APPENDIX L SEA LEVEL RISE (SLR) TECHNICAL REPORT

BAYLANDS SPECIFIC PLAN

Sea-Level Rise Technical Report

Prepared for
City of Brisbane

February 2025

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SECTION 1
Introduction

Situated along the San Francisco Bay shoreline, the Baylands Specific Plan (Plan) area will face increasing flood hazards as a result of sea-level rise. To support the CEQA analysis of the Plan's hydrologic impacts, this technical report considers existing flood hazards from coastal, stormwater, and groundwater sources and how these hazards will change with sea-level rise. Two sea-level rise scenarios projected out to Year 2100 are considered. This assessment and mapping integrates prior regional and Plan-specific studies. Impact analysis from a CEQA perspective overlaps substantially with the components of a San Francisco Bay Conservation and Development Commission (BCDC) sea-level rise risk assessment; therefore, this report also addresses the requirements of such a risk assessment and provides additional information to fulfill BCDC risk assessment requirements.

As part of its commitment to maintaining open space, particularly valuable wetland habitats and their adjoining ecotone, the City has requested mapping of future habitats as sea-levels rise. This report presents tidal habitat mapping as a function of water levels to provide estimate of wetland extents and acreages as a result of two sea-level rise scenarios at Year 2100.

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SECTION 2
Flooding Hazard

Overall, the Plan proposes extensive grading that will use soil excavated from the eastern landfill area to raise the finished floor elevations in the western railyard area to a minimum of 19 feet North American Vertical Datum (NAVD). Building pads and roads in the landfill area will generally remain at elevations 20 feet NAVD or higher. As such, buildings and infrastructure will be at least 8 feet above the present-day 100-year San Francisco Bay (Bay) water level, and, therefore, resilient to High Scenario[1] sea-level rise (SLR) through 2100. Portions of the Project that are lower than this would either be perimeter streets that need to match grade with properties outside the Plan area, unfinished parking,[2] flood-tolerant infrastructure, or open space that can tolerate intermittent flooding.

2.1 Existing Flooding Hazards

Because of its location adjacent to the Bay, as well as surface and groundwater hydrology through and below the Plan area, the Plan area faces existing flood hazards from coastal, stormwater, creek, and groundwater sources.

2.1.1 Coastal Flooding

As per FEMA (2019a) and BCDC (2021) (references provided at the end of this report), the elevation for assessing flood hazard along the Bay shoreline is the water surface elevation for the 100-year event. This event corresponds to a flood elevation that has a 1% chance of being exceeded in any given year. Water levels associated with this flood hazard are referred to by FEMA as the base flood elevation (BFE). Within the Bay, such an event is caused by a combination of astronomic tidal forcing, ocean circulation patterns, and atmospheric conditions (barometric pressures and wind) associated with winter storm events.

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1 The High Scenario for sea-level rise is defined by the California Ocean Protection Council (OPC 2024). This scenario is projected to have an effectively zero percent chance of being exceeded by 2100 (assuming 3°C of warming and no low confidence geophysical processes), but could occur after 2100. Considering the possibility of this amount of sea-level rise is recommended for projects like residential and commercial development with the potential for lifespans beyond 2100. Such projects face substantial consequences from flooding and should therefore be relatively risk adverse in their design.

2 The city's floodplain management code does not require unfinished areas (used only for vehicle parking, storage, or building access) to meet the requirement that applies to finished floors needing to be at or above the base flood elevation (City of Brisbane Municipal Code, Chapter 15.56).

Several studies of the Bay's hydraulics provide estimates of the 100-year flood elevation for the Bay adjacent to the Plan area. These elevations are a combination of stillwater elevations[3] and wind waves.

For stillwater elevations, FEMA (2019b) maps portions of the Plan area to be in the 1% annual chance flood hazard zone with an elevation of 10 feet NAVD (**Figure 1**). AECOM (2016), which uses the same hydraulic modeling as used by FEMA, provides additional precision, reporting the 100-year flood elevation at points in the Bay closest to the Plan area to range from 9.96 feet NAVD to 10.18 feet NAVD. For purposes of this assessment, the higher elevation of 10.18 feet NAVD is used as the 100-year stillwater flood elevation.

In the Bay just to the east of the Plan area and Highway 101, the base flood elevation is 13 to 14 feet NAVD. In these areas of the open Bay, waves are predicted to be 3 to 4 feet high during storm events, which are added to the stillwater elevation of 10 feet NAVD to raise the base flood elevation. Since the Highway 101 embankment between the Plan area and the Bay is above the stillwater elevation, waves would break and dissipate east of the highway and would not affect the Plan area on the west side of the highway.

The areas at risk of inundation from the 100-year flood are mapped by FEMA for the Plan area and adjoining areas in Brisbane in Figure 1. Most of the Plan area is not currently mapped in the 100-year flood zone, except along Visitacion Creek and a small area in the west of the Plan area, between Bayshore Boulevard and Industrial Way. A larger fraction of the western side of the Plan area is mapped in the 500-year flood hazard zone, indicating that existing ground elevations in certain parts of the Plan area are only about one foot above the 100-year elevation. The mapped inundation areas east of the railroad and the 500-year inundation area west of the railroad are likely attributed to coastal flood sources. The 100-year inundation mapped around the detention basin and along Industrial Way may be stormwater sourced from the upstream watershed that is impeded from draining by downstream water levels set by coastal conditions in the Bay (BKF 2022).

2.1.2 Stormwater and Creek Flooding

The Plan area is part of a watershed that drains hillslopes to the west, through the Plan area, and ultimately to the Bay (BKF 2023). West of the Plan area, the historic watershed of Visitacion Creek originates in the Bayshore Heights neighborhood of Daly City, combines with runoff from parcels in Brisbane west of Bayshore Boulevard, and then flows into the Levinson Detention Basin. A pipe and a brick-arch stormwater sewer carry water away from the detention basin southward along Bayshore Boulevard. Along the way, the sewer collects stormwater from the development along Industrial Way. This sewer turns eastward and passes under the railroad tracks just north Ice House Hill and connects to a timber box culvert. This box culvert ends just before Tunnel Avenue and discharges to an open channel. Via culverts, this earthen channel crosses under Tunnel Avenue, a pair of service roads, and Highway 101 before discharging to the Bay.

[3] Stillwater elevation refers to the water surface elevation in the absence of wind waves.

The southern portion of the Plan area adjacent to Brisbane Lagoon and the Kinder Morgan tank farm drain directly to the lagoon via a network of swales, small culverts under Lagoon Way, and overland flow. The lagoon is connected to the Bay by a bank of culverts under Highway 101. A small northeastern portion of the Plan area near Beatty Avenue drains north to a storm drain pipe that connects to the City of San Francisco's combined stormwater and sanitary sewer system.

During large rainfall events, overflow and ponding has been observed at and adjacent to the Levinson Detention Basin, the drainage ditch east of Industrial Way, and the timber box culvert. These areas have been mapped by FEMA as within the 1% annual chance flood hazard zone (Figure 1), but because detailed analysis has not been conducted, no base flood elevation is associated with this zone. Modeling conducted to support the Plan indicates that flooding in this area occurs when stormwater discharge from the watershed is impeded by high water levels in the Bay (BKF 2022). The mapping of inundated areas along Visitacion Creek east of the railroad tracks are associated with San Francisco Bay as the flood source and have the 100-year base flood elevation of 10 feet NAVD.

2.1.3 Groundwater

The groundwater table under the Plan area slopes downwards from the hillslopes west of the site towards the Bay (Geosyntec 2022b), rises upward under the landfill, then slopes back down east of the Plan area to approximately mean sea level at the Bay edge. Mounding of groundwater table under the landfill is due to downward precipitation infiltration and upwards movement of pore water from bay mud compressed by weight of landfill above. Minimal leachate is produced from within the landfill waste since no waste disposal has occurred at the site for more than 50 years.

Regional assessments of the depth of groundwater below the ground surface (May et al. 2023) are consistent with the project-specific assessment (Geosyntec 2022b). Both studies find that that groundwater is within a few feet of the ground surface in the railyards area and greater than 10 feet from the ground surface in the landfill area.

2.2 Proposed Conditions Flood Hazards

The 2023 Baylands Specific Plan (Baylands Specific Plan or Specific Plan) proposes extensive grading (BKF 2023) on the Plan area. This grading would use soil excavated from the eastern landfill area to raise the finished floor elevations in the western railyard area to a minimum of 19 feet NAVD. Building pads and roads in the landfill area (eastern portion of the Plan area) would generally remain at elevations 20 feet NAVD or higher. This grading involves excavating approximately 4.3 million (M) cubic yards of soil from the landfill area, with 1.8M cubic yards of this soil redistributed as fill on the landfill area. The remaining 2.5M cubic yards of soil would be transported to the railyards area (western portion of the Plan area) to raise the ground surface elevation on this side. This grading is designed to include soil improvement measures to mitigate settlement and liquefaction hazards, as well as to integrate with efforts associated with capping and containment of the contaminated areas.

2.2.1 Coastal Flooding

With the addition of fill to the ground surface elevation on the railyard area and the remaining fill on the landfill area, nearly all the Plan area would be above the current 100-year base flood elevation. Only select portions of the Plan area would be exposed to potential inundation for this coastal flood event (**Figure 2**). All finished floors would be above the base flood elevation. One below-grade parking area would be below the base flood elevation. The other areas facing potential inundation are all open space along waterways, including the Visitacion Creek channel, a stormwater detention area, and Brisbane Lagoon.

2.2.2 Stormwater and Creek Flooding

As described in BKF (2023), the Plan's proposed stormwater drainage system was developed and evaluated according to the Brisbane Storm Drain Master Plan (BSDMP) (RBF 2003). The Plan would include improvements along the system's primary drainage artery from Bayshore Boulevard and Industrial Way through to Visitacion Creek by increasing the conveyance capacity of the channel and several key culverts. A stormwater detention area would be constructed just east of the railroad tracks to replace the storage volume provided by the existing railyard area. Hydraulic controls would prevent tidal influence from extending upstream of this detention basin. Within the proposed development, low impact development (LID) treatments would be employed to collect, treat, infiltrate, and convey precipitation. Runoff from this collection system would flow through a new pipe network to the primary drainage artery.

The proposed system was evaluated with an XP-SWMM[4] hydrologic and hydraulics model (BKF 2022). The modeling was conducted with precipitation intensities specified in the BSDMP. This modeling indicates that the 100-year rainfall event concurrent with approximately the 10-year Bay water level can be conveyed entirely within the proposed pipe system, consistent with the BSDMP. In the Plan area along Bayshore Boulevard, existing flooding (Figure 1) would be eliminated by raising the ground surface elevation. In adjoining non-Plan areas just to the west of the Plan area (including Bayshore Boulevard), the existing elevations of non-Plan area property preclude elimination of inundation; however, inundation in these non-Plan areas would be reduced in depth and duration as a result of the additional conveyance and storage for proposed Plan conditions.

2.2.3 Groundwater

With-Plan conditions includes contamination remediation. This would consist of capping the landfill and installing a proposed leachate collection and recovery system (LCRS) that would be part of final closure of the landfill on the eastern portion of the Plan area (Geosyntec 2022b). These remediation measures would contain and suppress the elevation of the water table. In addition, the eastern portion of the Plan area, where groundwater levels are closest to the ground surface for existing conditions, would be raised by 8 to 12 feet as part of the Plan. As a result of control via the LCRS and elevating the ground surface above groundwater levels, the potential for

[4] XP-SWMM is computer software that represents the physical processes that govern the movement of water with mathematical equation, so that water levels, flow rates, and inundation can be simulated.

emergent groundwater at the completion of the Plan's construction would be less than existing conditions.

2.3 Future Flooding Hazards with Sea-Level Rise

Overall, the proposed 2023 Plan follows the State of California Ocean Protection Council (OPC) 2018 and local SLR planning guidance in effect at the time the Plan was developed and submitted to the City of Brisbane (City) and interprets this guidance appropriately for the Plan (Geosyntec 2022a). In particular, the Plan complies with the OPC 2018 SLR planning guidance as follows:

- Uses the medium-high risk aversion[5] scenario for assessing future vulnerability of the proposed residential, commercial, and industrial building finished floor elevations, as well as for groundwater and stormwater modeling, which is consistent with the OPC 2018 sea-level rise guidance for buildings.
- Uses the low risk aversion scenario[6] for assessing the future vulnerability of proposed habitat.
- Selects Year 2100 as the point in time for assessing future vulnerability. OPC guidance recommends choosing a time period based on the expected project lifespan; therefore, considering Year 2100 implies a minimum lifespan of approximately 70 to 80 years.

After the Plan was submitted in January 2023, California updated its SLR planning guidance in 2024 (OPC 2024). Therefore, as discussed below, the SLR analysis of the Plan for the EIR was conducted according to the 2024 updated guidance.

2.3.1 Sea-Level Rise Projections and Planning Guidance

As a result of human activities, concentrations of greenhouse gases (GHGs) are increasing in the atmosphere, trapping additional heat and causing the Earth to warm. Within the oceans and San Francisco Bay, the change towards warmer climate will cause increased sea-level rise due to thermal expansion of ocean waters and melting of ice sheets. The best available science at the time the Plan was developed, as reviewed specifically for California by a panel of national experts (Griggs et al. 2017) and a nationwide update (Sweet et al. 2022), predicts that sea-level rise will continue and accelerate throughout this century and into the next century.

Because future GHG emissions depend on future actions that are not yet known, and because the climate response to these emissions are not precisely known, the sea-level rise scenario that will occur is also not precisely known at this time. To accommodate this uncertainty, the OPC (OPC

[5] The medium-high risk aversion scenario for sea-level rise is defined by the California Ocean Protection Council (OPC 2018). This scenario is projected to be relatively unlikely (i.e., has only a 1-in-200 chance of being exceeded) and near the upper end of the range of potential sea-level rise. Considering the possibility of greater sea-level rise is recommended for projects like residential and commercial development. Such projects face substantial consequences from flooding and should therefore be relatively risk adverse in their design.

[6] The low risk aversion scenario for sea-level rise is defined by the California Ocean Protection Council (OPC 2018). This scenario is projected to be likely (i.e., has a 66% chance of occurring) and in the middle of the range of potential sea-level rise. Considering the possibility of moderate sea-level rise is recommended for projects like coastal trails and wetlands. Such projects face some consequences from flooding and should therefore be somewhat risk adverse in their design.

2018; OPC 2024) recommends considering a range of scenarios for climate change adaptation planning. OPC (2018) recommends using the low risk aversion scenario for open space, such as along Visitacion Creek and Brisbane Lagoon. They also recommend using the medium-high risk aversion scenario for occupied residential and commercial buildings, such as proposed for much of the Plan area. For OPC (2024), the derivation and terminology of the SLR scenarios was modified to be consistent with those in the nationwide update (Sweet et al. 2022). The 2024 scenario recommended for open space, corresponding to low risk aversion, is the Intermediate Scenario. The 2024 scenario recommended for residential and commercial buildings with lifespan to 2075 and beyond is the Intermediate-High Scenario. The 2024 scenario recommended for critical infrastructure (such as roads and landfills) and for lifespans beyond 2100 is the High Scenario. **Table 1** compares the sea-level rise projections from OPC (2018) and OPC (2024) for Year 2050 and Year 2100. All of these projections are relative to sea level in Year 2000. For this report, the bracketing OPC (2024) Intermediate Scenario of 3.1 feet and the High Scenario of 6.5 feet are used to assess the Plan.

TABLE 1 SEA-LEVEL RISE PROJECTIONS, IN FEET

		OPC 2018		OPC 2024		
	Scenario Name:	Low Risk Aversion	Medium-High Risk Aversion	Intermediate	Intermediate-High	High
	Summary of Likelihood:	Likely Range 66% Probability Sea-Level Rise Is …	1-in-200 Chance 0.5% Probability Sea-Level Rise Meets or Exceeds …	5% Exceedance Probability for 3°C Warming	0.1% Exceedance Probability for 3°C Warming	<0.1% Exceedance Probability for 3°C Warming
Year	Project Type:	Open Space	Residential & Commercial Buildings	Open Space	Residential & Commercial Buildings, Lifespan Beyond 2075	Critical Infrastructure, Lifespan Beyond 2100
2050		1.1	1.9	0.8	1.0	1.3
2100		3.4	6.9	3.1	4.8	6.5

SOURCE: OPC 2018 (high emissions scenario); OPC 2024 (for San Francisco)

In its 2018 guidance, OPC identifies best-available projections of sea-level rise and recommends which scenarios projects should consider. However, building projects in the near-term to meet relatively unlikely conditions that could occur far in the future can be costly and complicated. To provide more explicit guidance when weighing these tradeoffs, the state's more recent strategy (OPC 2020) recommends that development completed by Year 2050 should include adaptation for at least 3.5 feet of sea-level rise. The Plan exceeds this guidance by accommodating up to 6.9 feet of SLR.

SLR projections will continue to be updated to reflect increasing understanding of potential GHG emission scenarios and the climate's response to these emissions, which injects continuing change into any planning process. However, past updates to SLR projections have not varied much over the last few decades. The 2020 national update to SLR projections provides a range of 3.1 to 6.5 feet for San Francisco at Year 2100 (Sweet et al. 2022). These ranges are similar to the OPC (2018) low to medium-high risk aversion scenarios for Year 2100, which range from 2.4 to

6.9 feet. In 2024, California adopted the projections from Sweet et al. (2022) to update the state's guidance (OPC 2024).

At the time of its development, the Plan's sea-level rise analysis considered 3.4 feet (low risk aversion, high emissions scenario) and 6.9 feet (medium-high risk aversion, high emissions scenario) sea-level rise at 2100. These values are from the 2018 OPC guidance, which was the guidance in effect when the Plan was developed and when the analysis was initially conducted. The 2018 OPC guidance projections are slightly higher than the intermediate (3.1 feet) and high (6.5 feet) sea-level projections from the recently adopted 2024 guidance. The few tenths of a foot difference in sea-level rise correspond to approximately 3 to 5 years of difference in the time horizon; however, because this analysis considers a time horizon of approximately 75 years in the future, the difference is negligible, particularly when accounting for the uncertainty of climate change and actual sea-level rise in the future. In addition, the proposed project demonstrates adaptive capacity for the upper end of 6.9 feet of sea-level rise using the 2018 OPC guidance, which is conservative as compared to the recently adopted and slightly lower 2024 guidance of 6.5 feet.

OneShoreline, the San Mateo County agency charged with adapting the county's shoreline for SLR, recently released its draft planning guidance for the Bay shoreline (OneShoreline 2023). This guidance includes suggested language for general and specific plans to improve community resilience. The guidance also seeks improvements along the existing shoreline which would protect other landward parcels, recommends finished floor elevations at least 3 feet above the current base flood elevation, and calls for consideration of potential groundwater hazards due to SLR. Since the Baylands Specific Plan is not immediately along the Bay shoreline, the OneShoreline shoreline infrastructure guidance would not apply to the Specific Plan. The Specific Plan meets the OneShoreline guidance for finished floor elevations and future groundwater levels, as discussed below.

2.3.2 Coastal Flooding

Adding the OPC (2024) sea-level rise projections from Table 1 to the 100-year flood elevation of 10.2 feet NAVD yields the estimates of future 100-year flood elevations for the Plan area, which are shown in **Table 2**. Potential coastal inundation during the 100-year coastal flood event with High Scenario sea-level rise is then mapped for at Year 2100, as shown in **Figure 3**. As noted in the section above, considering the 100-year flood elevation with the projected sea-level rise in Year 2100 under High Scenario conforms to state SLR guidance for assessing future coastal flood hazards to critical infrastructure, as well as for residential and commercial development with lifespans beyond 2100.

TABLE 2 PLAN AREA 100-YEAR FLOOD ELEVATIONS WITH SEA-LEVEL RISE, FEET NAVD

	Year		
Scenario	**2025**	**2050**	**2100**
100-year Flood Elevation + Intermediate Scenario SLR	10.2	11.0	13.3
100-year Flood Elevation + High Scenario SLR	10.2	11.5	16.7

Even for the greater SLR scenario, 6.5 feet by Year 2100 under the High Scenario, nearly all of the Plan area would not be inundated (Figure 3). The only areas inundated by this future SLR and flood scenario would be limited to a portion of Frontage Road, which needs to match grade with the adjoining railroad tracks, and open space areas within the eastern landfill area of the Plan area. As assumed under the Project's proposed conceptual grading plan (BKF 2023), the remainder of the Plan area would be elevated well above coastal flood levels (e.g., the east side of the railroad tracks because of fill and capping of the landfill) or would be raised to finished grade elevations of 19 feet NAVD or higher (e.g., the west side of the railroad tracks, in the developed areas). Some areas between Baylands Street and Frontage Road and north of Main Street have finished ground surface elevations of between 10 to 17.5 feet NAVD to accommodate basement parking garages. While these areas could be inundated by the 100-year flood with 6.5 feet of sea-level rise, since these areas are unfinished, they do not need to meet the floodplain management code requirement of being at or above the base flood elevation.

2.3.3 Stormwater and Creek Flooding

The proposed system was evaluated with an XP-SWMM hydrologic and hydraulics model (BKF 2022) that considered an additional 6.9 feet of SLR added to the downstream boundary representing the Bay. This amount of SLR is consistent with the OPC (2018) projections for Year 2100 under the medium-high risk scenario and slightly more than the 6.5 feet SLR projection for Year 2100 under the OPC (2024) High Scenario. The model was configured to assume that culverts crossing under the railroad tracks and Highway 101 convey discharge without overtopping onto the tracks or highway. This modeling indicates that the 100-year rainfall event concurrent with approximately the 10-year Bay water level plus 6.9 feet SLR can be conveyed by the proposed stormwater pipe system and discharge along the streets, which are acceptable according to the BSDMP. Finished floor elevations will be at least one foot above the predicted hydraulic grade line with 6.9 feet of SLR, so would thereby meet the BSDMP requirements through 2100.

2.3.4 Groundwater

The potential groundwater response SLR was assessed with hydrogeologic modeling of the groundwater, proposed landfill remediation, and the Bay (Geosyntec 2022b). This modeling predicts the changes in the groundwater table elevation at the Plan area in response to Bay water levels increasing by 6.9 feet. This amount of SLR is consistent with the OPC (2018) projections for Year 2100 under the medium-high risk scenario and slightly more than the 6.5 feet SLR projection for Year 2100 under the OPC (2024) High Scenario.

The modeling of with-Plan conditions includes the proposed LCRS that would be part of final closure of the landfill on the eastern portion of the Plan area. A key aspect of the LCRS for influencing the water table with SLR are trenches on the east and south sides of the landfill. The trenches would include an impermeable barrier on the outer trench walls, to minimize the westward intrusion of Bay-influenced groundwater towards the Plan area. In addition, high conveyance capacity and pumping of this trench are intended to maintain its water level at the present-day average Bay water level. This trench design would minimize the influence of higher Bay water levels within the Plan area.

Overall, this groundwater analysis indicates that groundwater levels would either decrease or at most increase by up to 2 feet with 6.9 feet of SLR. With the proposed 8 to 12 feet of fill proposed as part of this Project, this change in groundwater is not likely to cause emergent groundwater flooding. However, not all potential impacts have been discussed, as described in more detail in the next paragraphs.

The modeled existing groundwater table elevation in the western portion of the Plan area is approximately 9 feet NAVD (Geosyntec 2022, Figure 4: Modeled Water Table Elevations for Present-Day Model) and the predicted change in water table elevation is an increase of 1.5 to 2 feet (Figure 5: Modeled Change in Water Table Elevation with 6.9 Increase in Water Level in the Bay). This implies the future water elevation is projected to be approximately 10.5 to 11 feet NAVD. The proposed finished grade in some portions of the west Plan area (e.g., basement garages, matching grade along Plan area boundaries) are as low as 10 feet NAVD (BFK 2023). Since the groundwater table could exceed the ground surface elevation, groundwater may be able to intrude into the basements of some structures in the west Plan area. Building-specific evaluation of the potential for groundwater intrusion into these lower areas and measures to adapt to such intrusion should be provided. In addition, the near-term and future groundwater table should be considered for additional geotechnical analysis such as corrosion, seismic stability, and buoyancy forces on subsurface structures.

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SECTION 3
Future Habitats

As part of its commitment to maintaining open space, particularly valuable wetland habitats and their adjoining upland ecotone, the City requested mapping of future habitats as sea-level rise causes tidal and creek wetlands habitats to migrate upward and landward over time. This section presents a simple methodology for tidal habitat mapping as a function of tidal water levels, and then uses this methodology to predict wetland extents and acreages with sea-level rise for two scenarios at Year 2100.

3.1 Zonation of Tidal Wetlands Habitats

Land elevation relative to the tides is a major determinant of tidal habitat type. Intertidal mudflats are generally in areas between mean lower low water (MLLW) and mean tide level (MTL); tidal marshes between MTL and mean higher high water (MHHW), ecotone between MHHW and highest astronomical tide (HAT); and uplands above the HAT (Baylands Goals 1999). **Table 3** provides tidal datums for the Oyster Point Tide Station, the nearest tide station to the Specific Plan area, located in San Francisco Bay, along with schematic habitat zonations.[7]

TABLE 3 WATER LEVELS FOR OYSTER POINT TIDE STATION (IN FEET) AND SCHEMATIC HABITATS

Tidal Datums	MLLW	NAVD88	Schematic Habitats
Highest Astronomical Tide (HAT)	8.62	8.10	Uplands above HAT
Mean Higher High Water (MHHW)	7.18	6.67	Ecotone between MHHW and HAT
Mean High Water (MHW)	6.54	6.03	Tidal marsh between MTL and MHHW
Mean Sea Level (MSL)	3.77	3.26	Intertidal mudflat between MLLW and MTL
Mean Low Water (MLW)	1.14	0.63	
Mean Lower Low Water (MLLW)	0.00	-0.51	Subtidal below MLLW

SOURCE: Oyster Point Marina, San Francisco Bay, CA, Station ID: 9414392. https://tidesandcurrents.noaa.gov/stationhome.html?id=9414392 as cited in BioHabitats (2023). Schematic habitats from Baylands Goals 1999.

NOTE: Conversion from MLLW to NAVD88 based on BM J571 1939.

3.2 Habitat Mapping

Habitats within the Plan area would evolve in response to SLR. The duration and frequency of inundation would increase for land hydraulically connected to the Bay (e.g., along Visitacion

7 The average local heights of the tides – for example average low tide or average high tide – are called tidal datums.

Creek and Brisbane Lagoon). This section presents habitat mapping provided in the Specific Plan documents, mapping conducted by ESA, along with a discussion of limitations.

3.2.1 Mapping in the Specific Plan

The proposed Specific Plan grading plan (BKF 2023) and *Wetland Mitigation Plan* (BioHabitats 2023) anticipate SLR by providing sloping terrain adjacent to tidally-influenced water bodies for tidal marshes to migrate landward as sea levels rise through the Year 2100. The Specific Plan uses an estimate of 3.4 feet of SLR by Year 2100, OPC's 2018 low risk aversion scenario, to design for SLR accommodation along the creek and lagoon. The Specific Plan documents provide estimates of the vertical zonation of tidal wetlands, based on tidal datums reported for the Bay (BioHabitats 2023; Table 5 and Figure 4). The zonation mapped in the Specific Plan is divided into land that is not inundated on a daily basis (above MHHW) and land that is (below MHHW) (City of Brisbane 2023). The higher areas would be a combination of marsh ecotone, upland, and ponded freshwater habitats. The lower areas would be a combination of tidal marsh, intertidal mudflats, and subtidal areas. Acreages for areas above and below MHHW are shown in **Table 4** for proposed conditions with and without SLR through Year 2100. For the Visitacion Creek area, 8.5 acres of upland converts to tidal habitat with SLR. For Lagoon Park, 16.3 acres of upland converts to tidal habitat.

TABLE 4 HABITAT EXTENTS, PROPOSED CONDITIONS WITH CURRENT SEA LEVELS AND WITH YEAR 2100 SEA-LEVEL RISE

Habitat type	Visitacion Creek		Lagoon Park	
	Proposed as-Built	Proposed + 3.4 Feet SLR	Proposed as-Built	Proposed + 3.4 Feet SLR
Habitat above MHHW (high tidal marsh edge, ecotone, upland, and ponded freshwater)	39.3	30.8	31.7	15.4
Habitat below MHHW (tidal marsh, mudflat, and subtidal)	0	8.5	0	16.3
Total	***39.3***	***39.3***	***31.7***	***31.7***

SOURCE: City of Brisbane (2023), Figure 5.1.
NOTE: The Specific Plan uses a SLR of 3.4 feet by Year 2100.

The *Wetland Mitigation Plan* acknowledges that tides driving habitat locations and extents within the Plan Area are muted to some degree due to the culverts that Bay waters pass through to reach the habitat areas. The degree of current and potential future muting of Bay tide ranges into Visitacion Creek and the lagoon has not been assessed. Tidal muting would reduce the extent of intertidal habitats and likely increase the extent of upland habitat.

3.2.2 Mapping by ESA

ESA prepared habitat projections to provide an independent estimate of the effects of SLR on tidal and upland habitats within the Specific Plan area. The ESA assessment used the 2023 proposed grading plan from BKF as the underlying topography, and then used tidal datums from the Bay to estimate the locations and extents of habitats, using the tidal zonation relationships provided in Section 3.1 of this technical report. In the absence of local vegetation-elevation and other data, this is a reasonable proxy for the tidal distribution marsh habitats. It is assumed the Specific Plan documents (BioHabitats 2023) used the same relationship between tidal datums and tidal habitats, although this is not stated.[8] Future conditions were estimated according to OPC (2024) with 3.1 feet of SLR by raising the tides by the amount of SLR. The 3.1 feet Intermediate Scenario is applied according to the state's guidance for projecting SLR for lower risk land use, such as tidal wetlands, at Year 2100 (OPC 2024) and is slightly lower than the 41 inches (3.4 feet) cited for SLR accommodation design in the Specific Plan's Chapter 7. For informational purposes to assess the site's capacity for resilience in the face of higher SLR, ESA also projected habitat types and quantities with 6.5 feet of SLR, which is the High Scenario projection at Year 2100.

ESA made assumptions regarding the presence and acreage of freshwater wetlands at Visitacion Creek and Lagoon Park based on illustrative concept diagrams presented in Chapter 5 of the Baylands Specific Plans (Fig. 5.3.23 and Fig. 5.3.31). ESA has not evaluated if these freshwater and seasonal wetlands will receive enough water to sustain wetlands, but has assumed that they will be designed and supplied with water in a manner that will effectively create such habitats. Once projected MHHW with SLR reaches the elevation of freshwater and seasonal wetlands, these wetland types are presumed to convert to tidal marsh wetlands.

Mapped habitats for as-built conditions with existing Bay water levels, with 3.1 feet of SLR and with 6.5 feet of SLR are shown in **Figure 4** through **Figure 7**, quantified in **Table 5** and discussed below.

Visitacion Creek. As designed, the tidal marsh along Visitacion Creek would shift upwards on its banks. For 3.1 feet of SLR, the conversion of uplands to marsh along the creek would be matched by the conversion of marsh to subtidal and mudflat. The amount of tidal marsh would remain nearly the same, while the decrease in uplands would be matched by nearly identical increase in subtidal and mudflat habitats. For 6.5 feet of SLR, tidal marsh would convert all freshwater marsh to tidal marsh.

Lagoon Park. At Lagoon Park, the land just above present-day HAT becomes flatter with increasing elevation, approaching 50:1 at the upper extent of SLR. As tides rise, relatively small increases in elevation correspond to substantial increases in horizontal extent of tidal marsh. This results in uplands converting to tidal marsh at a relatively high rate, faster than the conversion of marsh to subtidal habitat and mudflat. Therefore, about a third of the upland areas of the park are projected to convert to tidal marsh with 3.1 feet of SLR and about three quarters of the uplands areas of the park are projected to convert tidal marsh with 6.5 feet of SLR.

[8] See Appendix B, Figure 4.

TABLE 5 HABITAT EXTENTS, IMPACTED EXISTING CONDITIONS, AND PROPOSED CONDITIONS WITH CURRENT SEA LEVELS AND WITH 3.1 FEET AND 6.5 FEET SEA-LEVEL RISE

Habitat Type	Impacted Wetlands and Non-wetlands	Proposed								
		Visitacion Creek			Lagoon Park			Visitacion Creek + Lagoon Park		
		As-Built	+3.1 Feet SLR	+6.5 Feet SLR	As-Built	+3.1 Feet SLR	+6.5 Feet SLR	As-Built	+3.1 Feet SLR	+6.5 Feet SLR
Subtidal & intertidal mudflat	1.10	1.60	3.67	6.24	0.20	1.85	10.76	1.80	5.52	17.00
Tidal marsh	2.15	2.20	2.52	13.01	2.00	8.72	12.72	4.20	11.24	25.73
Freshwater Marsh	13.67	11.38	11.38	0.00	3.82	3.82	0.00	15.20	15.20	0.00
Wetlands & Non-wetlands Subtotal	*16.92*	*15.18*	*17.57*	*19.25*	*6.02*	*14.39*	*23.48*	*21.20*	*31.96*	*42.73*
Uplands		23.54	21.15	19.47	26.38	18.01	8.92	49.92	39.16	28.39
Total	**16.92**	**38.72**	**38.72**	**38.72**	**32.40**	**32.40**	**32.40**	**71.12**	**71.12**	**71.12**

SOURCES: ESA, SLR Tech Report, Figures 4-7, 2025; Biohabitats Wetland Delineation Report, 2023; The Baylands Specific Plan, Chapter 05, 2023

3.2.3 Discussion

Upland acreages calculated using the Specific Plan and ESA mapping methods are compared in **Table 6**. For both Visitacion Creek and Lagoon Park, ESA's methods result in a smaller acreage of uplands at existing sea-levels and greater acreage with about 3 feet SLR, compared to the Specific Plan methods.

TABLE 6 UPLAND AND FRESHWATER MARSH HABITAT EXTENTS, PROPOSED CONDITIONS WITH SEA-LEVEL RISE

Source of Estimate	Visitacion Creek		Lagoon Park	
	Current Sea Level	With SLR	Current Sea Level	With SLR
Specific Plan, +3.4 feet SLR	39.3	30.8	31.7	15.4
ESA analysis, +3.1 feet SLR	34.9	32.5	30.2	21.8

SOURCE: ESA 2023; BioHabitats 2023

As described above in Section 2.3, the Specific Plan uses a Year 2100 SLR amount of 3.4 feet (from OPC 2018) whereas ESA's habitat projections use a Year 2100 SLR amount of 3.1 feet (from OPC 2024). This difference in projected SLR likely accounts for some of the difference between the Specific Plan's and ESA's mapping. For the Specific Plan, the grading and methods used to estimate and map habitats are not detailed. In the case of Visitacion Creek, the Specific Plan appears to use an older creek alignment (shown as straight versus the 2023 modified S-shape). This may account for some of the differences between the Specific Plan's acreages and ESA estimates.

As noted above, both the Specific Plan and ESA estimates are based on Bay tides. Actual tides are likely muted to some degree due to the culverts that Bay waters must pass through to get to the habitat areas. Muting will affect the locations and extents of habitats, and may affect water quality. Additionally, estimated tidal habitats are based on schematic relationships between habitats and tidal elevations. Other factors such as soils and vegetation sources affect tidal habitat establishment. These factors can be better assessed with site-specific vegetation and elevation surveys.

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SECTION 4
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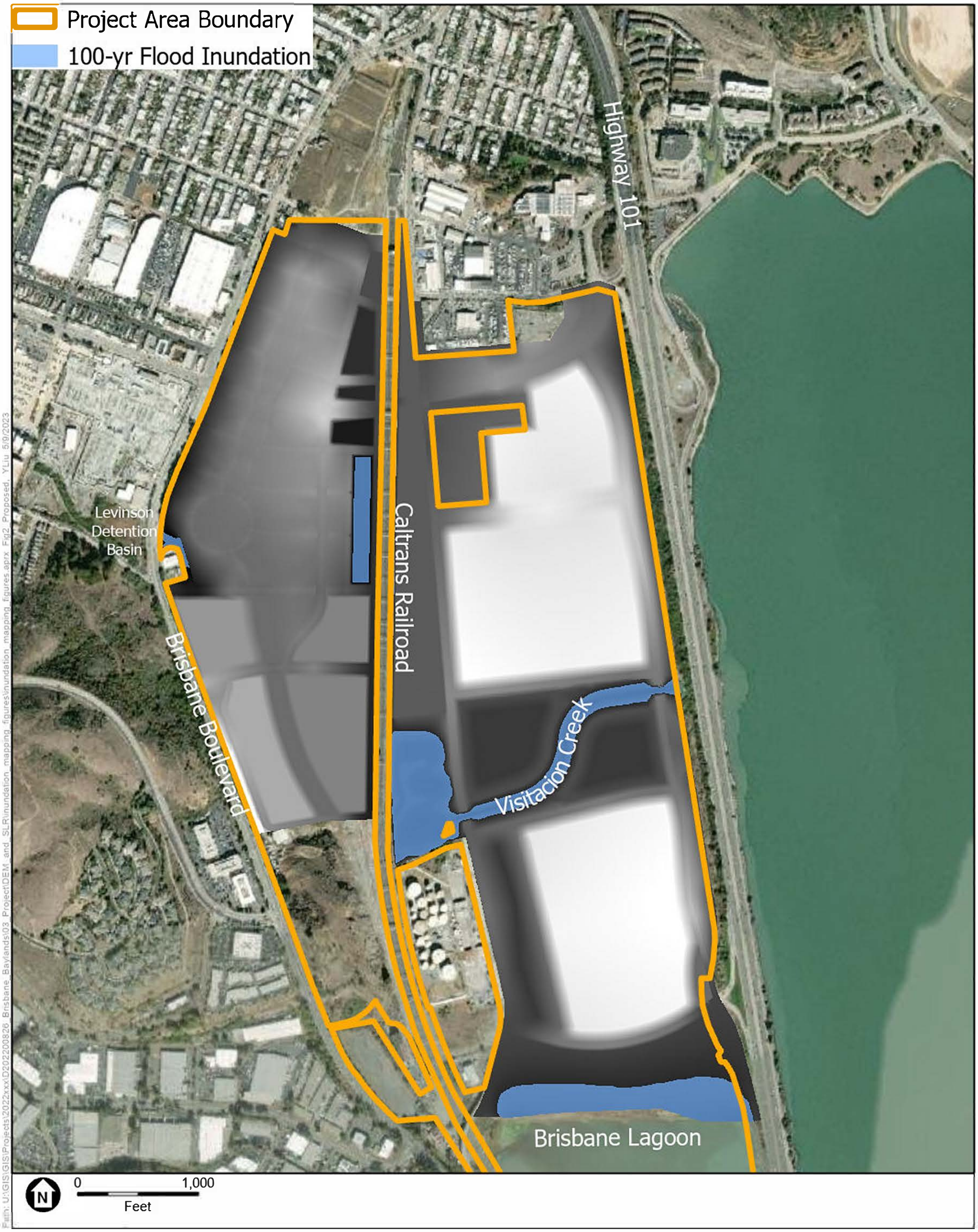
SECTION 5
Figures

SOURCE: FEMA (2019b)

Figure 1
100-Year Flood Inundation, Existing Conditions

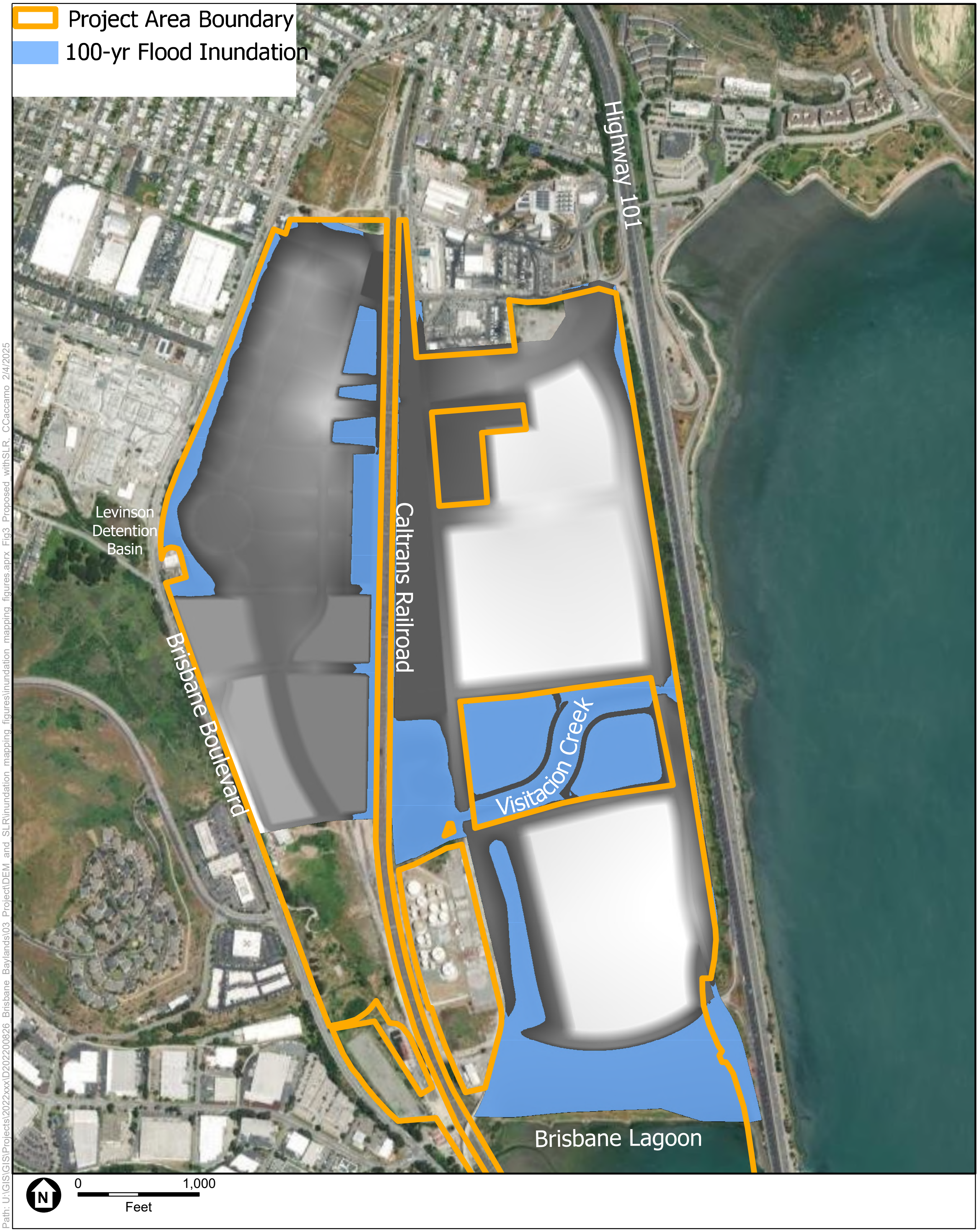
ESA



SOURCE: AECOM (2016), BKF (2023), ESA (2023)
Note: Estimated 100-year Flood at 10.18 ft NAVD

Figure 2
100-Year Flood Inundation, Proposed Conditions

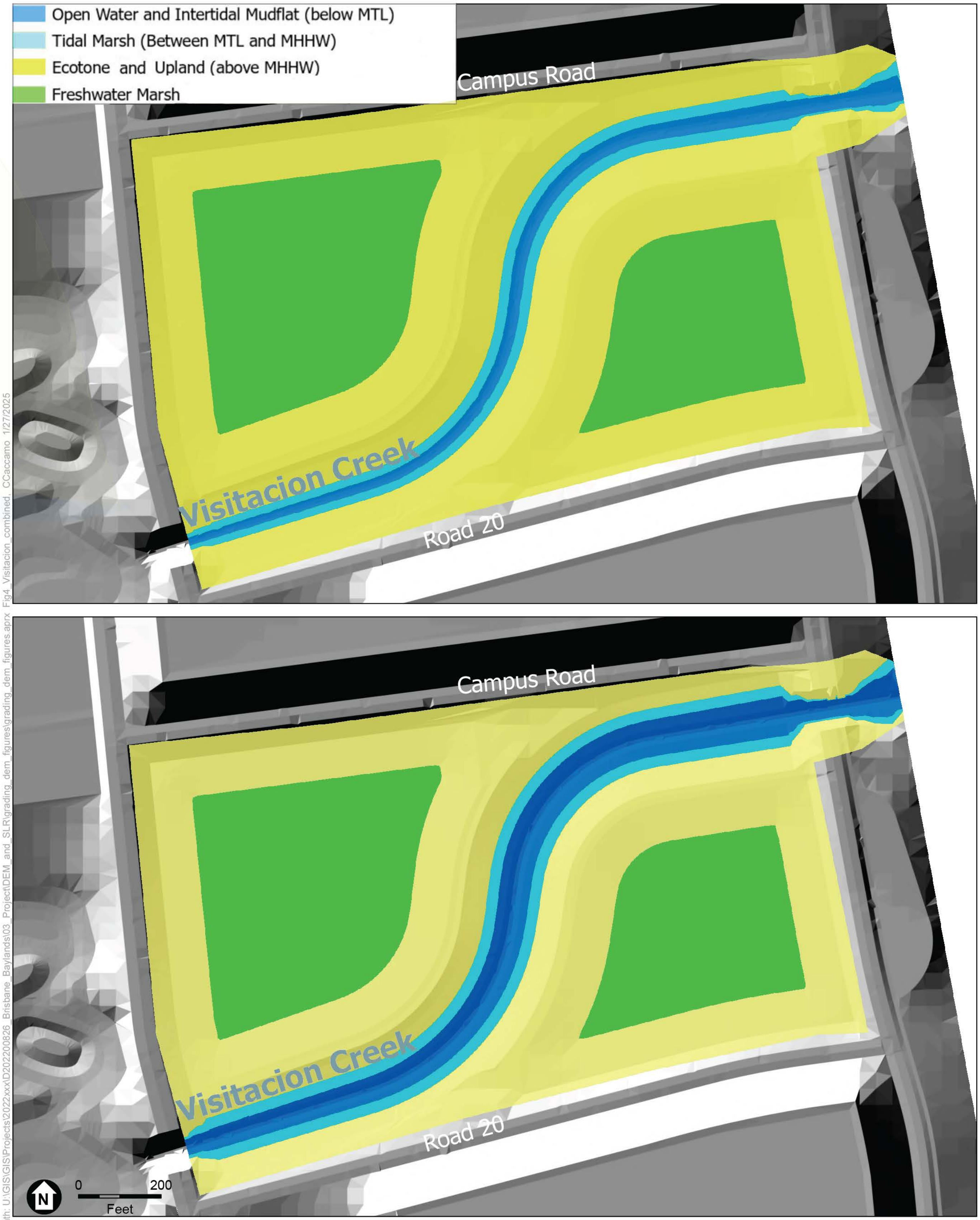
ESA



SOURCE: AECOM (2016), BKF (2023), ESA (2025)
Note: Estimated 100-year Flood at 16.68 ft NAVD

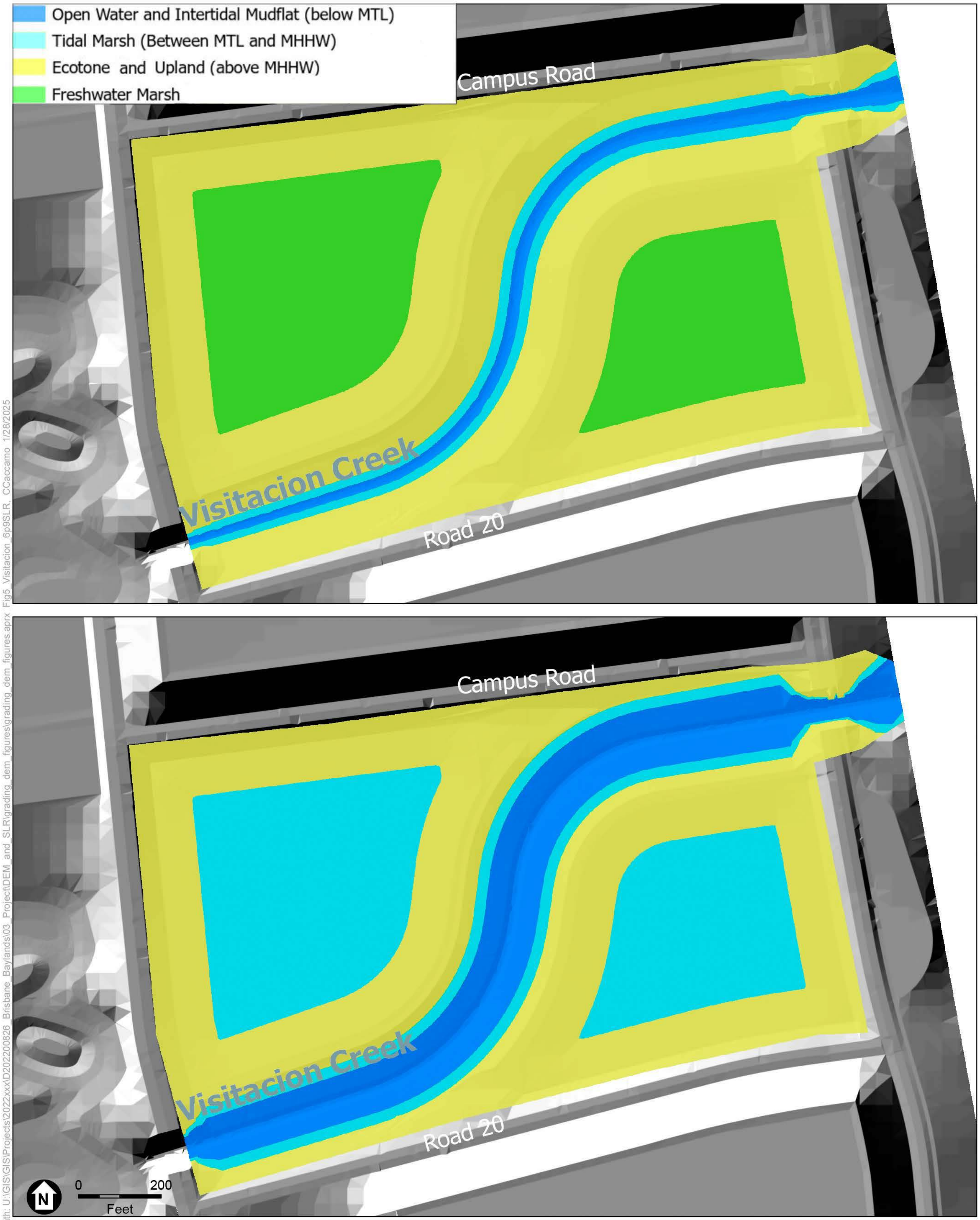
Figure 3
100-year Flood Inundation, Proposed Conditions and 6.5 feet SLR

ESA



SOURCE: BKF (2023), ESA (2025)
MTL: Mean Tide Level
MHHW: Mean Higher High Water

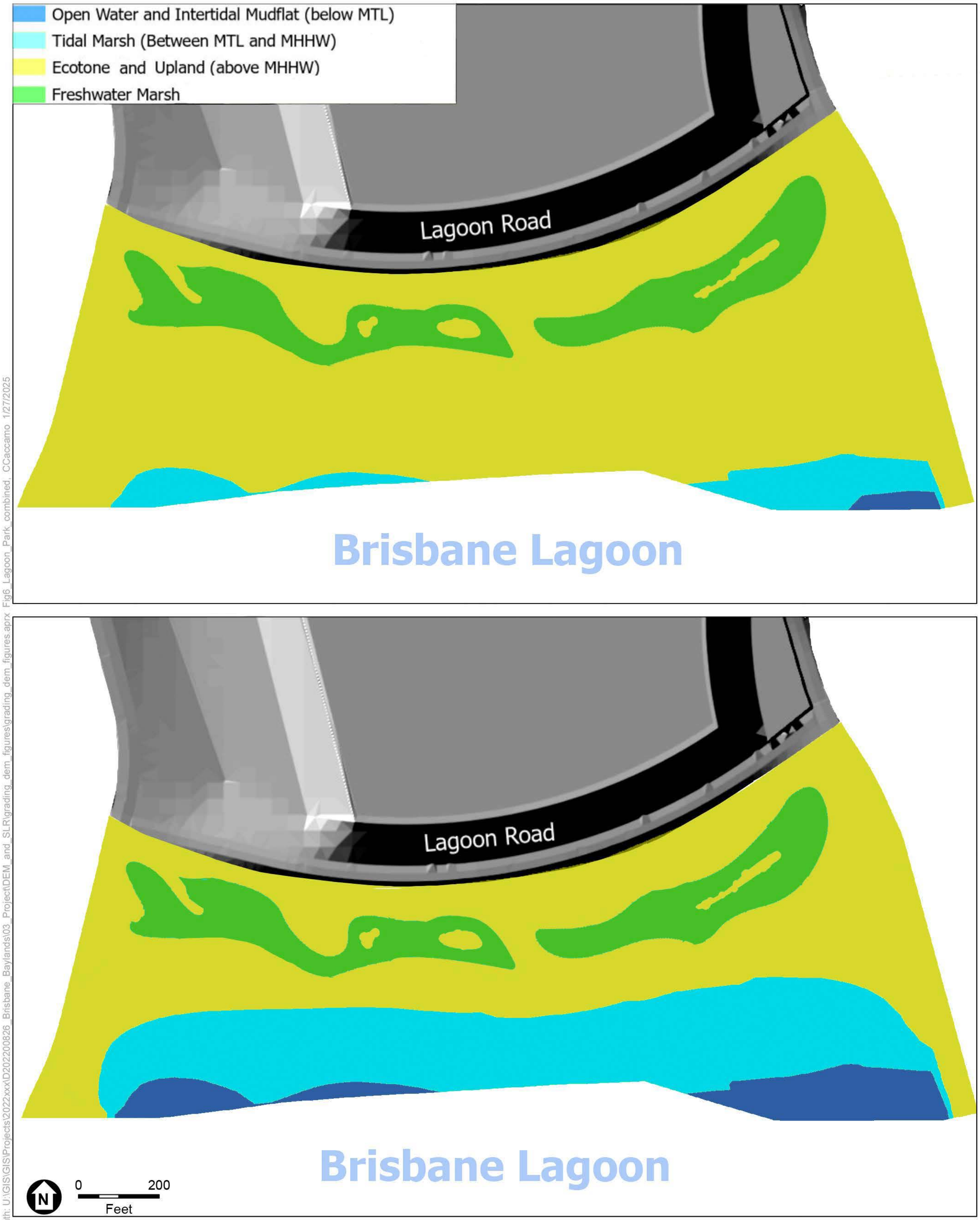
Figure 4
Proposed Habitat Areas at Visitacion Creek
Existing Sea Levels (top) and with 3.1 Feet of SLR (bottom)



SOURCE: BKF (2023), ESA (2025)
MTL: Mean Tide Level
MHHW: Mean Higher High Water

Figure 5
Proposed Habitat Areas at Visitacion Creek
Existing Sea Levels (top) and with 6.5 Feet of SLR (bottom)

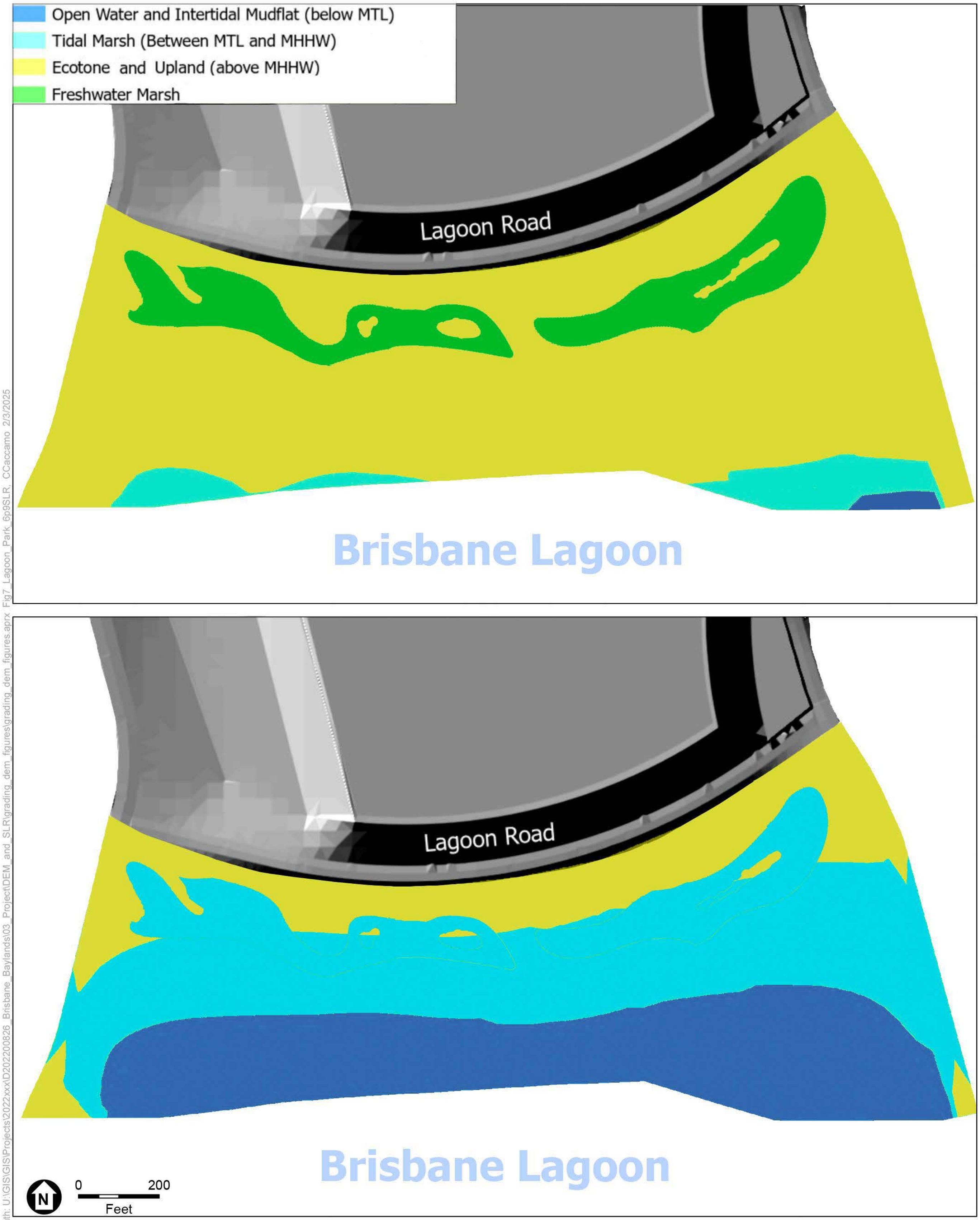
ESA



SOURCE: BKF (2023), ESA (2025)
MTL: Mean Tide Level
MHHW: Mean Higher High Water

Figure 6
Proposed Habitat Areas at Lagoon Park
Existing Sea Levels (top) and with 3.1 Feet of SLR (bottom)

ESA



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SOURCE: BKF (2023), ESA (2025)
MTL: Mean Tide Level
MHHW: Mean Higher High Water

Figure 7
Proposed Habitat Areas at Lagoon Park
Existing Sea Levels (top) and with 6.5 Feet of SLR (bottom)

ESA