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HAYWARD REGIONAL SHORELINE MASTER PLAN

FOR THE HAYWARD AREA SHORELINE PLANNING AGENCY (HASPA) part of a joint powers agreement of coh, hard and ebrpd

TASK 5 DRAFT DESIGN ALTERNATIVES DRAFT SUBMITTED 03/31/2020



EXECUTIVE SUMMARY

The Hayward Regional Shoreline Master Plan was commissioned in 2019 by the Hayward Area Shoreline Planning Agency. The Master Plan will serve as a guide to the protection of important features along the Havward shoreline that are vulnerable to sea level rise. The shoreline is home to critical urban infrastructure, including wastewater treatment plants, the San Mateo-Hayward Bridge (State Route 92) approach, and landfills. The project area also supports ecological bayland resources, hosts recreational opportunities along the San Francisco Bay Trail, and facilitates educational programming for adjacent residential neighborhoods and businesses. The Master Plan will develop various multi-benefit strategies for the shoreline, its existing infrastructure, and the surrounding natural habitat.

In accordance with the scope of work outlined for Task 5 – Draft Master Plan, the Project Team has prepared a "Design Alternatives Report". The Project Team has considered the full project area of the Hayward Regional Shoreline Master Plan, stretching nearly four miles from San Lorenzo Creek south to State Route 92, to produce three comprehensive Design Alternatives to help the shoreline adapt to climate change.

Each Design Alternative proposes a suite of projects and interventions that would ultimately meet the project goals while reducing risk and enhancing the ecological value of the Hayward Shoreline. The Project Team does not assume that one of the alternatives will be selected for further analysis in the final Master Plan but rather anticipates that discrete elements and projects from each alternative will be combined into a hybrid preferred alternative.

This report provides HASPA and stakeholders with the opportunity to compare the design alternatives to one another in order to inform the preferred alternative selection process.

Document Summary

Introduction

This section summarizes the Design Alternatives Selection process. It also presents the Master Plan Assumptions that guide the design and planning process.

Design Alternatives

Based on stakeholder and client feedback, three design alternatives were identified that combine a suite of adaptation strategies that were identified as part of Task 4. The spatial configuration and selection of strategies will be evaluated through these three alteratives and refined based on further client and stakeholder feedback. After the three alternatives are evaluated, a preferred hybrid Preferred Alternative will be selected based on the preferred combination and selection of adaptation strategies.

Evaluation Points & Comments

This section outlines the evaluation criteria that help compare the three design alternatives. It also provides worksheets to record consolidated client and stakeholder feedback.

We invite you to use the worksheets to consolidate your feedback and comments on the three Design Alternatives.



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INTRODUCTION



MASTER PLAN PROCESS

In accordance with the scope of work outlined for Task 4 – Goals and Policies and Adaptation Strategies and Implementation Actions, the Project Team has prepared an Adaptation Report for the study, producing a catalog of potential design strategies to help the shoreline adapt to climate change. The feasibility and applicability of these strategies as outlined in the report considered each strategy in isolation from every other strategy. As part of Task 5 - Design Alternatives, and based on client and stakeholder feedback, the strategies were combined into three comprehensive Design Alternatives. The Project Team does not assume that one of the alternatives will be selected for further analysis in the final Master Plan but rather anticipates that discrete elements and projects from each alternative will be combined into a hybrid preferred alternative. The Preferred Alternative will then be further analyzed and specific projects will be identified as part of the final Master Plan.

Design alternatives selection process:



SCAPE

DESIGN ALTERNATIVES SELECTION PROCESS

Based on stakeholder and client feedback, the Project Team has identified three Design Alternatives that represent a balanced approach to mitigate the effects of Sea Level Rise to the Hayward Shoreline. Although considered, a full perimeter protection at the bay's edge and a full retreat scenarios were discarded because of cost implications, permitting and feasibility challenges, and lack of overall support. The Project Team focused on developing three balanced alternatives that were informed by a wide variety of client and stakeholder feedback. Those three alternatives are presented in this report.



PROJECT GOALS

PROJECT STATEMENT:

The Hayward Regional Shoreline Master Plan creates a framework for resilience to prepare for sea level rise (SLR), groundwater intrusion, and storm surge. The Master Plan is being managed by the Hayward Area Shoreline Planning Agency (HASPA), a joint power authority including the City of Hayward, Hayward Area Recreation and Park District (HARD), and East Bay Regional Park District (EBRPD).

The Hayward Regional Shoreline Master Plan project area is bounded on the north by the Bockman Channel (also called the Bockman Canal) and extends approximately 3.25 miles south to the State Route 92 San Mateo Bridge approach. The extent of the project area into the Bay was defined by the outermost limit of the Hayward Area Shoreline Planning Agency Jurisdictional boundary, and the inland extent of the project area are drawn at the Union Pacific Rail Corridor. In total, the project area covers six square miles of various land uses, including open space, urban infrastructure, industrial, and residential.

The project area supports ecological bayland resources, hosts recreational opportunities along the San Francisco Bay Trail, and facilitates educational programming for adjacent residential neighborhoods and businesses at the Hayward Shoreline Interpretive Center. The shoreline is also home to critical urban infrastructure, including wastewater treatment plants, the San Mateo-Hayward Bridge approach (State Route 92), and landfills. The Master Plan will develop various multi-benefit strategies for the shoreline, its existing infrastructure, and the surrounding natural habitat. The Master Plan will consider multiple planning time horizons and sea level rise scenarios. Additionally, it will consider a range of adaptation strategies that can evolve and respond over time to changing sea levels.

The Shoreline Master Plan encompasses four goals.

PROJECT GOALS

Create a Resilient Shoreline Environment for People and Ecology

- Enhance the shoreline's ecological value and adapt to sea level rise
- Enhance recreational opportunities and adapt to climate change
- Create a management framework for adapting to sea level rise over time
- Provide refuge to help endangered shoreline species to adapt climate change

Enhance the Shoreline Environment to Reduce Risk to Critical Infrastructure and Built Assets

- Align with and enhance existing management and capital improvement plans
- Reduce risk to regional critical utilities from sea level rise, groundwater intrusion, and flood events
- Reduce risk to transportation infrastructure from sea level rise, groundwater intrusion, and flood events
- Reduce risk to agency assets such as the San Francisco Bay Trail and marsh restoration project(s)

Build Social Resilience in the Community

- Promote social equity, environmental justice, and public health
- Preserve the local economy and increase resilience to climate change
- Prevent the disruption of key community services

Build Capacity for Future Generations to Adapt to climate change

- Build organizational and community capacity
- Provide a place for education, interpretation and understanding of the shoreline and climate change
- Foster stewardship of the shoreline's cultural and ecological resources

MASTER PLAN ASSUMPTIONS

Overarching Assumptions

The Master Plan Assumptions will help inform the planning process moving forward. They summarize client and stakeholder feedback and set a framework to generate and compare the Design Alternatives.

- The plan assumes **little change to the urban fabric** (streets, buildings), **economy**, **land use, and critical built infrastructure** on the site over the planning horizon.
- The plan is considering a **perimeter protection approach to critical assets** and an **adaptation approach to shoreline ecosystems.**
- Non-structural strategies, such as retreat and land elevation, are not articulated in this plan, although they will be layered on to further reduce risk, and would likely be required to adapt to a higher SLR scenario long-term.
- The intent is to reduce risk to critical assets from daily tidal inundation up to 4' of SLR on top of the current mean higher high tide.
- For evaluation purposes of the line of protection, the Design Alternatives consider at a **target elevation of 14.3''** (NAVD 88)

SLR	MHHW + SLR	MHHW + SLR + 100 YEAR STORM	MHHW + SLR + 100 YEAR STORM + 2' FREEBOARD	MHHW + SLR + 500 YEAR STORM
0′	7′	10.3′	12.3′	11.3′
2′	9′	12.3′	14.3′	13.3′
4′	11′	14.3′	16.3′	15.3′
7′	14'	17.3′	19.3′	18.3′

• The plan is based on adapting the project area over a **mid-range time frame**. Based on State guidance this time frame is estimated to be between 50 and 60 years long.

Table 8: Sea level rise increments by time horizon and level or risk aversion, based on the California Coastal Commission recommendations.

			17% Prob. SLR meets or exceeds	5% Prob. SLR meets or exceeds	0.5% Prob. SLR meets or exceeds	
# Years from now	Year	Identifies areas that	Low Risk Aversion	Medium Risk Aversion	Medium High Risk Aversion	
10	2030		0.5		0.8	
20	2040	are at immediate flood	0.8	1.0	1.3	
30	2050	T SATA	1.1	1.4	1.9	Up to 2 ft
40 50 50 60	2	070 risk 080	1.9	2.4	3.5 4.5	Up to 4.5 ft
60	2080		7.4	10 .	4.5	Up to 4.5 ft
70	2090	Will be potentially			5.6	
80	2100	flooded			6.9	Up to 7 ft
					7.3	
					8.6	



MASTER PLAN ASSUMPTIONS

Site Assets & Planning Assumptions

This is table summarizes Master Plan and planning assumptions for key shoreline assets.

	ASSET	PLANNING ASSUMPTION
WASTEWATER INFRASTRUCTURE	Oro Loma WWTP	Remain in place
	Hayward WWTP	Remain in place
	Wastewater Wet Weather Storage	Maintain critical uses
	Biosolids Management, Aging, Drying	Maintain critical uses
	Solar Field	Maintain critical uses
	EBDA Pipeline	Adapt - decommission over time
	SR-92 Bridge Landing	Remain in place / adapt
TRANSPORTATION	Union Pacific Rail Corridor	Remain in place
INFRASTRUCTURE	Street Grid	 Maintain access to industrial zone from inland roads Maintain ingress and egress to surrounding residential neighborhoods
	Transmission Lines	Adapt / Relocate
ENERGY	Jet Fuel Pipeline	Remain in place - avoid disturbing function and use
MINASINGCIONE	Natural Gas Pipeline	Remain in place - maintain access
COMMUNICATION INFRASTRUCTURE	Fiber Optics	Remain in place - avoid disturbing function and use
BUILDINGS & LAND USE	Industrial Land Use	Remain in place- reevaluate at 4' SLR
RECREATIONAL INFRASTRUCTURE	Bay Trail	 Adapt / relocate Connect through the site north-south Access the Interpretive Center Connect to trail heads and parking areas Maximize blue water experience
	Hayward Shoreline Interpretive Center	 Adapt and decommission over time Relocate Ensure vehicular and pedestrian access and parking Locate along the Bay Trail Locate in proximity to educational opportunities that won't be inundated
	San Lorenzo Community Center Park	 Adapt and decommission over time Relocate Ensure vehicular and pedestrian access and parking
	Existing Tidal habitat + Hayward Marsh Restoration	Adapt to 4' SLR
HABITATS & ECOSYSTEMS	Muted & Managed Marsh	 Adapt or preserve Salt Marsh Harvest Mouse preserve Adapt or preserve endangered species habitat
	Salt Ponds	Adapt / relocate
	Seasonal Wetlands	Adapt / relocate
	Mudflats	Enhance
LANDFILLS	Alameda County & West Winton Landfills	Remain in placePrevent erosion and seepage

EVALUATION POINTS

In relation to the project goals and in order to help evaluate and compare the three Design Alternatives, the Project Team has defined a list of evaluation points that highlight key elements of the Shoreline Master Plan.

Line of Protection

• The line of protection includes a FEMA-certified levee that will reduce risk to inland communities by buffering the shoreline to the impacts of sea level rise and storm surge. The spatial alignment of this levee has multiple implications on cost, maintenance, and what is in or out of the new flood protection infrastructure.

Tidal Habitat

• The future extent of tidal habitat encompasses tidal habitat and muted tidal habitat, which is a controlled system. The spatial extent of connective blocks of marsh and proportion of tidal versus muted tidal habitat varies amongst the three alternatives.

Erosion Control

• A layered strategy of erosion control aims to reduce the risk of erosion and shelter inland marshes and ecosystems. Gravel beaches attenuate waves and provide shorebird nesting habitat and revetments provide a more conservative approach to edge stabilization for critical infrastructure.

Stormwater Management

• Once a line of protection is established, the stormwater and groundwater management inland of the levee system is critical, especially with increased precipitation events and to mitigate impacts of any bathtub effects that are created. A system of detention ponds, tide gates and water control structures, and flood control channels are used to manage stormwater and move it away from inland communities.

Wastewater Treatment

• The critical uses of wastewater treatment are maintained or enhanced with new multi-benefit infrastructure. Horizontal levees align with the First Mile project and possible future needs for local discharge.

<u>Bay Trail</u>

• The future location of the Bay Trail prioritizes the blue water experience where possible, maintains a variety of experiences, and aligns with new infrastructure improvements. For all three alternatives, the current alignment of the Bay Trail will be maintained as long as possible (until it is inundated with sea level rise) and connect to the realignment.

Hayward Shoreline Interpretive Center Relocation

• The future of the Hayward Shoreline Interpretive Center is connected to new infrastructure improvements. A variety of options are explored that locate the center in proximity to new educational opportunities. All three alternatives maintain a link to the Bay Trail.



NON-STRUCTURAL STRATEGIES

NON-STRUCTURAL STRATEGIES

A suite of overarching non-structural adaptation strategies will layer onto the preferred Shoreline Master Plan scenario and are separate from the Design Alternatives Analysis. The non-structural strategies outlined below will be further developed in the Master Plan document once a preferred alternative has been defined.

Groundwater Strategies

- Groundwater flooding has three general mitigation strategies- retreat, elevate land, or drain
- The three design alternatives will rely on drainage / pumping to manage groundwater
- A subsurface drainage network would help drain groundwater to collect in detention ponds where it can then be pumped to the Bay

Educational Programs

- The Hayward Regional Shoreline has a unique diversity of ecosystems and built infrastructure that presents a variety of opportunities for education and stewardship
- With new infrastructure improvements, such as an ecotone levee, educational programs are a critical layer to engage people in their shoreline and recreational assets in the future

Building Level Adaptation

- With new construction or retrofits, building scale strategies can be implemented to adapt to sea level rise
- Improving standards such as building codes and removing regulatory impediments
- The City can aid businesses and homeowners to assist them with understanding the resilience options available to them and with finding the funding to support these options

Long-term Strategic Relocation

- The relocation of buildings and critical infrastructure from vulnerable coastal areas upland reduces flood hazard risk and provides the opportunity to restore natural areas along the shoreline that provide a buffer for inland communities
- Strategic relocation is not supported for the Master Plan mid-range time frame, however, if a greater extent of sea level rise is experienced, it will be explored in the future

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3D VISUALIZATION EXISTING CONDITIONS

EXISTING CONDITIONS

ORO LOMA MARSH



SCAPE

San Lorenzo Community Center Park

Recently improved. Phase 2 to start construction in 2020

Oro Loma Marsh Existing tidal habitat

> Union Pacific Rail Corridor At risk of inundation

EXISTING CONDITIONS

ALAMEDA COUNTY LANDFILL



Frank's East Existing diked Bayland

Industrial Neighborhood

Vulnerable to Bay inundation and groundwater emergence with SLR

Alameda County Landfill

In the process of being capped. Has a liner on the lower western and northern edges. Future use will be a solar field.

EXISTING CONDITIONS

COGSWELL MARSH



800' width



EXISTING CONDITIONS

HARD MARSH



Bay Trail





Diked Bayland with least tern nesting mounds



Salt Marsh Harvest Mouse Preserve Muted tidal habitat



DESIGN ALTERNATIVES



#1: CLOSER TO THE BAY



#1: CLOSER TO THE BAY

This alternative looks at an alignment for the line of protection that reduces risk for a larger portion of the shoreline with a more conservative line of protection aligned closer to the Bay.

In the north end of the project area, the line of protection ties back along the San Lorenzo Creek channel and wraps in front of Oro Loma WWTP to protect it in place. It then cuts through the middle of Oro Loma Marsh and ties back to high ground at the two existing landfills. In the south, the alignment then follows the western edge of the oxidation ponds and cuts immediately south through Hayward and HARD Marsh. A raised access road along SR-92 ties back to high ground at the intersection of Clawiter Road.

This line of protection transforms existing tidal marsh into a muted system, which will be harder to manage with rising sea levels and subsiding land.

The assumed planning elevation for the line of protection is 14.3' NAVD88. The final design flood elevation will require further study and cost analysis.



#1: CLOSER TO THE BAY

LINE OF PROTECTION

The line of protection aligns closer to the Bay's edge to reduce risk to a greater extent of inland assets and reduce the linear feet of levee and associated construction costs. The assumed planning elevation for the line of protection is 14.3' NAVD88. The final elevation will require further study and cost analysis- this elevation will be used for planning purposes only.

Line of protection at the Bay's edge -

PROS

CONS

- Shortest distance
- Cheapest

- Power Lines on top of a levee
- Cuts Oro Loma Marsh in half

Ecotone Levee —

PROS

- Shortest distance
- Cheapest cost
- Protect Hayward Shoreline Interpretive Center

Levee Raising –

SR-92 Options ——

- Elevate in place
- Levees on either side
- Flood walls on either side

<u>CONS</u>

Cuts existing tidal habitat in half

SCAPE


TIDAL HABITAT

This tidal habitat configuration favors active management of ecosystems through the muting of marshes inland of the line of protection, while a band of tidal habitat exists outboard of the line of protection. This option presents important permitting and regulatory challenges around the impacts to exiting tidal marsh habitat. Additionally, muted marshes provide less ecosystem and wildlife benefits than tidal marshes, and will be harder to manage with rising sea levels and subsiding land.

Half of Oro Loma Marsh becomes muted -

<u>CONS</u>

- Existing tidal marsh becomes muted
- Muted marsh will be harder to manage with SLR
- Impacts to existing tidal habitat
- Regulatory issue

Ecotone levee aligns within Cogswell Marsh then to the south

PROS

• Some high marsh habitat is maintained with SLR

CONS

- Existing marsh becomes muted
- Impacts to existing habitat
- Regulatory issue

Expanded Salt Marsh Harvest Mouse Preserve -

PROS

• Maximize muted tidal habitat for Salt Marsh Harvest Mouse

CONS

- Existing tidal marsh becomes muted- regulatory issue
- Impacts to existing tidal habitat
- Muted marsh will be harder to manage with SLR



EROSION CONTROL

This alternative proposes a layered system of erosion control measures using gravel beaches that reduce the risk of erosion to levees that shelter the marshes behind. Revetments along the two landfills help to reduce the risk of erosion and seepage.

Gravel beaches in front of all marshes

PROS

• Gravel beaches provide habitat

CONS

- Beaches in front of all marshes requires a numerous groins to preserve existing breaches
- Cost
- Maintenance / replenishment

Cost of sheet pile is a concern for the City

Revetment and sheet piles along landfill edge with the Bay Trail

PROS

CONS

- Increased erosion protection to the landfill
- Possibility to incorporate rocky habitat to enhance ecological value



STORMWATER MANAGEMENT

There is a great need for stormwater and groundwater management inland of the new line of protection to reduce the risk of flooding with increased precipitation events and reduce any bathtub effect impacts. Providing storage capacity to temporally hold large volumes of water before it is discharged into the Bay is an important aspect of the Master Plan. As the Plan moves forward, additional studies will be required to assess the volume needed in relation to the hydrology of the area. If gravity flow discharge in not feasible, pumping stations will be required, which can be extremely costly to maintain and operate.

This alternative presents inland detention ponds that collect and hold stormwater before it is discharged to the Bay. This alternative provides the greatest storage capacity.

Dual Salt Pond / Stormwater Detention

PROS

- Provides historic salt pond habitat
- Large area for stormwater storage
- Along Sulphur Creek, a natural drainage area
- May enhance bird habitat- the birds seem to prefer fresh water over salt water

Dual Salt Pond / Stormwater Detention

PROS

- Provides historic salt pond habitat
- May enhance bird habitat- the birds seem to prefer fresh water over salt water

CONS

• Stormwater may impact habitat and flood breeding colonies

CONS

- Not directly adjacent to substantial flow from a flood control channel
- Stormwater may impact habitat and flood breeding colonies



WASTEWATER TREATMENT

This Alternative presents the smallest local discharge opportunity. Critical wastewater treatment functions are maintained and enhanced at Oro Loma WWTP with a horizontal levee that outlets effluent to Oro Loma Marsh. All of Hayward WWTP's functions and storage capacity are maintained.

Horizontal Levee

PROS

- Discharge some of Oro Loma WWTP's effluent
- Provides transition slope

<u>CONS</u>

- Potential impacts to current habitat
- Would require filling in part of Oro Loma Marsh
- Mosquito abatement regulatory issues

Maintain current use and capacity of Wastewater Wet Weather Storage ponds

PROS

<u>CONS</u>

- Loss of potential space for other uses
- storage capacity

Maintain wet weather equalization

- Maintain biosolids drying / management
- Maintain solar fields



BAY TRAIL

With this alternative, the Bay Trail is aligned closer to blue water where possible and connected to new infrastructure improvements. The trail also traverses a variety of Bay habitat types. A phased realignment of the trail will maintain its existing alignment and connect to the new alignment until it is inundated.

Bay Trail realigns through the middle of Oro Loma Marsh

<u>PROS</u>

Closer to the Bay

CONS

• Loss of blue water experience

• Marsh habitat experience

Living revetment education trail -

PROS

- Along the Bay's edge
- Raised levee protects landfill
- Educational component

<u>CONS</u>

• Proximity to landfill

Links to the Interpretive Center -

<u>PROS</u>

<u>CONS</u>

 Raised along FEMA levee to decrease flood risk • Cuts off existing marsh



HAYWARD SHORELINE INTERPRETIVE CENTER

Located behind the line of protection, the Hayward Shoreline Interpretive Center is protected in place. An ecotone levee in immediate adjacency to the center presents opportunities for education programming related to future restoration and adaptive management projects.

Access road is elevated in place -

PROS

<u>CONS</u>

•

- Reduced risk of flooding
- Potential to tie into CalTrans improvements

Interpretive Center is protected in place

PROS

CONS

- Interpretive Center is protected in place
- Ecotone levee related educational opportunities

• Direct visual connection to the Bay is lost

May impact existing marsh habitat



ORO LOMA MARSH



Line of Protection / Ecotone Levee / Bay Trail Aligns through the middle of Oro Loma Marsh, wraps sludge ponds



Tide Gate Controls tidal flow to muted tidal habitat inland of the line of protection

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ALAMEDA COUNTY LANDFILL



Living Revetment / Bay Trail Outboard levee of Alameda County landfill



Frank's East Salt Pond / Stormwater Detention pond

Levee raising

COGSWELL MARSH



Wastewater Wet Weather Storage

Storage capacity is maintained

Line of Protection / Ecotone Levee / Bay Trail Built outboard of existing oxidation pond levee into Cogswell Marsh

HARD MARSH









This alternative looks at an alignment that balances risk reduction and ecological enhancement with a line of protection that runs through the middle of the shoreline area.

The line of protection is pulled back in the north along the Union Pacific Rail Corridor and ties back to high ground at the San Lorenzo Creek channel. It then ties back to high ground at the two existing landfills and follows the western extent of the oxidation ponds to the south. The alignment pulls back in the southern portion of the site and cuts through the middle of the Salt Marsh Harvest Mouse Preserve, then ties back along a new levee along the access road for SR-92.

This alternative maintains a larger extent of tidal habitat, while still reducing risk to critical infrastructure.

The assumed planning elevation for the line of protection is 14.3' NAVD88. The final design flood elevation will require further study and cost analysis.



LINE OF PROTECTION

In this alternative, the line of protection balances risk reduction and ecological enhancement through an alignment that follows the middle of the shoreline. The assumed planning elevation for the line of protection is 14.3' NAVD88. The final elevation will require further study and cost analysis- this elevation will be used for planning purposes only.

Oro Loma perimeter protection				
PROS		С	CONS	
•	Protects existing sludge ponds and WWTP infrastructure	•	Oro Loma WWTP not protected with line of protection	
		٠	Access to Oro Loma WWTP will be inundated	
E	Ecotone Levee			
PROS		С	CONS	
•	Medium distance ecotone levee	•	Mosquito abatement issues	
•	Aligns with First Mile project	٠	Footprint of levee may impact existing marsh habitat	

Ecotone Levee aligns within the oxidation ponds —

PROS

• Ecotone levee aligned within the oxidation ponds preserves marsh habitat

CONS

- Ecotone levee aligned within the oxidation ponds leads to a loss of wastewater wet weather storage capacity
- Mosquito abatement issues
- Footprint of levee may impact existing marsh habitat

SR-92 Options -

- Levees on either side
- Flood walls on either side



TIDAL HABITAT

A larger extent of tidal habitat is enhanced outboard of the line of protection. Through marsh management and sediment placement, the shoreline's ability to accrete sediment is increased

Ecotone levee is aligned within the oxidation ponds -

PROS

Preserves Cogswell Marsh habitat

CONS

• Reduces storage capacity at Wastewater Wet Weather Storage ponds

Maximize amount of connected tidal habitat-

Salt Marsh Harvest Mouse Preserve is cut in half -

PROS

• May help half of the Salt Marsh Harvest Mouse Preserve to accrete more tidal sediment

CONS

- Impacts to existing tidal habitat
- Regulatory issue



EROSION CONTROL

This alternative presents a layered system of erosion control measures using gravel beaches that reduce the risk of erosion to levees that shelter the marshes behind. Revetments along the two landfills to reduces the risk of erosion and seepage.

Revetment and sheet pile along landfill edge

PROS

CONS

- Increased erosion protection for the landfill Cost of sheet pile is a concern for the City
- Possibility to incorporate rocky habitat

Gravel beaches in front of all marshes

PROS

• Gravel beaches provide habitat

<u>CONS</u>

- Beaches in front of all marshes requires a numerous groins to preserve existing breaches
- Cost
- Maintenance / replenishment



STORMWATER MANAGEMENT

There is a great need for stormwater and groundwater management inland of the new line of protection to reduce the risk of flooding with increased precipitation events and reduce any bathtub effect impacts. Providing storage capacity to temporally hold large volumes of water before it is discharged into the Bay is an important aspect of the Master Plan. As the Plan moves forward, additional studies will be required to assess the volume needed in relation to the hydrology of the area. If gravity flow discharge in not feasible, pumping stations will be required, which can be extremely costly to maintain and operate.

In this alternative, inland detention ponds are utilized to hold stormwater before it is pumped to the Bay.

Dual Salt Pond / Stormwater Detention

PROS

- Provides historic salt pond habitat
- Large area for stormwater storage
- Along Sulphur Creek
- Enhances bird species habitat- the birds seem to prefer fresh water over salt water

CONS

• Stormwater may impact habitat and flood breeding colonies

Dual Salt Pond / Stormwater Detention

PROS

- Provides historic salt pond habitat
- Large area for stormwater storage
- May enhance bird species habitat- the birds seem to prefer fresh water over salt water

CONS

- Stormwater may impact habitat and flood breeding colonies
- Not directly adjacent to a flood control channel



WASTEWATER TREATMENT

Critical wastewater treatment functions are maintained and enhanced at Oro Loma and Hayward WWTP's with horizontal levees that outlet effluent to Oro Loma and Cogswell Marsh. Most of Hayward WWTP's existing function and storage capacity is maintained.

Horizontal Levee only along Union Pacific Rail Corridor

PROS

CONS

- Discharge some effluent from Oro Loma
- Aligns with First Mile project
- Provides transition slope

- Potential impacts to current habitat
- Would require filling in part of Oro Loma Marsh
- Mosquito abatement regulatory issues

Most of the Wastewater Wet Weather Storage ponds to remain

Horizontal Levee built into the oxidation ponds ______ for Hayward WWTP local discharge

PROS

• Local Discharge for Hayward WWTP

<u>CONS</u>

- Loss of Wastewater Wet Weather Storage space with ecotone slope built into them
- Mosquito abatement regulatory issues
- Hayward WWTP is not currently planning for the level of treatment that may be required to discharge into protected species habitat



BAY TRAIL

The Bay Trail is aligned to promote a diversity of experiences while reducing the risk of flooding. A phased realignment of the trail will maintain its existing alignment and connect to the new alignment until it is inundated.

Aligns to the back of Oro Loma Marsh and Alameda County Landfill -

CONS

- Further from the Bay
- No blue water experience

Bay Trail is elevated on structure

PROS

- Alignment is closer to the Bay and • provides a direct marsh experience
- Pulled away from wastewater treatment uses Existing bridge is only at 9.75' elevation ۲

CONS

- Costly to maintain bridges outside the line of protection

Spur to the Interpretive Center


HAYWARD SHORELINE INTERPRETIVE CENTER

The Hayward Shoreline Interpretive Center is adapted in place through the elevation of the building itself or retrofit to a floating structure. Its location within a marsh maintains direct connection to shoreline ecosystems.

Access road is elevated in place -

PROS

- Reduced risk of flooding
- Potential to tie into CalTrans improvements

Interpretive Center becomes elevated / floating in place -

PROS

<u>CONS</u>

• Closer to the Bay- maintain marsh connection

• Building elevation may be costly

SCAPE



ORO LOMA MARSH





Line of Protection / Ecotone Levee / Bay Trail

Aligns along the Union Pacific Rail Corridor in the back of Oro Loma Marsh

ALAMEDA COUNTY LANDFILL



Outboard of Alameda County landfill to reduce erosion

Frank's East Salt Pond / Stormwater Detention pond

Levee raising

Bay Trail Aligns behind Alameda County Landfill

COGSWELL MARSH



Raised on piles in existing alignment

Wastewater Wet Weather Storage Storage capacity is reduced with levee construction

Line of Protection / Ecotone Levee / Bay Trail

Built inland of existing oxidation pond levee into the oxidation ponds

HARD MARSH









This alternative explores an alignment that is pulled the furthest inland to maximize ecological restoration along the shoreline and layer risk reduction infrastructure.

In the north, the line of protection is pulled back along the Union Pacific Rail Corridor and ties back to high ground at the San Lorenzo Creek channel. It then aligns to the eastern edge of Frank's East and ties back to high ground at the two existing landfills. It is pulled to the east of the oxidation ponds and follows the eastern extent of the diked Baylands to the south before tying back to high ground with a levee parallel to SR-92 along Clawiter Road.

This alternative prioritizes a larger extent of connected tidal habitat that is Bayward of the line of protection and incorporates ecological and risk reduction infrastructure along a wider extent of Baylands.

The assumed planning elevation for the line of protection is 14.3' NAVD88. The final design flood elevation will require further study and cost analysis.



LINE OF PROTECTION

In this alternative, the line of protection moves inland, opening a larger extent of shoreline for ecological restoration. The assumed planning elevation for the line of protection is 14.3' NAVD88. The final elevation will require further study and cost analysis- this elevation will be used for planning purposes only.

Oro Loma perimeter protection ———	
PROS	CONS
 Protects existing sludge ponds and WWTP infrastructure 	 Oro Loma WWTP not protected with line of protection
	Access will be inundated
Oro Loma sludge ponds restored to marsh	
Ecotone Levee wraps the east of Oro Loma Marsh and Frank's East	
PROS	CONS
Increase effluent discharge	Longer distance
	More cost
Levee raising	
PROS	CONS
Multi-step layered protection	Building 2 levees costs more
Solar fields were raised	
Line of protection moves to the east of the oxidation ponds	
PROS	CONS
Line of protection further inland	 Minimal space between Line E and the oxidation ponds for levee construction

SR-92 Option

• Rebuilt as a causeway



TIDAL HABITAT

In the most expansive tidal habitat system, connectivity is restored between existing and restored marshes. Through marsh management and sediment placement, the shoreline's ability to accrete sediment is also increased.

Breach at Bockman Channel —

- PROS
- Tributary connection to Baylands

CONS

• Bockman water quality may impact marsh health

Fringe marsh restoration

PROS

• Fringe marsh may buffer landfill

<u>CONS</u>

• May be hard to restore fringe marsh

Breach into Triangle Marsh

PROS

 Breaching into Triangle Marsh may help it accrete more tidal sediment

CONS

- Breaching into Triangle Marsh may impact landfill protection
- Impacts to existing habitat

Transition Salt Marsh Harvest Mouse Preserve to tidal habitat-

PROS

- Maximize muted tidal habitat that could be maintained with SLR
- Large, connected tidal habitat system
- Connection to Eden Landing
 through causeway

CONS

- Impacts to existing Salt Marsh Harvest Mouse Preserve habitat
- May be a regulatory issue



EROSION CONTROL

A layered system of erosion control measures utilizes gravel beaches that reduce the risk of erosion to levees that shelter the marshes behind. Revetments along the two landfills to reduces the risk of erosion and seepage.

Gravel beaches in front of all marshes

PROS

• Gravel beaches provide habitat

<u>CONS</u>

- Beaches in front of all marshes requires a numerous groins to preserve existing breaches
- Cost
- Maintenance / replenishment

Gravel beach and fringe marsh restoration to reduce risk to landfill -

PROS

• Gravel beach provides an additional layer of protection for the landfill

Revetments and sheet pile along landfill edges -

PROS

CONS

- Increased erosion protection to the landfill
- Possibility to incorporate rocky habitat
- Full perimeter protection is more expensiveCost of sheet pile is a concern for the City



STORMWATER MANAGEMENT

There is a great need for stormwater and groundwater management inland of the new line of protection to reduce the risk of flooding with increased precipitation events and reduce any bathtub effect impacts.

In this alternative, no detention space is proposed, which could lead to flooding impacts or require constant pumping from the flood control channels to the bay.

No additional stormwater storage space

<u>CONS</u>

- No capacity to mitigate increased precipitation and groundwater impacts
- Need to manage stormwater inland of a line of protection

Dual Salt Pond / Stormwater Detention

PROS

- Provides historic salt pond habitat
- May enhance bird species habitat- the birds seem to prefer fresh water over salt water

<u>CONS</u>

- Very small area in comparison to future need
- Stormwater may impact habitat and flood breeding colonies



WASTEWATER TREATMENT

Critical wastewater treatment functions are maintained and enhanced at Oro Loma and Hayward WWTP's with horizontal levees that outlet effluent to Oro Loma and Cogswell Marsh. This alternative assumes that EBDA is decommissioned. This allows for a freshwater treatment marsh in the former wet weather equalization ponds at Hayward WWTP to facilitate local discharge to Cogswell marsh. The level of protection for the open water treatment wetland, solar fields, and biosolids ponds is not addressed at this time and will be investigated as part of the preferred alternative.

Horizontal Levee wraps the back of Oro Loma Marsh and Frank's East

PROS

• Discharge a larger amount of Oro Loma's effluent

CONS

- Potential impacts to current habitat
- Would require filling in part of Oro Loma Marsh

- Provides transition slope
- Aligns with First Mile project

• Mosquito abatement regulatory issues

Horizontal Levee built into the oxidation ponds – for Hayward WWTP local discharge

PROS

• Local Discharge for Hayward WWTP

CONS

- Loss of Wastewater Wet Weather Storage space with ecotone slope built into them
- Mosquito abatement regulatory issues
- Hayward WWTP is not currently planning for the level of treatment that may be required to discharge into protected species habitat

Open water treatment wetland for Hayward WWTP -

PROS

• May facilitate local Discharge for Hayward WWTP

<u>CONS</u>

- Loss of Wastewater Wet
 Weather Storage ponds
- Only feasible if EBDA pipeline is decommissioned
- Hayward WWTP is not currently planning for the level of treatment that may be required to discharge into protected species habitat

SCAPE



BAY TRAIL

The Bay Trail is pulled back to a higher inland elevation to reduce the risk of flooding with sea level rise. A phased realignment of the trail will maintain its existing alignment and connect to the new alignment until it is inundated.

Aligns to the back of Oro Loma Marsh and Frank's East

<u>CONS</u>

- Further from the Bay
- No blue water experience

Links to the Interpretive Center -

PROS

• Landfill provides expansive Bay views

Aligns along the western extent of the oxidation ponds -

PROS

<u>CONS</u>

• Higher elevation leads to risk reduction with sea level rise

Proximity to wastewater uses



HAYWARD SHORELINE INTERPRETIVE CENTER

The Hayward Shoreline Interpretive Center is relocated to the West Winton landfill where it is protected from flooding. The high point maintains visibility of the structure and offers expansive views of the Bay.

Interpretive Center is relocated to the West Winton landfill –

PROS

- Access and parking is protected
- High view point
- Increased visibility

<u>CONS</u>

• Costly to construct on the landfill



ORO LOMA MARSH





ALAMEDA COUNTY LANDFILL



Outboard of Alameda County landfill to reduce erosion



Line of Protection / Ecotone Levee / Bay Trail Aligns along the back of Frank's East

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COGSWELL MARSH



Former Wastewater Wet Weather Storage ponds

Transitions to a freshwater treatment marsh

Line of Protection Along the eastern extent of the oxidation ponds

Levee Raising / Bay Trail Built inboard of the oxidation pond levee

Horizontal Levee Discharges effluent from Hayward WWTP



HARD MARSH






EVALUATION POINTS & COMMENTS



DESIGN ALTERNATIVES

The three design alternatives were developed to explore various configurations of adaptation strategies for a future vision of the Hayward Regional Shoreline in the future with sea level rise. Please share any comments, ideas, or questions with the Project Team. Any feedback will help refine the alternatives, select a preferred alternative and ensure coordination between stakeholders and agencies.

1. Closer to the Bay



COMMENTS

2. Down the Middle



COMMENTS



3. Further Inland



COMMENTS



LINE OF PROTECTION

The line of protection includes a FEMA-certified levee that will reduce risk to inland communities by buffering the shoreline to the impacts of sea level rise and storm surge. The spatial alignment of this levee has multiple implications on cost, maintenance, and what is in or out of the new flood protection infrastructure.

1. Closer to the Bay



COMMENTS

2. Down the Middle



COMMENTS

PROJECT AREA FLOOD PROTECTION LEVEE (APPROX. ELEVATION 14.3' NAVD88) ECOTONE LEVEE



COMMENTS

3. Further Inland



COMMENTS



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TIDAL HABITAT

The future extent of tidal habitat encompasses tidal habitat and muted tidal habitat, which is a controlled system. The spatial extent of connective blocks of marsh and proportion of tidal versus muted tidal habitat varies amongst the three alternatives.

1. Active Management of Ecosystems



COMMENTS

2. Adaptive Management of Ecosystems



COMMENTS



TIDAL HABITAT

🚧 MUTED TIDAL HABITAT

NEW MUTED MARSH TIDE GATE

3. Maximum Tidal Restoration



COMMENTS





POTENTIAL UPLAND SEDIMENT AUGMENTATION



EROSION CONTROL

A layered strategy of erosion control aims to reduce the risk of erosion and shelter inland marshes and ecosystems. Gravel beaches attenuate waves and provide shorebird nesting habitat and revetments provide a more conservative approach to edge stabilization for critical infrastructure.

1. Wave attenuation along existing outboard levees



COMMENTS

2. Hybrid- balancing engineered and habitat benefits



COMMENTS



3. Layered approach + maximum habitat benefits



COMMENTS





STORMWATER MANAGEMENT

Once a line of protection is established, the stormwater and groundwater management inland of the levee system is critical, especially with increased precipitation events and to mitigate impacts of any bathtub effects that are created. A system of storage ponds, tide gates and water control structures, and flood control channels is used to manage stormwater and move it away from inland communities.



1. Maximum stormwater storage

COMMENTS

2. Dual Salt Pond/ Stormwater Storage



COMMENTS



3. No stormwater storage



COMMENTS





WASTEWATER TREATMENT

The critical uses of wastewater treatment are maintained or enhanced with new multi-benefit infrastructure. Horizontal levees align with the First Mile project and possible future needs for local discharge.

1. Local discharge for Oro Loma WWTP



COMMENTS

2. Local discharge for Oro Loma and Hayward WWTP



COMMENTS

PROJECT AREA

FRESHWATER TREATMENT MARSH

- **DIRECTION OF WATER FLOW**
- HORIZONTAL LEVEE

3. Horizontal levee + open water treatment wetland



COMMENTS





BAY TRAIL

The future location of the Bay Trail prioritizes the blue water experience where possible, maintains a variety of experiences, and aligns with new infrastructure improvements. For all three alternatives, the current alignment of the Bay Trail will be maintained as long as possible (until it is inundated with sea level rise) and connect to the realignment.

1. Prioritize blue water experience



COMMENTS

2. Prioritize marsh habitat experience



COMMENTS

- PROJECT AREA
- **•••••** EXISTING BAY TRAIL
- ------ NEW BAY TRAIL

3. Prioritize risk reduction to bay trail



COMMENTS



HAYWARD SHORELINE INTERPRETIVE CENTER

The future of the Hayward Shoreline Interpretive Center is connected to new infrastructure improvements. A variety of options are explored that are located in proximity to new educational opportunities. All three alternatives maintain the link to the Bay Trail.

1. Remain in place / protected behind ecotone levee



COMMENTS

2. Remain in place / elevate or float



COMMENTS

PROJECT AREA

••••• EXISTING BAY TRAIL

- ----- NEW BAY TRAIL
- **INTERPRETIVE CENTER**

3. Relocate to higher ground



COMMENTS



