

22. RAVENSWOOD PONDS

US Fish and Wildlife Service (FWS)

VULNERABILITY SUMMARY

The Ravenswood Pond Complex is **moderately vulnerable** to sea level rise. If inundated, snowy plover habitat could be lost, and rising sea levels could reduce the flood reduction benefits provided. Adaptive capacity is high, as despite the potential loss of snowy plover habitat, other habitat benefits would remain, and the flood reduction and recreational uses on site could be adapted as well. Consequences of the loss of the pond complex could impact the region, with potential for permanent loss of wetlands and heavy costs to improve local protection of heavily used roads and other adjacent assets.

SENSITIVITY High	EXPOSURE Moderate	ADAPTIVE CAPACITY High	CONSEQUENCES High
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ASSET CHARACTERISTICS

Marsh Road | Menlo Park

Asset Description and Function:

The Ravenswood Pond Complex contains four managed seasonal ponds, earthen berms, the All American Canal, and fringe marshes outside of the berms. The former salt ponds now in the Don Edwards San Francisco Bay National Wildlife Refuge provide three benefits: habitat, recreation, and flood risk reduction. Ponds are normally dry except during rain, or when deliberately filled with water to control vegetation. The South Bay Salt Pond (SBSP) Phase 2 Restoration Project will restore tidal marsh in the outer pond and build up interior berms to protect snowy plover habitat. Adjacent to the Ravenswood Ponds is the Bedwell Bayfront Park, which is a closed landfill with a leachate and methane collection system, including a flare that burns the gas. The area also includes wastewater equalization basins owned by the West Bay Sanitary District. These are considered critical assets and impacts to these should be clarified in the future.



Asset Type	Wetlands (Managed ponds)
Asset Risk Class	N-Wetlands
Size	685 acres
Year of Construction	2003 (Purchased)
Elevation	5 feet
Level of Use	Typically filled during winter months
Annual O&M Cost	\$20,000 - \$50,000
Special Flood Hazard Area	N/A
Physical Condition	N/A
Landowner	US FWS
Underground Facilities	There are pipes underneath the ponds running parallel to the road, but the pipes are not associated with this asset.
Environmental Considerations	The ponds provide important nesting and foraging habitat for the endangered western snowy plover and other waterbirds; planned restoration actions will restore tidal marsh habitat and enhance remaining ponds to support a diversity of wildlife.



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ASSET SENSITIVITY

The sensitivity of the asset to inundation is high, as two feet of water level rise will flood all four ponds. Temporary flooding that occurs during snowy plover nesting season (April through August) would prevent them from nesting, as they depend on dry soils. Permanent flooding would therefore eradicate nesting sites. The fringe marshes can also be sensitive to high water, and if permanently overwhelmed, could be converted to tidal mud flat. The loss of wetland and marsh functions could affect the other benefits provided by wetlands, including water quality, and the flood risk reduction benefits of the ponds would be reduced, and the Bayshore Expressway and assets behind it have no other line of defense from high water on San Francisco Bay.

If all the berms in the complex were overtopped, the road could be inundated, affecting traffic in both directions. Recreational uses at the Ravenswood Complex have moderate sensitivity to temporary or permanent flooding, as flooding could reduce the abundance or diversity of waterfowl and shorebird species that has historically attracted birdwatchers, or it could reduce trail access. The future sensitivity of the site (given restoration) is moderate and will depend on the ability of sediment and tidal marsh accretion to keep up with sea level rise. Snowy plover nesting habitat will remain sensitive to future flooding, though other species and habitats may be less sensitive.

Aerial view of Ravenswood Ponds



SHORELINE VULNERABILITY

Shoreline Overtopping Analysis

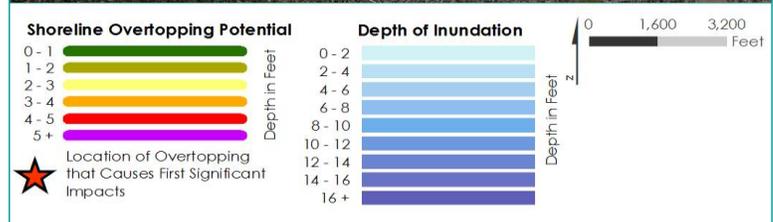
Ravenswood Slough, connected to San Francisco Bay, is the source of coastal flooding at the Ravenswood Ponds. When water surface elevations reach between 12 and 24 inches above the current mean higher high water (MHHW) level, the slough overtops the embankment at many low spots along the eastern portion of the site, indicated by the red stars on the map to the right, potentially creating a flow path through the asset and widespread flooding. No overtopping analysis has been performed on the existing berms or future levees to understand how they would perform during a storm.

First Significant Impacts: 24 inches above MHHW.



Cross-Cutting Vulnerabilities

The ability of the existing fringe marshes and future restored tidal marshes to keep up with sea level rise will depend largely on the Bay sediment supply, which is affected by many additional factors. All activities in this location depend on permits from multiple agencies (sometimes with competing objectives), which can make adaptation and restoration of the ponds' many functions and varied habitats challenging.



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SEA LEVEL RISE EXPOSURE ANALYSIS

Exposure Discussion

Exposure of the asset in its current state is moderate as it has never been overtopped, but it is subject to waves during high tides (and to potential breaches of the earthen berms) and is fully inundated under all three sea level rise scenarios (see maps on right). Once inundated, ponds would not drain because there is no natural drainage or any pumping. High groundwater tables may contribute to poor drainage on site, but there are no known instances to date of groundwater being the sole source of standing water. The outboard earthen berms along Pond R3 and R4 are higher than the land, and therefore prevent inland flooding of State Route 84 and the section of Bayshore (and everything behind it) between Marsh Road and State Route 84. Future inundation at the site could lead to exposure of the highway as well. Future restoration plans will restore Pond R4 to tidal marsh (the outermost pond) and raise the levee along the All American Canal, reducing tidal and wave action on Pond 3. It is expected that increased sediment will allow the marsh to accrete at pace to match sea level and the marsh will be successfully established. It is expected that the SBSP Phase 2 Restoration Project will raise levees to protect the snowy plover habitat in Pond R3 from flooding. The SAFER Bay project anticipates raising levees/berms along the Bayshore highway, which will reduce exposure of the highway and associated infrastructure to inundation.

Baseline Scenario: Asset inundated by 9 feet.



Mid-Level Scenario: 13 feet of water inundates asset.



High-End Scenario: Asset under 16 feet of water.



Exposure Analysis Results

Scenario	Potential Inundation Depth (feet)	
	Minimum	Maximum
First Significant Impacts (24 inches)	0	9
Baseline 1% Flood	0	9
Mid-Level 1% + 3.3 feet	0	13
High-End 1% + 6.6 feet	3	16

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ADAPTIVE CAPACITY, CONSEQUENCES, AND POTENTIAL ADAPTATION

Adaptive Capacity

Adaptive capacity of the asset's many functions varies and is high overall. There are additional options for western snowy plover nesting in the region, even if the local population could not nest here. Furthermore, the area can provide habitat benefits for a greater diversity of species, particularly as it converts to tidal marsh. To increase the ability of tidal marsh to adapt with sea level rise, the SBSP Phase 2 Restoration Project includes a proposal to build an artificial upland transition zone (30:1 slopes). It may be possible for the tidal fringe marshes, and tidal marsh created when the pond complex is breached, to accrete at a pace commensurate with sea level rise due to the expected sufficient sediment supply. This also enhances the adaptive capacity of the flood risk reduction benefits provided by the complex because marsh in front of the levees provides an additional line of defense from wave action and erosion of berms. Even with the loss of these, the Bayshore Expressway could also be protected with a flood wall or levee in the long-term. Recreational uses of the site are highly adaptive, as trails are easy to relocate and bird viewing options would likely remain.

Consequences

Environmental impacts to the asset would be high, given the potential for a loss of many functions provided by wetlands in general, including biodiversity and water quality benefits, and given local agencies' goals to restore significant tidal marsh in the San Francisco Bay. Wetland and marsh habitat is already limited in San Francisco Bay, and, if they do not accrete at a pace commensurate with sea level rise, it could be a major loss of an important habitat in the region. Direct economic impacts from damage to the site itself would be low, although if the berms were overtopped in a major storm and assets behind the pond complex (i.e., highway, bridge access, or businesses) flooded, this could cause considerable economic damages that have not yet been quantified. If the asset were permanently inundated, it would also be costly to build levees or other flood protection for the Bayshore Expressway and nearby assets behind the complex; levee construction costs millions of dollars per mile. If the site were lost, some public access and recreational uses could be lost as well, though the adjacent Bedwell Bayfront Park could absorb some of those and may still provide options for wildlife viewing from the property.

Additional Important Information

Nearby Bedwell Bayfront Park is regularly used for recreation due in large part to the bird viewing opportunities at the Ravenswood ponds. It may be possible for sea level rise to affect the landfill at Bedwell Bayfront Park either from the rising groundwater table, or by eroding and exposing part of the landfill, which could release waste materials into nearby waters. As part of the SBSP Phase 2 Restoration Project, future plans aim to improve the adaptive capacity of the Ravenswood Pond Complex to sea level rise. These plans include breaching the outermost pond to restore tidal marsh along the Bay and adding water control structures to manage water levels and improve circulation in the innermost ponds. The All American Canal levees will be improved to enhance flood protection and the remaining three ponds will continue to be managed for habitat—water birds and western snowy plover. Upland transition zones to buffer wave action and provide wetland migration space are also a part of the restoration project.

Asset-Specific Adaptation

Successfully preparing the SBSP for sea level rise is a complex task, and will include different approaches for different habitat types, such as snowy plover nesting habitat, duck pond habitat, and tidal marsh. To ensure a successful approach, the restoration project is designed to allow tidal marsh habitats to shift over time, and also incorporates an adaptive management approach, which allows for changes as needed based on detailed, science-based monitoring data.

Vulnerable Wetlands

This is the only Asset Vulnerability Profile on vulnerable wetlands in the County. The vulnerability assessment analysis shows that there are 7,242.9 acres of vulnerable wetlands in the project area.

Trail along the pond complex on a rainy day.

