



December 5, 2018  
Job No.: 1236-031

# MEMORANDUM

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**TO:** Michael O'Hara – Tim Lewis Communities

**FROM:** Angelo J. Obertello, P.E., LEED AP, QSD, Principal

**SUBJECT:** Sea Level Risk Assessment and Strategy  
Encinal Terminals  
Alameda, California

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The following provides a summary of the coastal flooding and sea level rise risk assessment for the Encinal Terminals project. Also, this includes a summary of the proposed project improvements to provide long term protection from rising sea levels.

## **BACKGROUND**

The Encinal Terminals project is located along the northern waterfront of Alameda, California and adjacent to the Oakland / Alameda Estuary. The site was previously used for shipping container storage. The existing site conditions include existing concrete and timber wharves located along the western and northern edges of the project site. The remainder of the northern edge includes an existing sloped shoreline with rip-rap protection. The eastern edge of the site is bound by a fence that separates the project site from the existing public access and parking areas associated with the Fortman Marina. Clement Avenue bounds the southern edge of the project site. The site is nearly completely covered by pavement and concrete surfaces. There are also 3 existing buildings.

The existing elevations of the wharf structures range from 13.1 to 13.4 (NAVD88). The existing elevations of the remainder of the site range from 11.2 to 14.3 (NAVD 88).

The proposed project will redevelop this existing industrial site into a mixed-use waterfront community. The project proposes public access corridors along the waterfront and perimeter of the project. Also, a central boulevard access corridor for pedestrians, bicycles and vehicular access will be provided interior to the project site establishing a visual corridor and access from Clement Avenue to the perimeter open spaces. The proposed buildings will include a mix of residential, commercial, maritime and retail uses. The project is designed to have resiliency including built-in protection from sea level rise and planned adaptive capacity strategies.

**VULNERABILITY ASSESSMENT**

In accordance with BCDC’s sea level rise policies, a risk assessment has been conducted for the Encinal Terminals project. The areas within the project site vulnerable to coastal flooding at various levels of future sea level rise have been evaluated. These areas of potential inundation are depicted on the enclosed Figures 2 and 3.

**Tidal Water Levels**

The following table outlines the tidal water levels at the project site. These are based upon nearest tidal station which is located at the Park Street Bridge (National Oceanic and Atmospheric Administration Datum 9414746) and FEMA preliminary Flood Insurance Rate Maps, dated April 16, 2015.

<b>Water Level</b>	<b>Elevation (NAVD 88)</b>
100-Year Tide (Base Flood Elevation per FEMA)	9.9
King Tide	7.5
MHHW	6.4
MHW	5.7
MSL	3.3

The site experiences negligible wave or wind run-up because of the protected nature of the Oakland / Alameda Estuary. The wave wind run-up is estimated to be 1-foot or less and is accounted for in the 100-Year Base Flood Elevation (BFE) stated above.

**Sea Level Rise Projections**

This risk assessment utilizes the best available science for sea level rise projections. In March 2018, the California Ocean Protection Council published an update to its sea level rise guidance. The updated report provides the scientific foundation for a decision-making process to select which sea level rise projection is appropriate for a specific project. This approach considers many factors, including project location, lifespan of the project, degree of sea level rise exposure, risk tolerance and adaptive capacity of the project. The updated guidance provides sea level rise projected values for low risk aversion, medium-high risk aversion, and extreme risk aversion. The Council’s updated report estimates the likely range of sea level rise at 2100 for low risk aversion sites to be 2.4-3.4 feet, medium-high risk aversion to be 5.7-6.9 feet and extreme risk aversion to be 10.2 feet.

The areas within the project site that would be inundated, if left unprotected, at these various sea level rise projections are depicted on the enclosed Figures 2 and 3.

### **Risk Assessment**

The Encinal Terminals Project has been planned with a practical approach to provide long term protection to the public access areas and future buildings. The proposed waterfront and development areas are planned to be constructed at a minimum elevation that provides built-in protection from the projected sea levels at 2100 for a medium-high risk aversion. Additionally, the waterfront improvements, including seawalls and revetments, are planned with adaptive capacity to accommodate being elevated in the future, if necessary, in the case that extreme sea level rise occurs.

### **PROJECT DESIGN**

#### **Built-In Protection**

The proposed project will be designed such that the proposed public access areas, streets and building sites will be raised to a minimum elevation of 13.5, providing built-in protection from 6-feet of sea level rise above the typical year King Tides, which occur 2 to 6 times per year. This also provides built-in protection from 3.6 feet of future sea level rise above the current 100-year coastal flood elevation. More specifically, the following improvements are planned to provide protection from sea level rise:

- The wharf structure will be improved to provide various public access and waterfront open space features. This will include a minimum of a 4-inch topping slab, which will result in the minimum wharf elevation of 13.5.
- The public access corridor along the northern shoreline and eastern boundary will be elevated to a minimum elevation of 13.5.
- A portion of the northern shoreline improvements will include concrete steps into the Bay providing public access to water. The eastern public access area will also include steps and ramps down to the existing marina access areas. These lower components of the public access areas will inundate more frequently over time as sea levels rise.
- The proposed buildings will be raised to establish the minimum habitable floor elevation at 14.0.
- The proposed streets within the interior of the project site will be raised to a minimum elevation of 13.5.

### **Adaptive Strategies**

The proposed project is planned to include adaptive capacity for additional future adaptive measures to be implemented providing protection from higher amounts of sea level rise. The adaptive strategies may include implementation of floodwalls, earthen berms, elevated wharves and other storm drain system enhancements, such as pump stations at outfalls. The project has been designed to accommodate these adaptive measures without requiring fill within the Bay.

The wharf structure would be periodically inundated at extreme amounts of sea level rise. Accordingly, the project has reserved a corridor along the landside of the wharf that can be adapted to be protected from extreme sea level rise. This interior corridor will provide for a long term protected public access area. This adaptive measure would also provide protection for the interior development areas, including the buildings and streets. The northern and eastern perimeters have also been planned to allow for adaptive measures such as an elevated flood protection berm and / or floodwalls to be implemented. The locations of these adaptive measures are depicted on the enclosed Figure 3 and perimeter illustrative cross sections.

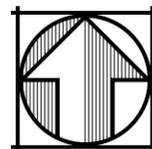
The project will establish a community facilities district, geologic hazard abatement district and / or owners association that will be responsible for monitoring sea level rise and implementing adaptive measures. This will include monitoring scientific guidance and updates on sea level rise, as well as commissioning periodic shoreline condition assessments by a coastal engineer to document the physical effects of sea level rise and life expectancy of the shoreline protection measures. The district or association will also be responsible for collecting and managing reserve funds to implement the adaptive measures in the future when they are determined to be necessary.



ENCINAL TERMINALS  
**FIGURE 1**  
 EXISTING CONDITIONS

CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA

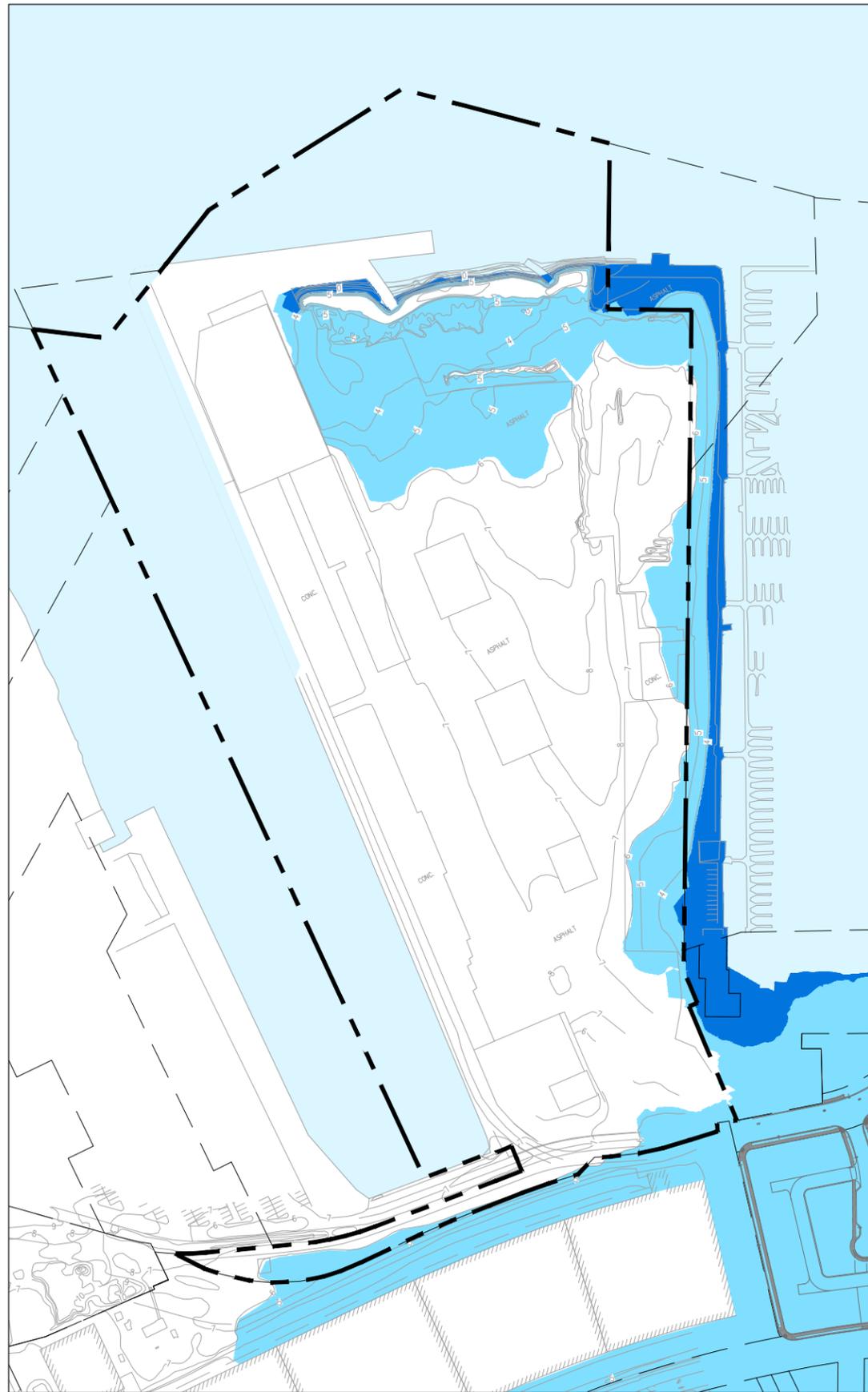
DATE: NOVEMBER 30, 2018 SCALE: 1"=200'



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EXISTING CONDITIONS



PROPOSED CONDITIONS

**SEA LEVEL RISE CRITERIA**

THE PROPOSED ELEVATION OF THE WATERFRONT PUBLIC ACCESS AREAS IS 13.5 WHICH EQUATES TO 7.1' ABOVE MHHW ELEVATION OF 6.4 AND 6' ABOVE THE KING TIDE ELEVATION OF 7.5.

HISTORICAL DATA FROM TIDAL STATIONS NEAR THE SITE REFLECTS A LIKELY PROJECTION THAT WATER LEVELS REACH ABOVE THE KING TIDE ONLY TWO TO SIX TIMES PER YEAR.

THE 2050 PROJECTION OF 1.9' SEA LEVEL RISE WOULD YIELD WATER LEVELS OF ELEVATION 9.4 TWO TO SIX TIMES PER YEAR, APPROXIMATELY 4' BELOW THE PROPOSED ELEVATION OF THE WATERFRONT PUBLIC ACCESS AREAS.

THE 2100 PROJECTION OF 5.7' SEA LEVEL RISE WOULD YIELD WATER LEVELS OF ELEVATION 13.2 TWO TO SIX TIMES PER YEAR, SLIGHTLY BELOW THE WATERFRONT PUBLIC ACCESS.

WITH 2070 SLR LEVELS NOT PRESENTING FLOOD RISK FOR THE WATERFRONT PUBLIC ACCESS AREAS, THERE ARE SEVERAL POTENTIAL ADAPTIVE MEASURES THAT MAY BE EMPLOYED IN THE FUTURE TO MITIGATE 2100 SLR AND SUPPORT MAINTAINING PUBLIC ACCESS. SOME OF THESE POTENTIAL MEASURES INCLUDE:

- IMPLEMENTATION OF FLOODWALLS, EARTHEN BERMS, ELEVATED WHARVES AND OTHER STORM DRAIN SYSTEM ENHANCEMENTS.
- THE WHARF WILL BE RECONSTRUCTED AT HIGHER ELEVATION PROVIDING PROTECTION FROM ADDITIONAL SEA LEVEL RISE PROJECTED FOR THE LIFE SPAN OF THE NEW STRUCTURE.

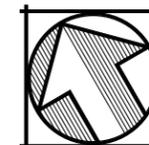
**LEGEND**

-  100 YEAR WATER SURFACE ELEVATION (9.9')
-  BFE + 3.6' SEA LEVEL RISE (13.5') KING TIDE + 6.9' SLR (13.3')

**ENCINAL TERMINALS  
FIGURE 2  
SEA LEVEL RISE  
INUNDATION  
(BFE +3.6') & (KING TIDE +6.9')**

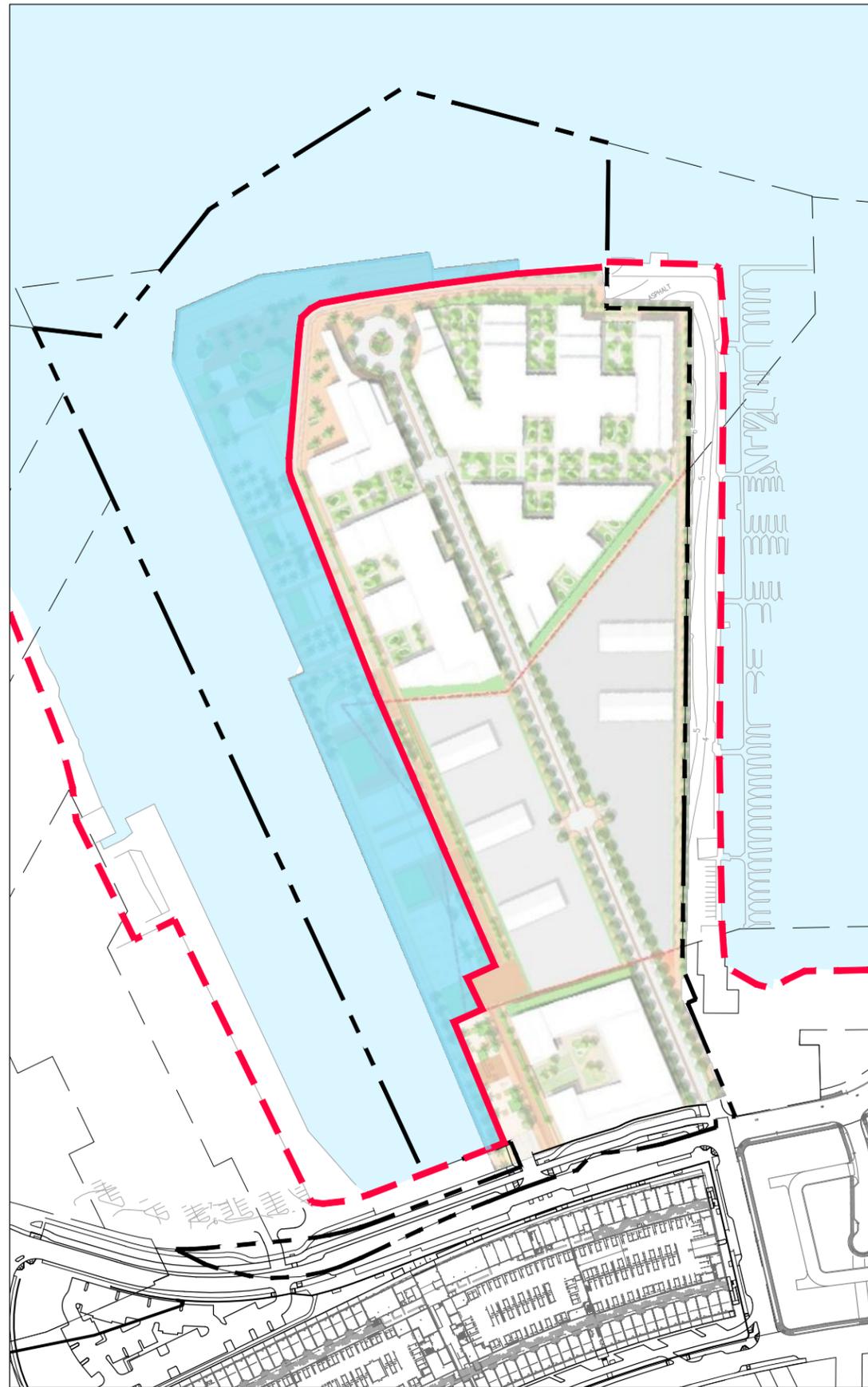
CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA

DATE: NOVEMBER 30, 2018 SCALE: 1"=250'



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PROPOSED CONDITIONS

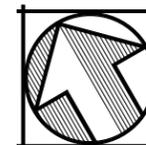
**LEGEND**

-  100 YEAR WATER SURFACE ELEVATION (9.9')
-  BFE + 5.7' SEA LEVEL RISE (15.6')
-  ADAPTIVE MEASURE (15.6')-ENCINAL TERMINALS
-  ADAPTIVE MEASURE (15.6')-REGIONAL

**ENCINAL TERMINALS  
FIGURE 3  
SEA LEVEL RISE  
INUNDATION - (BFE + 5.7')**

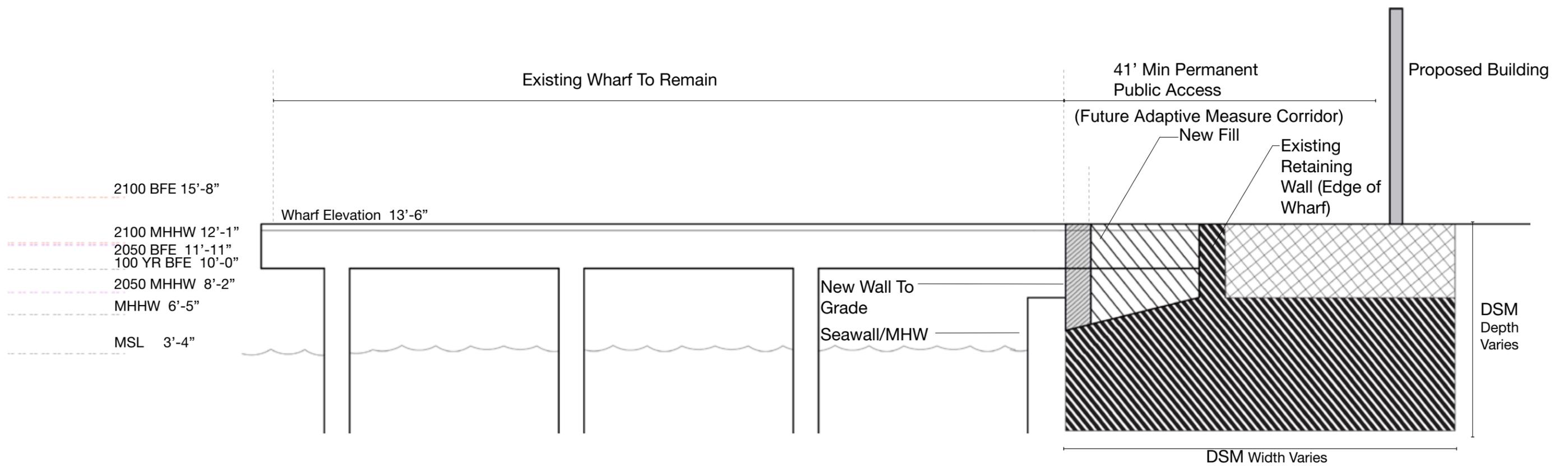
CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA

DATE: NOVEMBER 30, 2018 SCALE: 1"=250'



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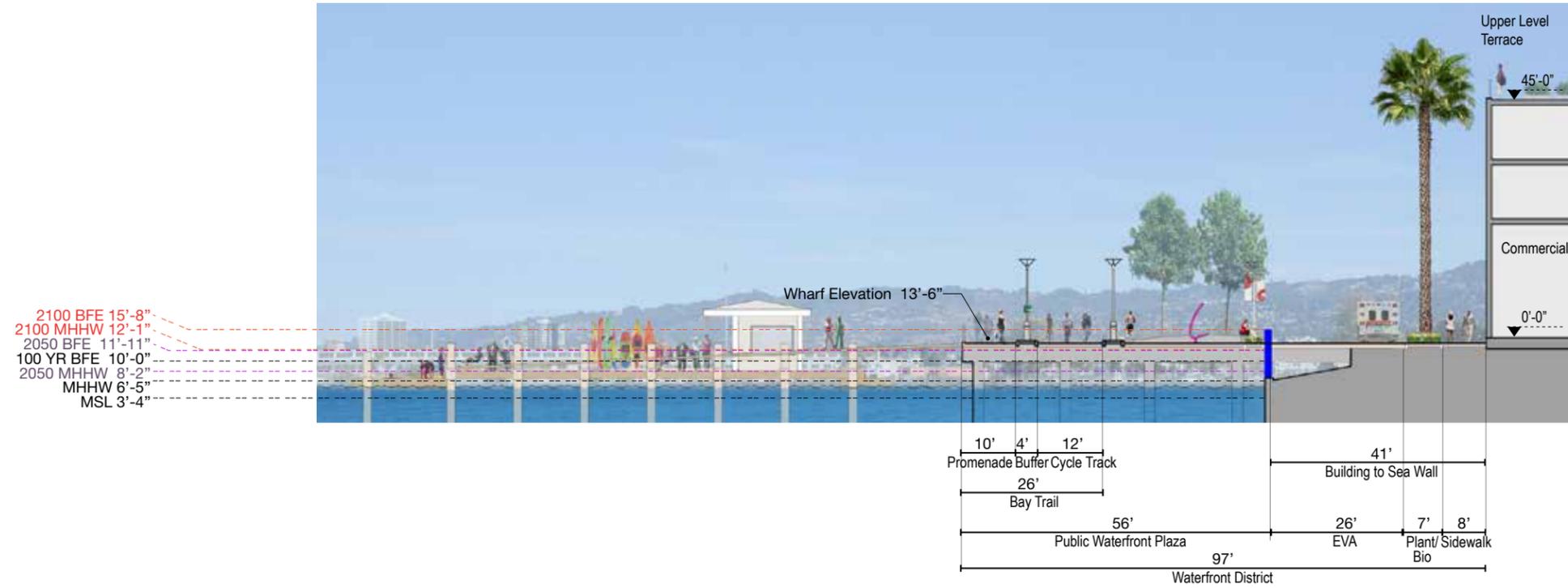
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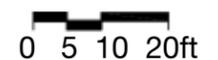
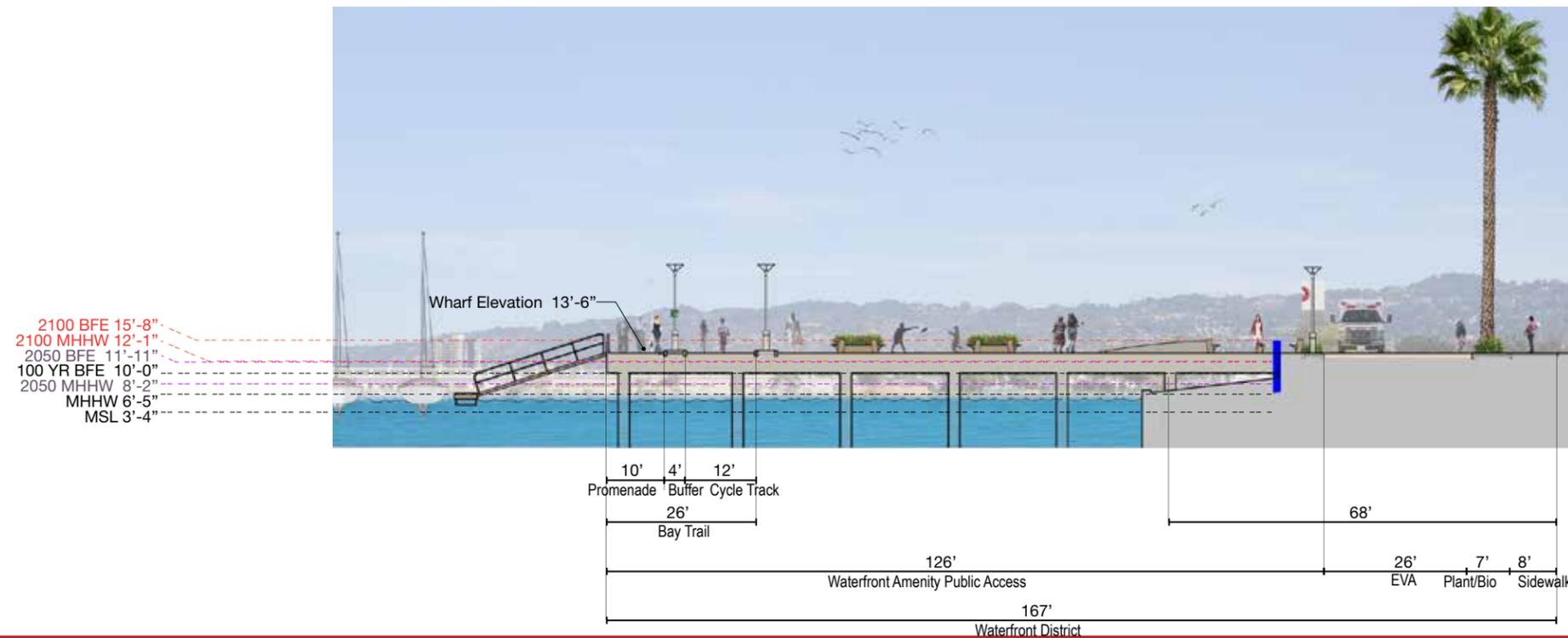
## Typical Public Access/ Wharf Improvements Section



# Section P1



# Section P2



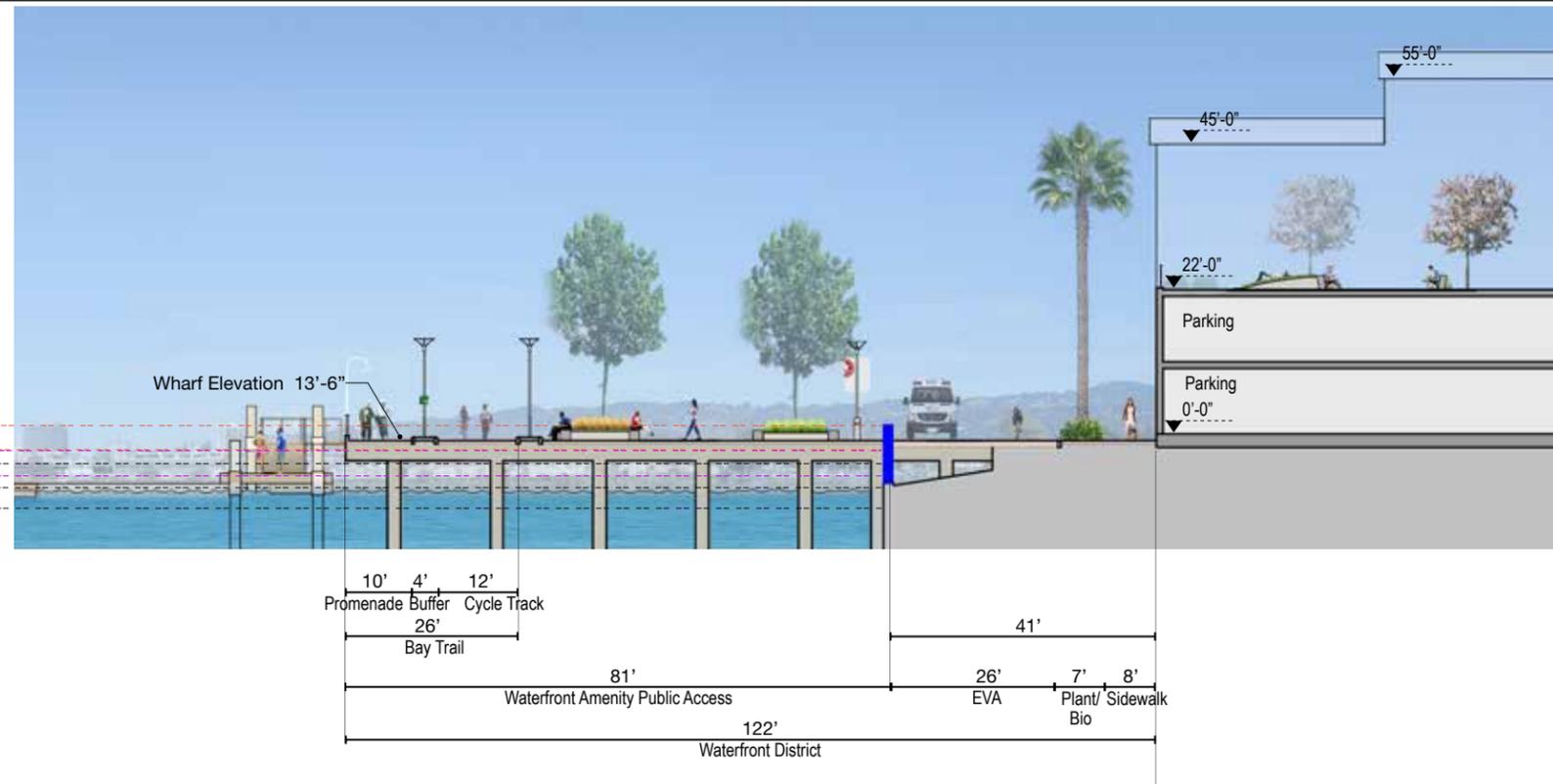
# Site Sections: P1-P2



## Section P3

Note: Minimum 26' Bay Trail is shown, but the Bay Trail may meander and vary through the waterfront amenity area.

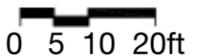
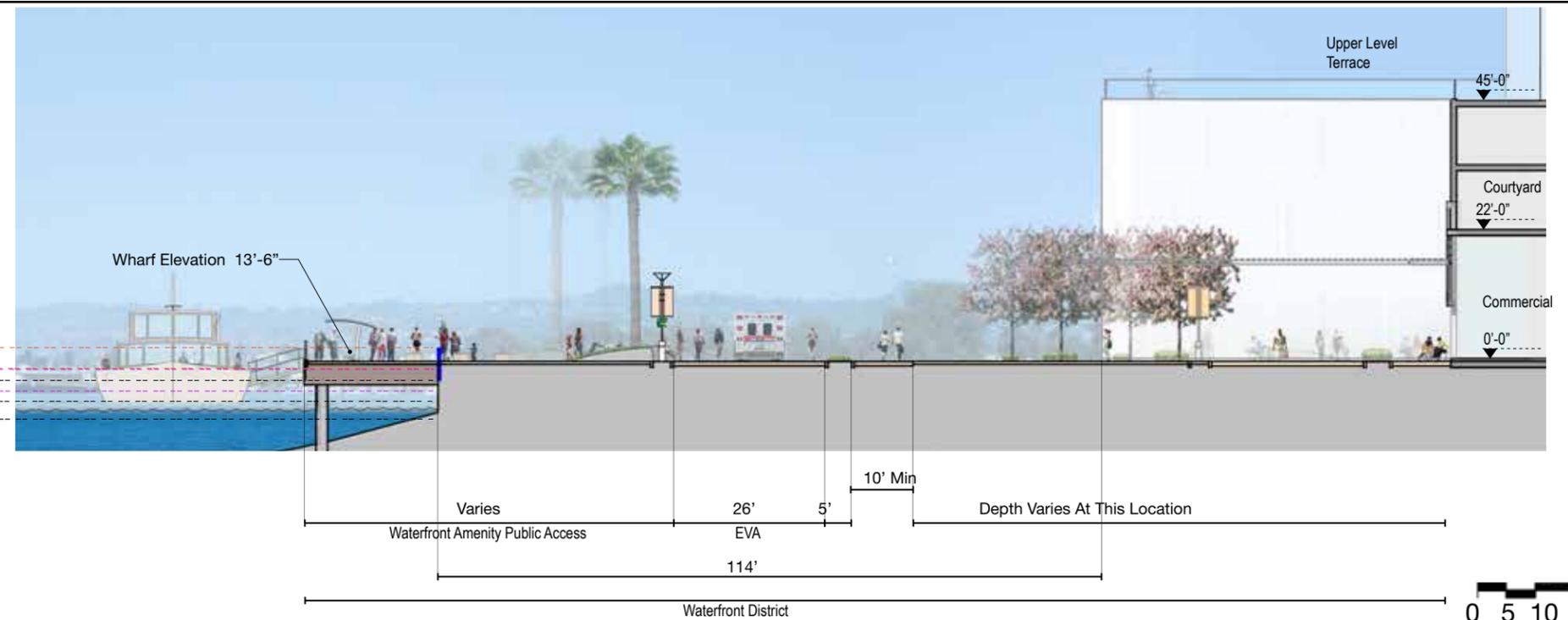
2100 BFE 15'-8"  
 2100 MHHW 12'-1"  
 2050 BFE 11'-11"  
 100 YR BFE 10'-0"  
 2050 MHHW 8'-2"  
 MHHW 6'-5"  
 MSL 3'-4"



## Section P4

Note: Minimum 26' Bay Trail is shown, but the Bay Trail may meander and vary through the waterfront amenity area.

2100 BFE 15'-8"  
 2100 MHHW 12'-1"  
 2050 BFE 11'-11"  
 100 YR BFE 10'-0"  
 2050 MHHW 8'-2"  
 MHHW 6'-5"  
 MSL 3'-4"



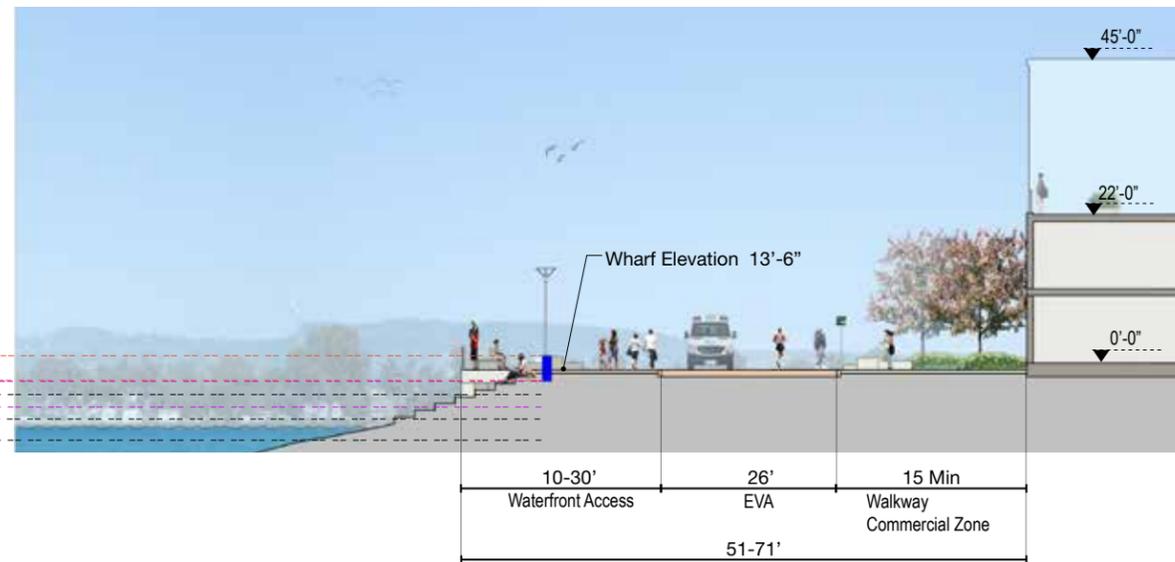
## Site Sections: P3-P4



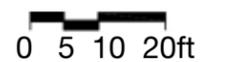
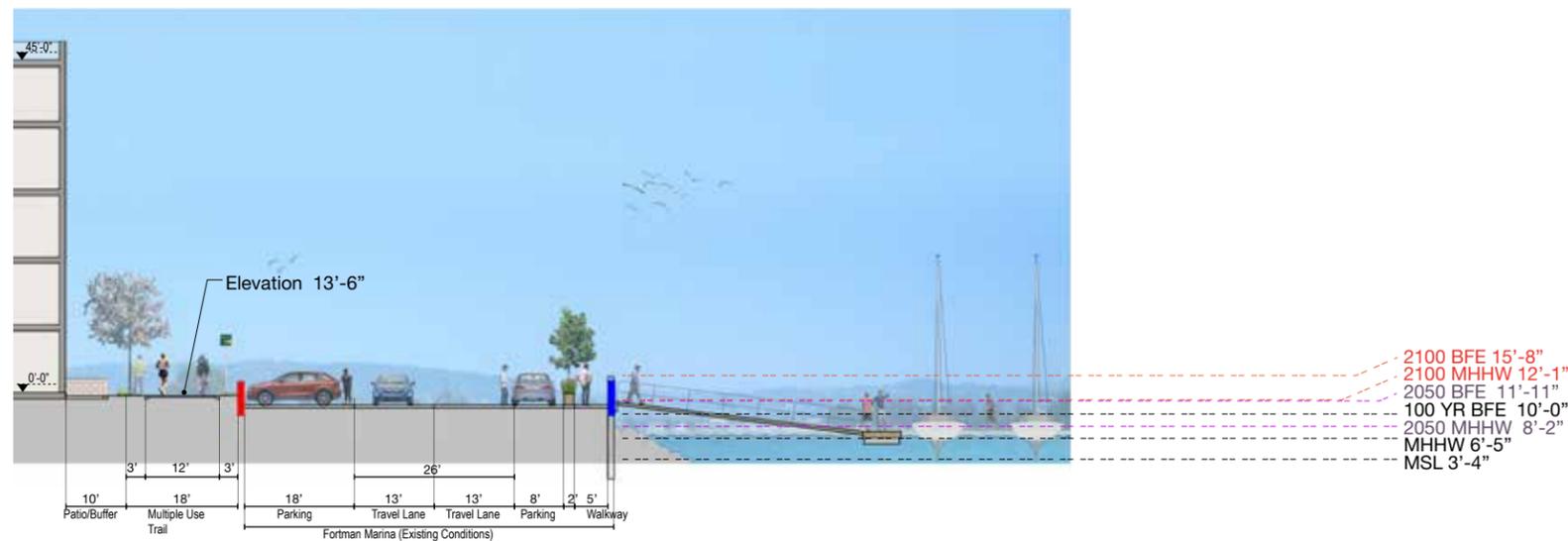
# Section P5

Note: Minimum 26' Bay Trail is shown, but the Bay Trail may meander and vary through the waterfront amenity area.

2100 BFE 15'-8"  
 2100 MHHW 12'-1"  
 2050 BFE 11'-11"  
 100 YR BFE 10'-0"  
 2050 MHHW 8'-2"  
 MHHW 6'-5"  
 MSL 3'-4"



# Section F1



## Site Sections: P5 & F1

