

## AAPA ENVIRONMENTAL IMPROVEMENTS AWARD APPLICATION CATEGORY: ENVIRONMENTAL ENHANCEMENT

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## Antioch Dunes Restoration Project Summary

The Port of Stockton (Port) is located in the Sacramento-San Joaquin Delta (Delta) in California's Central Valley. Annual maintenance dredging of the Stockton Deep Water Ship Channel, a 35-footdeep navigation channel within the San Joaquin River, is conducted by the U.S. Army Corps of Engineers (Corps) in partnership with the Port to allow safe travel of ships calling on the Port from the Pacific Ocean. The Port is responsible for securing new dredged material placement sites for use as part of the Corps' operations and maintenance dredging program.

About a decade ago, the Port identified an opportunity to reuse maintenance dredging material to restore sensitive sand dune habitat in the Antioch Dunes National Wildlife Refuge (Refuge) located

*The Refuge is home to the last remaining populations of three endangered species: Antioch Dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly.* 

along the northern Contra Costa County waterfront. The Refuge is home to the last remaining populations of the endangered Lange's metalmark butterfly and two endangered plants, the Antioch Dunes evening primrose and the Contra Costa wallflower. The butterflies require coastal dune habitat and rely on the plant communities that support Antioch Dunes evening primrose and Contra Costa wallflower. This habitat was once widespread in this portion of the Delta; however, it is now a tiny fraction of its former size due to sand mining and development dating back to the late 1800s.

After years of interagency collaboration and planning, the Port, in partnership with the Corps and the U.S. Fish and Wildlife Service (USFWS), began the Antioch Dunes Restoration Project (Restoration Project). USFWS is now reusing dredged sand to restore the dune habitat in an attempt to increase populations of the protected species. Since implementation activities began in 2013, the Restoration Project has successfully placed more than 90,000 cubic yards of sandy dredged material at the Refuge. In 2020, the first placement cell was completed and restoration of the second placement cell commenced. It is the first significant beneficial reuse of Stockton Deep Water Ship Channel dredged material for ecosystem restoration in this region. The success of this project is expected to result in future opportunities for beneficial reuse of dredged sediment for environmental enhancement purposes.

## Goals and Objectives

The purpose of the Restoration Project is to create both environmental and economic benefits by combining the annual Stockton Deep Water Ship Channel maintenance dredging effort with restoration of dune habitat that provides sanctuary to numerous endangered species.

### Re-Establishment of Dune Habitat for the Protection of Endangered Species

The first objective of the Restoration Project is to beneficially reuse clean sand to restore dune habitat for the endangered Lange's metalmark butterfly, Antioch Dunes evening primrose, and Contra Costa wallflower. The Refuge supports the last remaining populations of these three endangered species.

#### **ANTIOCH DUNES EVENING PRIMROSE**

A short-lived perennial plant with large white flowers. The primrose was federally listed as endangered in 1978. Its naturally occurring population is confined to the Refuge.



#### **CONTRA COSTA WALLFLOWER**

A yellow-flowered herbaceous plant that is a biennial or short-lived perennial. Like the primrose, the wallflower was listed as endangered in 1978.



#### LANGE'S METALMARK BUTTERFLY

This quarter-sized, burnt orange and black-and-white butterfly was one of the first insects to be listed as endangered under the Endangered Species Act in 1976. The Refuge is the only known home to the butterfly on the planet.



#### A New Placement Site for the Port

The second objective of the Restoration Project is to accept material hydraulically dredged by the Corps from the Stockton Deep Water Ship Channel. Dredging is critical to sustaining vessel access to the Port, and efficient and cost-effective dredged material placement sites enable maintenance dredging efforts to continue each year. The Restoration Project also allows the Port to meet two key environmental initiatives: finding environmentally beneficial reuses for dredged material and being faithful environmental stewards.

USFWS is allowing the Port to use its property for a placement site in return for the use of the clean sand dredged from the Stockton Deep Water Ship Channel. Prior to the Restoration Project, USFWS planned to haul sand to the Refuge via truck to accomplish restoration activities. By hydraulically placing sandy dredged material directly at the Refuge, the air and greenhouse gas emissions associated with trucking were avoided.

## Background

### Creation of the Refuge

In 1980, USFWS created the 55-acre Refuge as part of the San Francisco National Wildlife Refuge complex. The timeline on the next page details other key points in the history of the Antioch Dunes. It is the first and only national wildlife refuge in the United States created specifically for the preservation of plants and insects—the Antioch Dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly. The butterflies require coastal dune habitat and rely on the specific plant communities in which the evening primrose and wallflower also thrive. Another plant species that thrives in dune habitat, naked stemmed buckwheat, is the primary food source for the butterflies.

#### Interagency Collaboration for an Innovative Restoration Project

When the Port learned of the need for sand to re-establish dune habitat at the Refuge, it identified a unique but also challenging opportunity. Until recently, it has been difficult to get agency approval for beneficially reusing dredged material, especially for ecosystem restoration projects. The Port led collaboration efforts between the Corps, USFWS, the National Marine Fisheries Service, and the Central Valley Regional Water Quality Control Board. The end result was successful, with all of the agencies approving the Restoration Project.

The Corps is responsible for ensuring that the Stockton Deep Water Ship Channel is maintained to its authorized depth of 35 feet. Their role in the project is to coordinate with the dredging contractor to prepare the site and supply the hydraulically dredged material by way of a pipeline.

USFWS was able to find a free, ongoing source of suitable local sand as a means for restoring dune habitat at the Refuge. Before this interagency partnership was implemented, restoration efforts led by USFWS had stalled due to prohibitive material handling costs for the large volumes of sand required.







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# THE HISTORY OF ANTIOCH DUNES

## **1900**s

### - 140,000 years ago

The dunes were formed by deposits of glacial sands that were carried downriver from the Sierra Nevadas. Over thousands of years, ocean winds and bay tides slowly shaped the dunes that grew to 120 feet in height and stretched for two miles along the southern bank of the San Joaquin River. The San Francisco Earthquake and subsequent fires occurred in 1906 and the Antioch sand dunes played a critical role in rebuilding the city. Sand was taken from the dunes to mass produce bricks as San Francisco recovered from the devastating destruction. The Great Western Power Company – later acquired by PG&E – built a transmission line across the dunes.

## **1950**s

The City of Antioch bought land from the Stamm family and built a sewage treatment plant in the dunes.

## - **1980**s

The 55-acre Antioch Dunes National Wildlife Refuge was established and the first acquisition ever was made by the U.S. Fish and Wildlife Service specifically for the protection of plants and insects.

## **1990**s

PG&E donated 7,000 cubic yards of riverine sand to recreate new dunes and habitat for the endangered species. Native plants, including the primrose, wallflower and buckwheat were planted on the new dunes. Service personnel and volunteers counted 2,342 Lange's during the population peak count in 1999, the highest count on record.

## **- 1800**s

The Los Meganos Land Grant, later named Antioch, was awarded to Jose Noriega and settlers were encouraged to take up residence on the land grant. A brick factory was built in town and later a dairy, piggery, sheep fold and store were established at the dunes. A shipyard and vineyard were also located at the dunes.

## **- 1930**s

The western portion of the sand dunes as well as the vineyard was acquired by the Stamm family who proceeded to mine sand from the property for almost half a century. Various beaches, dance pavilions, wharfs and recreational cottages attracted visitors to the shore of the San Joaquin River – making Antioch Beach very popular. Lange's Metalmark Butterfly was discovered and the first specimens of Antioch Dunes evening primrose were collected.

## - **1970**s

Lange's Metalmark Butterfly was placed on the Federal Endangered Species List, along with the wallflower and primrose. The Antioch Dunes were designated as a "critical habitat."

## Today —

Two disjunct parcels (the Stamm and Sardis Units) contain sand dunes that vary from 0–50 feet high and make up the refuge. Due to the sensitivity of the habitat and the endangered species, the refuge is not open to unsupervised use by the public. However, refuge staff and local educators conduct on-site environmental education efforts through monthly guided tours and special events. Volunteers regularly assist refuge staff with habitat restoration projects and endangered species surveys.

The Port of Stockton, in partnership with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers are working collaboratively to aid in the restoration of the dunes and delicate ecosystem. Each fall the Delta is dredged to keep the shipping channel clear and the dredged material is rebuilding the dunes.



Construction underway at the Refuge.

## Methodology and Objectives

The Port, the Corps, and USFWS first implemented a pilot project to assess the feasibility of placing sandy dredge material at the Refuge in 2013. The pilot project revealed that the concept appeared to be a success, and the three agencies moved forward with planning for the more robust Restoration Project.

The Port worked closely with the Corps and USFWS to design a series of dredge material placement cells within the Refuge boundaries. Containment berms or levees were constructed to hold the dredged material within the cells and allow for sufficient dewatering before reuse. Working in the Refuge also presented unique environmental challenges not typically faced when establishing new traditional dredged material placement sites. Ordinarily, placement sites would be established in areas void of habitat for endangered species to avoid environmental impacts and ensure agency approval. As home to the endangered Lange's metalmark butterfly, Antioch Dunes evening primrose, and Contra Costa wallflower, the Refuge contains very sensitive habitat, which required significant coordination between all parties involved to ensure that there were no adverse environmental impacts.

Once the Restoration Project was permitted, USFWS crews carefully removed any endangered plants—and the naked stemmed buckwheat that is the primary food source for the butterflies—within the area that was to become the first placement cell for the sand. The plants were safely relocated to other areas within the Refuge.

Each year, during the Corps' annual maintenance dredging of the Stockton Deep Water Ship Channel, clean dredged sand is pumped into the placement cell. The amount of sand deposited annually depends on the amount of sedimentation that occurs within the Stockton Deep Water Ship Channel in areas near the Refuge. Construction of the first placement cell was completed in 2020 and the second placement cell has been used for dredged material placement since that time. As of 2022, sandy dredged material is still being placed in the second placement cell.

It is expected that implementation of the Restoration Project will continue into the foreseeable future, until the goal of restoring the Refuge to its original condition is realized. Dredged material could be available indefinitely; maintenance dredging occurs in several nearby locations each year. The site is now a thriving component of the Stockton Deep Water Ship Channel's maintenance dredging program.

## **Evaluation of Award Criteria**

#### Environmental Benefits, Beautification, and Community Involvement

The Restoration Project's primary environmental benefits are restoring the species and habitats of the Antioch Dunes in a manner that avoids regional air quality impacts while beneficially reusing dredged material.

The sand dune habitat within the Refuge originally formed during the glaciation period and was once widespread in this portion of the Delta. It is now a tiny fraction of its former size. Restoring and enhancing this habitat is important both ecologically and for beautification purposes. The Refuge holds a significant place in the public mind and is uniquely visible due to its heavily commercialized surroundings.

Prior to the concept of the Restoration Project, USFWS planned to haul sand to the Refuge by truck for restoration purposes. This method would have resulted in numerous truck trips from regional sand suppliers to the Refuge site, causing short-term air and greenhouse gas emissions from the trucking activities. By hydraulically placing sandy dredged material directly at the Refuge, the air and greenhouse gas emissions associated with trucking are completely avoided.

Beneficial reuse of dredged materials has many environmental, social, and economic benefits. Despite these benefits, most dredged material is still treated as a waste product rather than a valuable

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resource. Articles about the Restoration Project have been published in the *Contra Costa Times*, *Bay Nature*, local blogs, and industry publications. In September 2014, the Port worked with USFWS to design and construct an interpretive exhibit at the Refuge to outline the importance of the dune habitat to endangered species, as well as how sand is beneficially reused at the site. The Refuge also has a public interpretive center and trails that illuminate the history and importance of this dune ecosystem.

Increased public awareness of the environmental stewardship projects undertaken by governmental agencies contributes to the public's understanding of local ecosystems and can enable future public and private actions to produce similar environmental benefits.



Educational exhibit located at the Refuge.

#### Port Involvement

After identifying the opportunity, the Port's role in leading interagency collaboration was invaluable to the success of the Restoration Project. This was the first time the Port and USFWS partnered to restore habitat for endangered species through beneficial reuse of dredged material. Over the course of a decade, the Port conducted research at its placement sites in various locations throughout the Delta to support the conclusion that placement of dredged material from the Stockton Deep Water Ship Channel has no adverse impacts to the soil, groundwater, or surface water. In fact, the Port's research

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showed that groundwater quality underlying placement sites was improved as compared to surrounding areas. Even with this data in hand, several more years of regulatory agency coordination were required for the Port to work through agency concerns and obtain necessary approvals for the Restoration Project. Ultimately, negotiations were successful, resulting in a project with clear benefits to all the agencies involved.

The Port provided and continues to provide dredged material at no cost to the Refuge while meeting its responsibility of providing the Corps a placement site for Stockton Deep Water Ship Channel dredged material. In addition to saving money by avoiding fees associated with placing material at alternative nearby sites, the Port is also meeting key environmental initiatives with the Restoration Project: finding environmentally beneficial reuses for dredged material and continuing to be faithful environmental stewards.

#### **Creative Approaches**

This creative Restoration Project is a clear win for all agencies involved. The Port provided dredged material at no cost to USFWS, provided the Corps a location for dredged material placement, and met key Port environmental initiatives. The Restoration Project is the first significant beneficial reuse of dredged material from the Stockton Deep Water Ship Channel for ecosystem restoration that has occurred in this region.

#### **Proven Results**

More than 90,000 cubic yards of sandy dredged material have been placed on the site and used by USFWS to re-establish the extremely rare dune habitat since 2013, and the endangered species in that habitat are already showing improvement. The butterfly population, which was as low as 40 at one time, has recently grown to 78. The evening primrose has experienced a significant increase in numbers, and the wallflower and buckwheat are reappearing. Eventually, the Refuge hopes to re-establish Lange's metalmark butterfly on the western unit as well. The Restoration Project is expected to continue for at least a couple of decades until the Refuge's dune system is fully restored.

#### **Cost-Effective Solutions**

The Restoration Project benefits the economy by maintaining the Stockton Deep Water Ship Channel so that it is safe for ship transit and the efficient movement of goods. Although dredging and dredged

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material placement would likely have occurred without the Restoration Project, the Restoration Project decreased the overall costs of Stockton Deep Water Ship Channel maintenance dredging. The Port avoided the fees that are often charged for dredged material placement sites. USFWS also saved money by receiving the material at no cost versus paying to import sand via truck. The Restoration Project also increases the high regional profile and local interest in the Refuge. Local labor, materials, and equipment suppliers and operators were used for Restoration Project construction.

#### Transferability to the Port Industry

This ambitious effort to restore habitat for endangered insect and plant species is the largest dune habitat restoration project that has been conducted by USFWS. Success of this project is expected to increase future opportunities for reuse of dredged material for other environmental enhancement projects. The beneficial reuse of Stockton Deep Water Ship Channel dredged material at the Refuge provide critical reference data points that will be helpful for future beneficial reuse projects—both at the Refuge and at other locations—and will help to establish a precedent for similar projects in the future.



View of restored dunes along the Stockton Deep Water Ship Channel.