APPENDIX G

JUNE 2019
AMPORTS

REVISED REVIEW OF SEA-LEVEL RISE FOR RORO OPERATIONS AT ANTIOCH BERTH

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PROJECT NO.	DOCUMENT NO.
A104430	003

VERSION	DATE OF ISSUE	DESCRIPTION	PREPARED	CHECKED	APPROVED
001	June 11, 2019		JWK	JBSW	TWT

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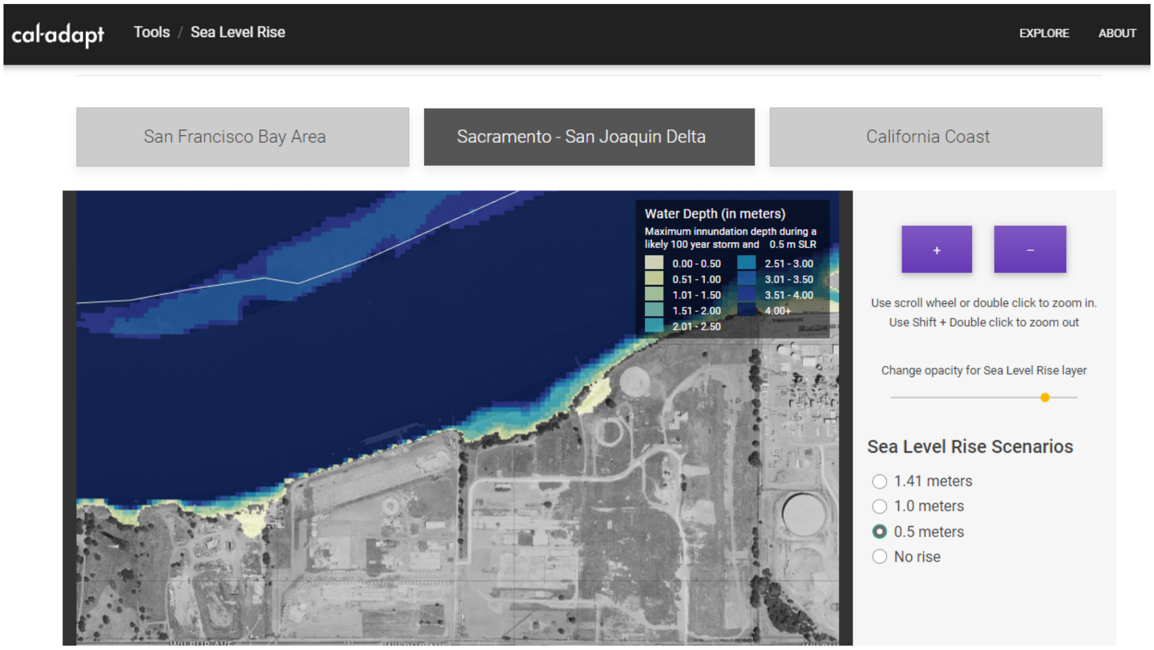

cal-adapt
Tools / Sea Level Rise
EXPLORE
ABOUT
San Francisco Bay Area
Sacramento - San Joaquin Delta
California Coast
Water Depth (in meters)
Maximum innundation depth during a likely 100 year storm and 0.5 m SLR
0.00 - 0.50
0.51 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 3.50
3.51 - 4.00
4.00+
+
−
Use scroll wheel or double click to zoom in.
Use Shift + Double click to zoom out
Change opacity for Sea Level Rise layer
Sea Level Rise Scenarios
1.41 meters
1.0 meters
0.5 meters
No rise

13

1 Sea-Level Rise Review

1.1 Background

This study revisits the issue of Sea-Level Rise at the Antioch berth formerly known as the Gaylord Paper Antioch Marine Terminal, a wood pulp unloading berth located along the south bank of the San Joaquin River in Antioch, CA.

The original wharf was designed in 1955 by Earl and Wright Consulting Engineers for the Crown Zellerbach Corporation and constructed soon after design was complete. The existing deck was redesigned in 1956 following a fire at the wharf. The 1956 design replaced a timber framed deck with concrete beams and slab. The existing elevation of the original wharf is approximately 15.5 ft, MLLW.

A new concrete deck is proposed to be constructed at the site between two existing mooring dolphins. The existing elevations of the original mooring dolphins, to remain, on either side of the new concrete deck were surveyed to be 10.7 ft and 10.8 ft MLLW. An isolated timber pier to the east of the main pier has a deck elevation of 11.0 ft at its northern end. The top of bank inside a curb at the shoreline south of the pier varies from 10.6 ft MLLW to 10.8 ft MLLW.

The anticipated future use is as a car carrier vessel unloading facility to be operated by AMPORTS, Inc. The new use of the dock requires the construction of the new concrete deck to support the car carrier vessels' stern unloading ramps. The new deck elevation is limited to as to accommodate the vessels ramp at low tide. The deck elevation as designed is +12.0' MLLW and slowly ramps down to +10.7' MLLW to match the top of existing bank.

AMPORTS has the option on a 40-year lease at the facility.

No structures will be located on the new deck. The only equipment to be mounted on the new deck is a mooring bollard, guard rails, and a light standard.

1.2 Governing Codes, Standards, and Regulations

The following codes, specifications, regulations and industry standards, where applicable, were and are now being used in the Sea-Level Rise consideration for design.

Original Sea-Level Rise Design Standard:

"State of California Sea-Level Rise Interim Guidance Document" (2009), developed by the Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT)

New Sea Level Rise Design Standard:

State of California Sea-Level Rise Guidance (updated 2018), developed by California Natural Resources Agency and California Ocean Protection Council (Guidance)

1.3 Proposed New Construction Elevations

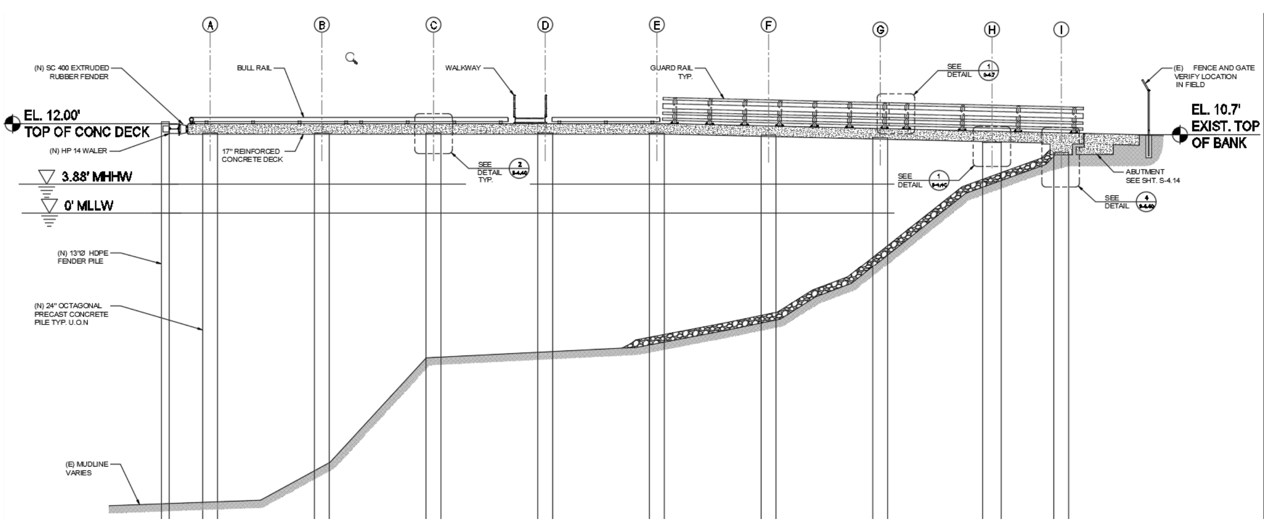


Figure 1 New Construction Elevations

1.4 Mean Sea-Level Change Estimates

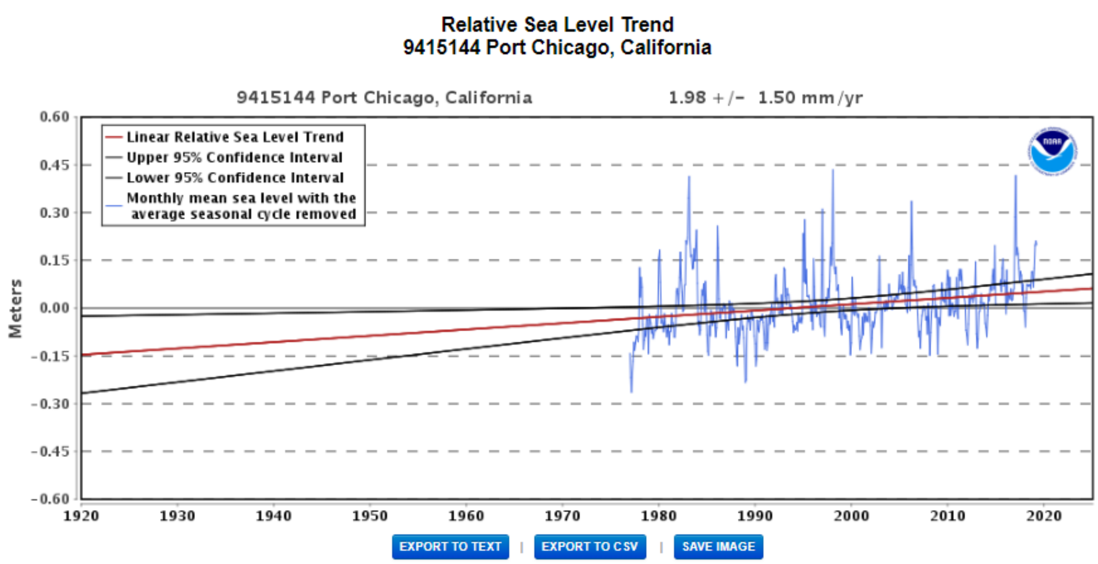
1.4.1 Original Mean Sea-Level Change Estimation from Co-Cat

This original mean sea level change estimate from Co-Cat was used in the design of the new deck structure. The California State Lands Commission requested that the deck be designed to the updated State of California Sea-Level Rise Guidance document which is shown in Section 1.4.2. We will compare the conclusion derived from Co-Cat with a conclusion derived from the Sea-Level Rise Guidance document from the California Natural Resources Agency and Ocean Protection Council (Guidance) and determine if the original design elevation is still acceptable.

Historical Rate of Sea-level Change

NOAA estimates that at Port Chicago, approximately 14 miles downriver, the mean sea-level trend is 2.08 mm/year with a 95% confidence interval of +/- 2.74 mm/year based on monthly mean sea-level data from 1976 to 2006, which is equivalent to a change of 0.68 feet in 100 years; or approximately 0.07 feet in 10 years.

[Note that NOAA has refined this value since our original design and the previous measured rate of sea-level rise is estimated to be 1.98 mm/year with a 95% confidence interval of +/- 1.5 mm/year based on monthly mean sea-level data from 1976 to 2018.]



The relative sea level trend is 1.98 millimeters/year with a 95% confidence interval of +/- 1.5 mm/yr based on monthly mean sea level data from 1976 to 2018 which is equivalent to a change of 0.65 feet in 100 years.

Future Projections

Our original estimate for the mean sea-level change at the site was based upon the "State of California sea-level rise interim guidance document" (2009), developed by the Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), with science support provided by the Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust. The ranges provided in this document are based upon a large body of research on climate change, focusing on establishing likely sea-level change scenarios.

Variability

Uncertainty is an integral component of this risk assessment. There are numerous factors contributing to sea-level rise, including: greenhouse gas emission, melt of glaciers, polar ice sheet accumulation, disintegration of the West Antarctica Ice Sheet, and thermal expansion. All these factors may affect sea-levels over time, to various degrees, and may not have the same influence as climate change continues. As a result, many scenarios have been used in projecting long-term sea-level variations, resulting in an appreciable level of uncertainty in estimating design values. In fact, the CO-CAT document warns that "because the science related to SLR [sea-level rise] is rapidly advancing, this guidance document will be regularly revised to reflect the latest scientific understanding of how the climate is changing and how this change may affect SLR."

Level of Risk and Sea-Level Change Trajectory

The trestle is classified as an important structure, whose potential failure in response to increasingly frequent flooding could be considered consequential for operations, but not critical environmentally. Occasional interruptions due to extreme weather and storm conditions would likely not be a factor as there are environmental limits on the vessel's transit to the berth.

New deck structures will be designed above the potentially affected elevation over water.

Based on the important but not critical nature of the structure, and given the uncertainty surrounding the estimation of long-term SLR projections, a "Medium" trajectory for future sea-level change was retained for design purposes. This trajectory carries an inherent level of risk that is commensurate with the purpose of the structure and the cost of upgrading that structure over time.

Sea-level Change Timeline

While the design life for this project is 40 years, sea-level change was conservatively estimated for a design life whose ending would coincide with 2070, approximately 50 years from construction. Based on anticipated projections for sea-level rise by 2070, **a base sea-level change value of 2.0 ft. was estimated for consideration at the end**

the project life. As early as 2030, the relative increase in sea-level may reach 0.6 ft according to BCDC "Medium" (model average) curve. This is illustrated in Figure 1.4-1.

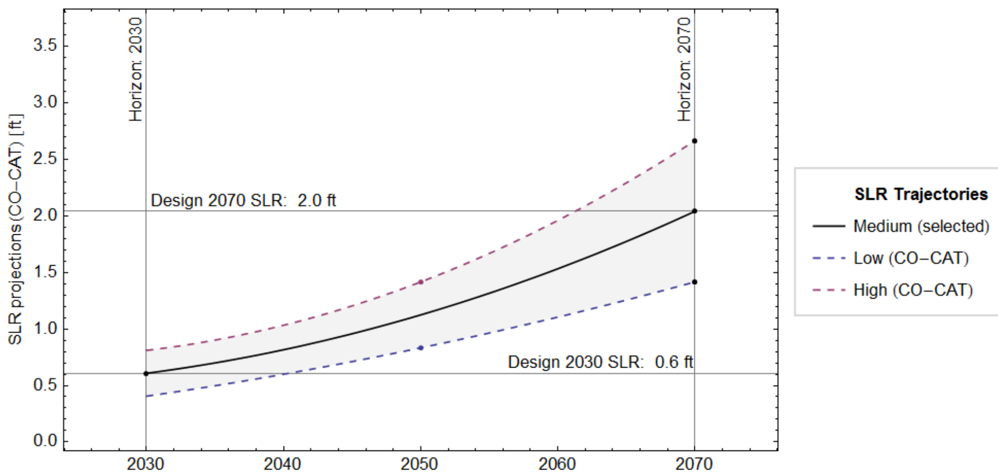


Figure 1.4-1 CO-CAT recommendations for mean sea-level change with selected "Medium" (model average) path indicating a 2.0 ft. mean sea-level change projections from 2000 baseline by 2070 (approx. 50 years from construction), and approximately 0.6 ft by 2030.

The vertical datum used for the AMPORTS Antioch Terminal project are the MLLW water level and the NAVD88 datum. The astronomical tides at the Antioch Terminal are semi-diurnal (two low tides and two high tides per day) as in other areas of San Francisco Bay.

Table 1.1- Datums for 9415064, Antioch, San Joaquin River CA. (NOAA)

Datum	Description	Elevation [ft-MLLW]	Elevation [ft-NAVD 88]
MHHW	Mean higher high water	3.88	5.96
MHW	Mean high water	3.41	5.49
MSL	Mean sea-level	2.03	4.11
MTL	Mean tidal level	2.00	4.08
DTL	Mean diurnal tidal level	1.94	4.04
MLW	Mean low water	0.59	2.67
MLLW	Mean lower low water	0.0	2.08

The projected sea-level change would set calm-water MHHW at 5.8 feet at the project site. The negative consequences of sea-level change would be most critical during a storm event including the effect of a large storm tide and runoff with elevated baseline sea-level. When combined with surge and waves there could potentially be an effect on the existing walkways, existing catwalks, and existing mooring dolphins, as well as the shoreline itself. This would mostly be due to splashing of water at the levels anticipated rather than overtopping. Five feet of combined surge and waves at this location is unlikely.

1.4.2 New Mean Sea-Level Change Estimation from State of California Sea-Level Rise Guidance, Updated 2018

Looking forward from current water levels at the site using the guidance from the SLR Guidance document from the California Natural Resources Agency and Ocean Protection Council, updated 2018, we compare our previous assumption with an estimate derived from the newer document.

The SLR Guidance directs us to check the projections for the nearest tide gauge referenced in the document. For Antioch, CA, that would be the San Francisco tide gauge.

Table 1 of SLR Guidance document, "Projected Sea-Level Rise in Feet for San Francisco," is presented below.

Using the SLR Guidance Document, Appendix 4: Risk Decision Framework. The site has low economic impacts and low impact on communities, infrastructure, or natural systems and thus assigned "Low Risk Aversion" and design for "Likely Range, high emissions."

TABLE 1: Projected Sea-Level Rise (in feet) for San Francisco

Probabilistic projections for the height of sea-level rise shown below, along with the H++ scenario (depicted in blue in the far right column), as seen in the Rising Seas Report. The H++ projection is a single scenario and does not have an associated likelihood of occurrence as do the probabilistic projections. Probabilistic projections are with respect to a baseline of the year 2000, or more specifically the average relative sea level over 1991 - 2009. High emissions represents RCP 8.5; low emissions represents RCP 2.6. ***Recommended projections for use in low, medium-high and extreme risk aversion decisions are outlined in blue boxes below.***

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)						H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN	LIKELY RANGE			1-IN-20 CHANCE	1-IN-200 CHANCE	
		50% probability sea-level rise meets or exceeds…	66% probability sea-level rise is between…			5% probability sea-level rise meets or exceeds…	0.5% probability sea-level rise meets or exceeds…	
					Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion
High emissions	2030	0.4	0.3	-	0.5	0.6	0.8	1.0
	2040	0.6	0.5	-	0.8	1.0	1.3	1.8
	2050	0.9	0.6	-	1.1	1.4	1.9	2.7
Low emissions	2060	1.0	0.6	-	1.3	1.6	2.4	
High emissions	2060	1.1	0.8	-	1.5	1.8	2.6	3.9
Low emissions	2070	1.1	0.8	-	1.5	1.9	3.1	
High emissions	2070	1.4	1.0	-	1.9	2.4	3.5	5.2
Low emissions	2080	1.3	0.9	-	1.8	2.3	3.9	
High emissions	2080	1.7	1.2	-	2.4	3.0	4.5	6.6
Low emissions	2090	1.4	1.0	-	2.1	2.8	4.7	
High emissions	2090	2.1	1.4	-	2.9	3.6	5.6	8.3
Low emissions	2100	1.6	1.0	-	2.4	3.2	5.7	
High emissions	2100	2.5	1.6	-	3.4	4.4	6.9	10.2
Low emissions	2110*	1.7	1.2	-	2.5	3.4	6.3	
High emissions	2110*	2.6	1.9	-	3.5	4.5	7.3	11.9
Low emissions	2120	1.9	1.2	-	2.8	3.9	7.4	
High emissions	2120	3	2.2	-	4.1	5.2	8.6	14.2
Low emissions	2130	2.1	1.3	-	3.1	4.4	8.5	
High emissions	2130	3.3	2.4	-	4.6	6.0	10.0	16.6
Low emissions	2140	2.2	1.3	-	3.4	4.9	9.7	
High emissions	2140	3.7	2.6	-	5.2	6.8	11.4	19.1
Low emissions	2150	2.4	1.3	-	3.8	5.5	11.0	
High emissions	2150	4.1	2.8	-	5.8	5.7	13.0	21.9

**Most of the available climate model experiments do not extend beyond 2100. The resulting reduction in model availability causes a small dip in projections between 2100 and 2110, as well as a shift in uncertainty estimates (see Kopp et al. 2014). Use of 2110 projections should be done with caution and with acknowledgement of increased uncertainty around these projections.*

From the table, over a 50-year design life from 2020 we would want to design for a 1.9 foot rise in sea-level as shown for the 2070 projections.

1.4.3 Comparison of Elevations

The original design considered a SLR of 2.0 ft with criteria from Co-Cat. The new SLR Guidance resulted in a design 1.9 ft SLR. The original design remains compliant with the newer Guidance document.

1.4.4 Elevation Consideration

Our current deck design elevation of 12 ft above MLLW at the face, sloping back toward the shoreline to an elevation of 10.7 ft MLLW is more than capable of remaining operational with a 2 foot rise in sea-level.

Inundation maps for 100-year storm events from https://cal-adapt.org/ provide the following graphics for no sea-level rise, 0.5 meter (1.64 ft) sea-level rise and, 1.0 meter (3.28 ft) sea level rise scenarios.

Note that no inundation of the landside south of the top of bank (10.7 ft MLLW), and therefore, above the lowest point of the top of new deck, through the 0.5 meter (1.64 ft) SLR projection. At 3.28 feet of SLR combined with a 100 year storm, some puddling occurs south of the top of the bank, so the lowest part of the deck might be temporarily affected. However, this may only occur at SLR scenarios above the 2.0 ft we are anticipating.

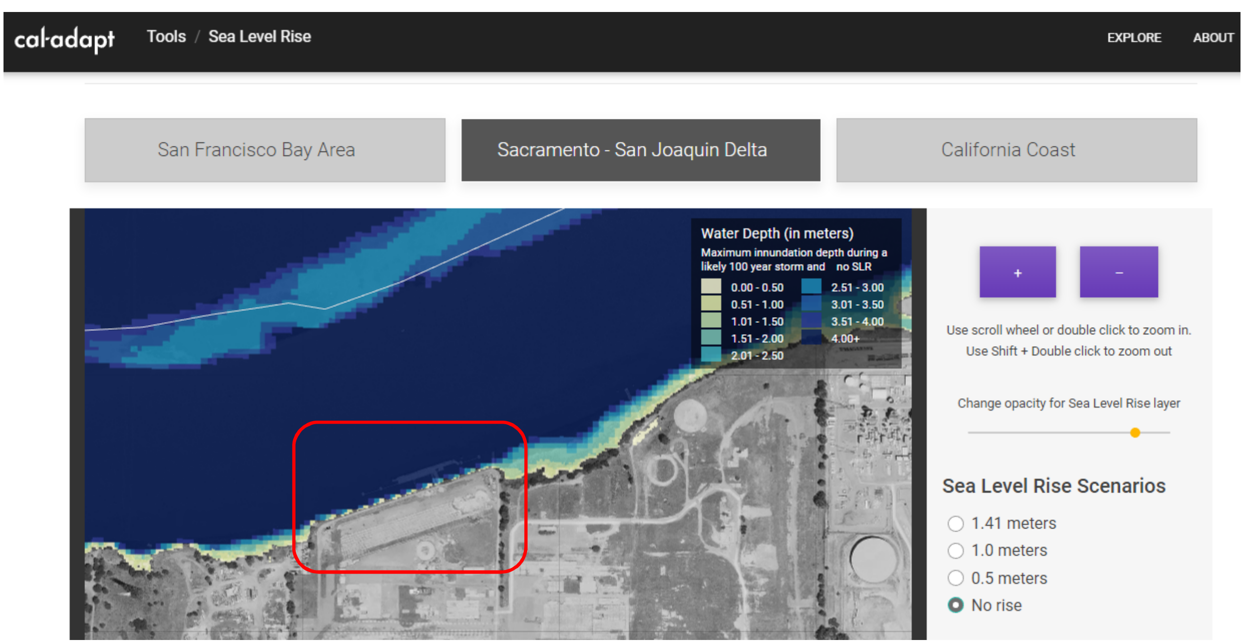


Figure 2- Inundation at 100-year storm with 0 ft SLR

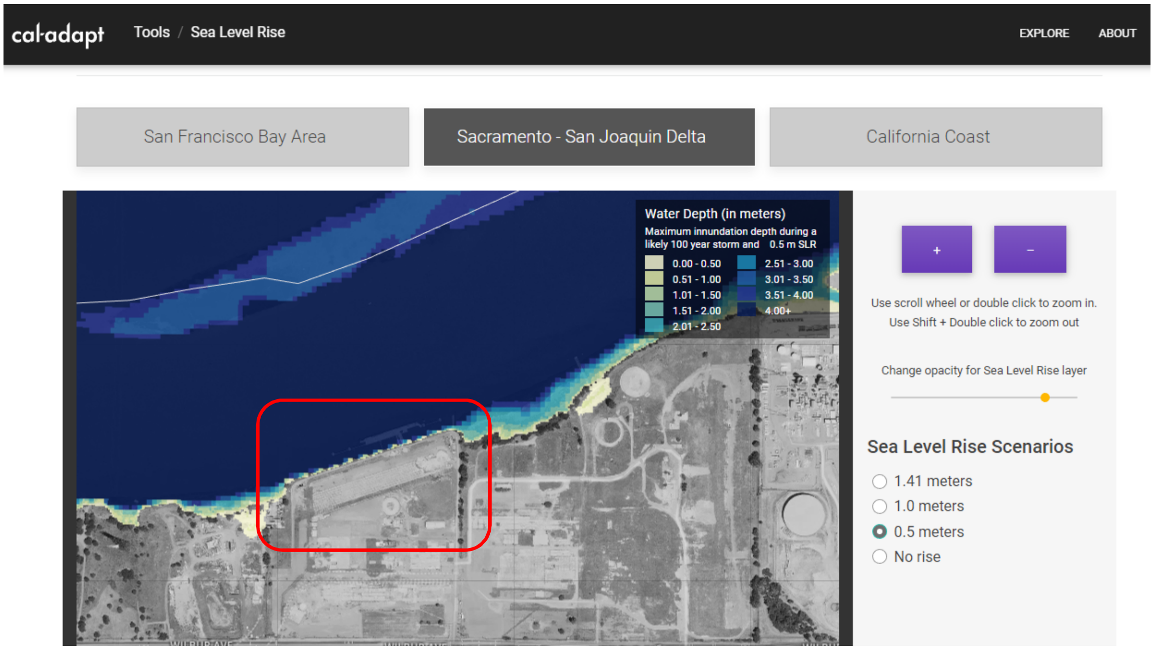


Figure 3- Inundation at 100-year storm with 1.64 ft SLR

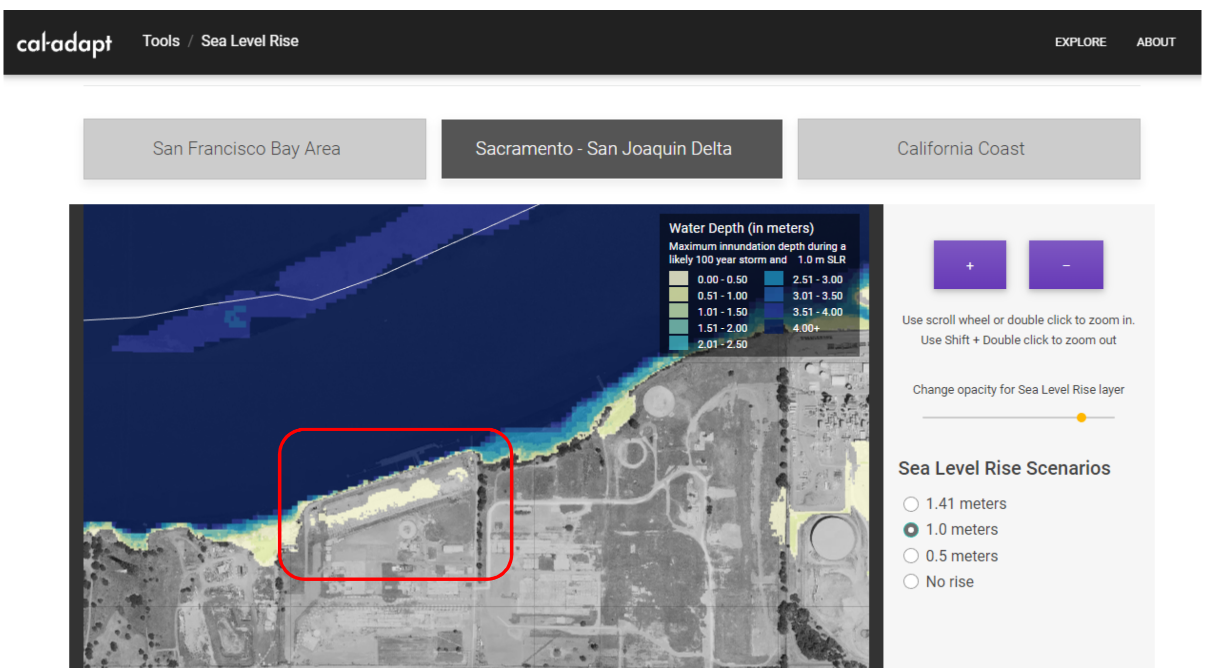


Figure 4- Inundation at 100-year storm with 3.28 ft SLR