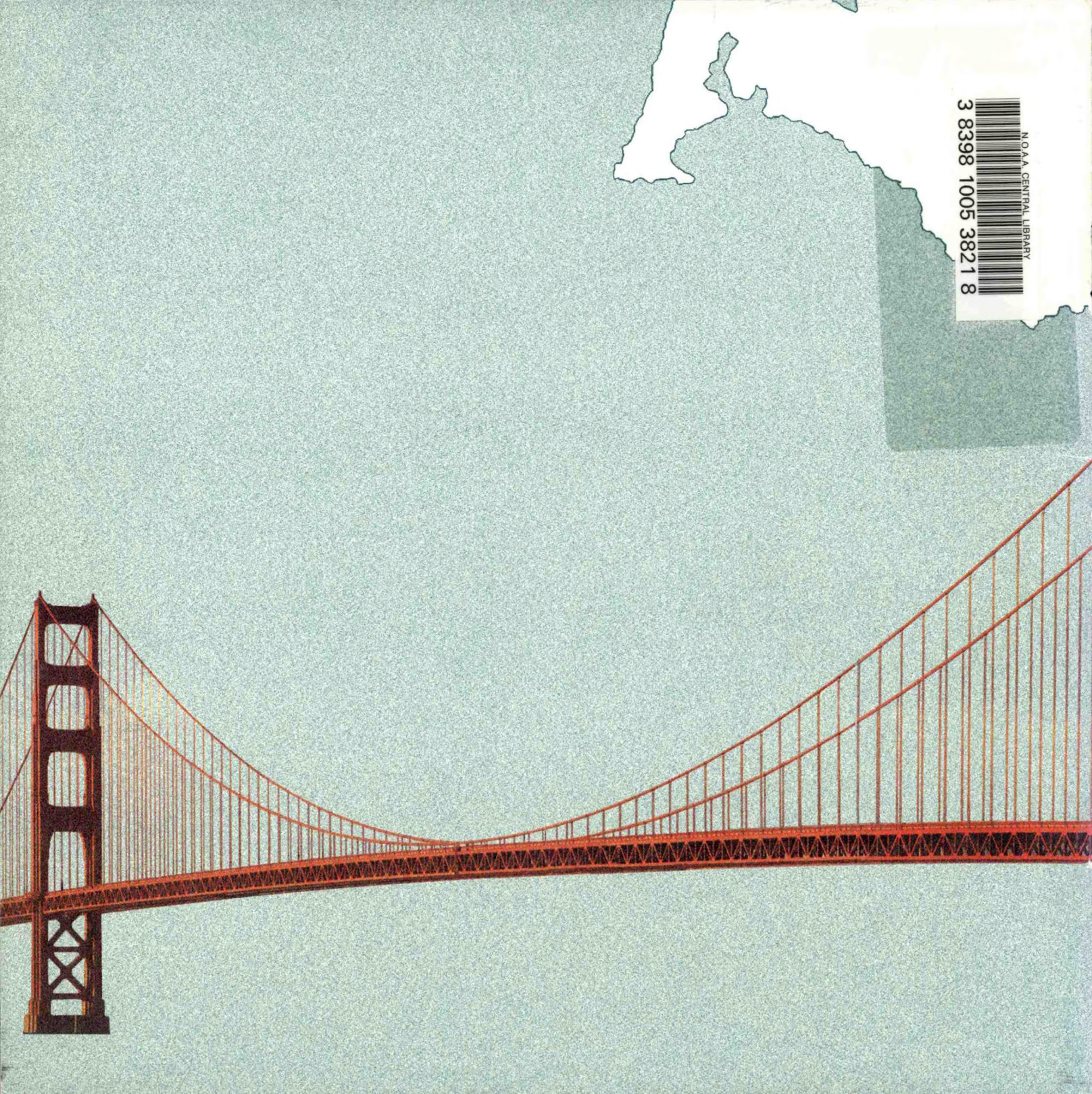
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